

The Senate

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Rural and Regional Affairs  
and Transport  
References Committee

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Current and future regulatory requirements  
that impact on the safe commercial and  
recreational use of Remotely Piloted Aircraft  
Systems (RPAS), Unmanned Aerial Systems  
(UAS) and associated systems

July 2018

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# Table of contents

<b>Membership of the committee .....</b>	<b>iii</b>
<b>Abbreviations .....</b>	<b>ix</b>
<b>List of recommendations .....</b>	<b>xiii</b>
<b>Part I.....</b>	<b>1</b>
<b>Chapter 1.....</b>	<b>1</b>
<b>Introduction .....</b>	<b>1</b>
Referral and terms of reference .....	1
Conduct of the inquiry .....	2
Terminology .....	2
Structure of the report.....	3
Acknowledgement.....	3
192 ways to use RPAS .....	4
Opportunities and challenges .....	6
<b>Chapter 2.....</b>	<b>11</b>
<b>RPAS laws in Australia.....</b>	<b>11</b>
The Chicago Convention and the International Civil Aviation Organization.....	11
Australia's legal framework.....	13
Concerns raised in evidence regarding the regulations .....	20
<b>Chapter 3.....</b>	<b>29</b>
<b>'Anything in the air is a risk': RPAS and aviation safety .....</b>	<b>29</b>
RPAS in aviation incidents worldwide .....	29
RPAS incidents and encounters in Australia.....	31
International regulatory responses to RPAS .....	33
Australian research .....	38

<b>Part II</b> .....	<b>43</b>
<b>Chapter 4</b> .....	<b>43</b>
<b>Safer Skies: Registration and education</b> .....	<b>43</b>
Identifying all RPAS operators .....	43
Educating all RPAS operators .....	51
<b>Chapter 5</b> .....	<b>65</b>
<b>Enforcement measures</b> .....	<b>65</b>
Vulnerable airspace .....	65
Airspace around public buildings .....	69
Local government initiatives .....	72
Delegation of enforcement powers.....	73
<b>Chapter 6</b> .....	<b>77</b>
<b>Technological compliance</b> .....	<b>77</b>
Technology-based solutions .....	77
Airworthiness .....	83
Air traffic control.....	87
<b>Part III</b> .....	<b>91</b>
<b>Chapter 7</b> .....	<b>91</b>
<b>A comprehensive approach to RPAS safety</b> .....	<b>91</b>
Whole of government approach .....	91
Consultation beyond the aviation sector .....	93
Cost-effective solutions .....	94
Regulatory consistency.....	96
<b>Chapter 8</b> .....	<b>101</b>
<b>Committee view and recommendations</b> .....	<b>101</b>
Evidence-based regulatory reform .....	102

Mandatory registration regime .....	103
Tiered education program.....	105
Vulnerable airspace .....	106
Airworthiness standards .....	107
Whole of government approach .....	109
Addressing other policy challenges.....	111
Concluding comments .....	113
<b>Appendix 1 .....</b>	<b>115</b>
<b>Submissions received.....</b>	<b>115</b>
<b>Appendix 2.....</b>	<b>119</b>
<b>Public hearings and witnesses .....</b>	<b>119</b>



## List of abbreviations

AAUS	Australian Association for Unmanned Systems
Act	<i>Civil Aviation Act 1988</i>
ADS-B	Automatic Dependent Surveillance Broadcast
AGL	Above Ground Level
AIN	Aviation Infringement Notice
ASAP	Aviation Safety Advisory Panel
ASTRA	Australian Strategic Air Traffic Management Group
ATCO	Air Traffic Control Operators
ATM	Air traffic management
ATSB	Australian Transport and Safety Bureau
AusALPA	Australian Airline Pilots' Association
BVLOS	Beyond visual line of sight
CAR	Civil Aviation Regulations 1988
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CEO	Chief Executive Officer
CIRRIS	Corporate Integrated Reporting and Risk Information System
CMATS	Civil Military Air Traffic Management System
Committee	Senate Rural and Regional Affairs and Transport References Committee
DAA	Detect and Avoid
Defence	Department of Defence
DHA	Department of Home Affairs (formerly the Department of Immigration and Border Protection)

DIRDC	The Department of Infrastructure, Regional Development and Cities (formerly the Department of Infrastructure and Regional Development)
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration (United States)
GPS	Global Positioning System
HLS	Helicopter landing site
IAA	Irish Aviation Authority
IALPG	International Aerospace Law and Policy Group
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
MAAA	Model Aeronautical Association of Australia
NFRM	Notice of Final Rule Making
NPRM	Notice of Proposed Rule Making
PANS	Procedures for Air Navigation Services
RA	Restricted Area
RAAO	Recreational Aviation Administration Organisation
RA-Aus	Recreational Aviation Australia
ReOC	Remote pilot operator's certificate
RePL	Remote pilot licence
Rex	Regional Express Airlines
RMIT	Royal Melbourne Institute of Technology
RPA	Remotely piloted aircraft
RPAS	Remotely piloted aircraft systems
RPT	Regular public transport
RTF	Unmanned Aircraft Systems Registration Task Force Aviation Rulemaking Committee (US)

SARPs	Standards and Recommended Practices
SIM card	Subscriber identification module (used in mobile phones)
SOC	Standard Operating Conditions
TCAS	Traffic Collision Avoidance System
UAS	Unmanned aerial systems
UASSC	Unmanned Aircraft Systems Standards Sub-committee
UAV	Unmanned aerial vehicle
UK	United Kingdom
US	United States of America
UTM	Unmanned traffic management
VIPA	Virgin Independent Pilots Association



# **List of recommendations**

## **Recommendation 1**

**8.10** The committee recommends that the Civil Aviation Safety Authority draw on the growing body of international empirical research and collision testing on remotely piloted aircraft systems below 2kg to immediately reform Part 101 of the Civil Aviation Safety Regulations 1998.

## **Recommendation 2**

**8.20** 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.

## **Recommendation 3**

**8.26** The committee recommends that the Australian Government develop a tiered education program whereby remotely piloted aircraft system (RPAS) users progressively unlock RPAS capabilities upon completion of each level of training. Three tiers are proposed as follows:

- purchase of the RPAS – mandatory registration requires user to demonstrate knowledge the basic rules for flying RPAS, and the penalties for non-compliance (as described in Recommendation 2);
- recreational use of RPAS – second tier requires user to demonstrate an advanced understanding of aviation rules and safety before unlocking additional capabilities; and
- commercial use of RPAS – final tier requires user to demonstrate comprehensive aviation knowledge before obtaining commercial operator licence and unlocking full RPAS capability.

## **Recommendation 4**

**8.29** The committee recommends that the Civil Aviation Safety Authority, in cooperation with the Australian Federal Police and other relevant authorities, prohibit the use of remotely piloted aircraft systems in the airspace above significant public buildings, critical infrastructure and other vulnerable areas.

## **Recommendation 5**

**8.31** The committee recommends that the Department of Infrastructure, Regional Development and Cities, in cooperation with the Civil Aviation Safety Authority, work with manufacturers of remotely piloted aircraft systems (RPAS)

to develop future solutions to RPAS safety, including the implementation of technical restrictions on altitude and distance for 'off-the-shelf' RPAS.

#### **Recommendation 6**

**8.37** The committee recommends that the Department of Infrastructure, Regional Development and Cities, in cooperation with the Civil Aviation Safety Authority, develop appropriate airworthiness standards for remotely piloted aircraft of all sizes and operations. At a minimum, fail-safe functions such as 'return to home' and safe landing functionality, and forced flight termination, should be mandated.

#### **Recommendation 7**

**8.38** The committee recommends that the Australian Government develop import controls to enforce airworthiness standards for foreign manufactured remotely piloted aircraft systems.

#### **Recommendation 8**

**8.44** The committee recommends that the Department of Infrastructure, Regional Development and Cities, in collaboration with the Civil Aviation Safety Authority, develop a whole of government policy for remotely piloted aircraft safety in Australia, and establish appropriate coordination and implementation mechanisms with relevant departments and agencies to implement the policy.

**8.45** As part of a whole of government policy approach, the committee further recommends that the Australian Government explore cost-effective models to develop and administer new regulatory initiatives for remotely piloted aircraft systems, including a mandatory registration regime and tiered education program. The harmonisation of state and territory privacy laws should also be considered.

#### **Recommendation 9**

**8.50** The committee recommends that, as part of a whole of government approach to remotely piloted aircraft systems (RPAS) safety, the Civil Aviation Safety Authority work with Airservices Australia and other relevant agencies to implement a comprehensive research and data gathering regime. Information should be collated and centralised in a way that allows for the examination of RPAS registrations, operations, trends and incidents, to provide an evidence base on which to assess the efficacy of current regulations, and to inform the development of future policy and regulations.

#### **Recommendation 10**

**8.64** The committee recommends that, following the development of a whole of government policy approach to RPAS safety, including the establishment of a national registration system, the Civil Aviation Safety Authority (CASA) work with state and territory enforcement bodies to implement a nationally consistent enforcement regime for remotely piloted aircraft systems. Under this regime,

**enforcement bodies would be delegated powers to provide on-the-spot fines and report infringements of the regulations directly to CASA.**



# Part I

## Chapter 1

### Introduction

#### Referral and terms of reference

1.1 On 13 October 2016 the Senate referred the following matters to the Senate Rural and Regional Affairs and Transport References Committee (committee) for inquiry and report by 27 April 2017:

- (a) current and future regulatory requirements that impact on the safe commercial and recreational use of Remotely Piloted Aircraft Systems (RPAS), Unmanned Aerial Systems (UAS) and associated systems, including consideration of:
  - i. Civil Aviation Safety Regulation Part 101,
  - ii. local design and manufacture of RPAS and associated systems,
  - iii. importation of RPAS and associated systems,
  - iv. state and local government regulation, and
  - v. overseas developments, including work by the International Civil Aviation Organization (ICAO) and overseas aviation regulatory jurisdictions;
- (b) the existing industry and likely future social and economic impact of RPAS technology;
- (c) the international regulatory/governance environment for RPAS technology and its comparison to Australian regulation;
- (d) current and future options for improving regulatory compliance, public safety and national security through education, professional standards, training, insurance and enforcement;
- (e) the relationship between aviation safety and other regulation of RPAS for example, regulation by state and local government agencies on public safety, security and privacy grounds;
- (f) the potential recreational and commercial uses of RPAS, including agriculture, mining, infrastructure assessment, search and rescue, fire and policing operations, aerial mapping and scientific research;
- (g) insurance requirements of both private and commercial users/operators, including consideration of the suitability of existing data protection, liability and insurance regimes, and whether these are sufficient to meet growing use of RPAS;
- (h) the use of current and emerging RPAS and other aviation technologies to enhance aviation safety; and

- (i) any other related matters.<sup>1</sup>

### **Conduct of the inquiry**

1.2 The committee advertised the inquiry on its webpage. The committee invited submissions from interested organisations and individuals, and received 94 public submissions. A list of individuals and organisations that made public submissions, together with other information authorised for publication is at Appendix 1.

1.3 The committee held public hearings as follows:

16 March – Dalby, Queensland

16 June – Melbourne, Victoria

26 June – Sydney, NSW

28 June – Brisbane, Queensland

29 August – Canberra, ACT

17 October – Canberra, ACT

1.4 A list of witnesses who appeared at the hearings is at Appendix 2. Submissions and Hansard transcripts of evidence may be accessed through the committee's website.<sup>2</sup>

1.5 On 16 February 2017, the Senate granted an extension of time for reporting until 6 December 2017.<sup>3</sup> On 16 November 2017, the Senate granted a further extension of time for reporting until 28 March 2018.<sup>4</sup> On 22 March 2018, the Senate granted a further extension of time for reporting until 31 July 2018.<sup>5</sup>

### **Terminology**

1.6 During the inquiry, the committee received evidence which used a range of terms to refer to remotely piloted aircraft systems (RPAS) technology, including 'unmanned aerial vehicles' (UAVs), 'unmanned aerial systems' (UAS) or 'drones'. While the preferred terminology used by the International Civil Aviation Organization refers to RPAS technology, the evidence gathered during the inquiry uses a number of terms to describe the broad range of technologies relevant to the inquiry. Therefore, the terms drone, UAV, UAS, RPA and RPAS may be used interchangeably throughout this report.

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1 *Journals of the Senate*, No. 11–13 October 2016, pp. 331–332.

2 Parliament of Australia, *Regulatory requirements that impact on the safe use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and associated systems*, [https://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Rural\\_and\\_Regional\\_Affairs\\_and\\_Transport/Drones](https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Drones) (accessed 6 March 2018).

3 *Journals of the Senate*, No. 30–16 February 2017, p. 994.

4 *Journals of the Senate*, No. 71–16 November 2017, p. 2252.

5 *Journals of the Senate*, No. 91–22 March 2018, p. 2886.

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## Structure of the report

1.7 The report is divided into three parts, consisting of a total of eight chapters. Part I of the report comprises Chapters 1 to 3 and focuses on the current system and structure of RPAS regulations:

- the remainder of Chapter 1 considers the growing use and application of RPAS, and the respective opportunities and challenges that have emerged as a result;
- Chapter 2 sets out Australia's regulatory framework in relation to RPAS, including the 2016 amendments to the Civil Aviation Safety Regulations 1998; and
- Chapter 3 considers the evidence before the committee regarding RPAS incidents and regulatory responses both within Australia and worldwide.

1.8 Part II of the report comprises Chapters 4 to 6, with a focus on possible improvements to RPAS management in Australia:

- Chapter 4 considers the implementation of measures that allow for the identification and education of all RPAS operators. Measures discussed include a registration regime, and mandatory education requirements for all operators;
- Chapter 5 discusses a number of enforcement measures directed at the safe and lawful use of RPAS, including the restriction or prohibition of RPAS use in certain airspace, and the delegation of enforcement powers to local authorities; and
- Chapter 6 gives consideration to the use of technology-based solutions such as geo-fencing and 'detect and avoid' systems. The need for airworthiness standards for UAS and the potential for unmanned air traffic management is also discussed.

1.9 Part III of the report comprises Chapters 7 and 8 and draws together the evidence informing the committee's views and recommendations:

- Chapter 7 discusses the need for a holistic approach to RPAS management, with wide-ranging stakeholder consultation, and a whole of government framework; and
- Chapter 8 provides the committee's comments and recommendations.

## Acknowledgement

1.10 The committee thanks the large number of individuals and organisations who made submissions to this inquiry, and to witnesses who offered their time to give evidence at public hearings and provide additional information. The committee is particularly grateful to those witnesses who travelled substantial distances to appear before the committee. Both submitters and witnesses contributed significantly to the committee's deliberations and report.

1.11 The committee started its evidence gathering for the purposes of the inquiry in Dalby, Queensland where it held an RPAS demonstration and public hearing on 16 March 2017. The committee would like to thank the operators for taking the time to demonstrate the use of their RPAS to the committee and to explain their operations and technology. The demonstration day in Dalby proved to be critical to the committee's understanding of the use and application of RPAS and informed its deliberations throughout the course of the inquiry.

1.12 The committee also acknowledges the 2014 House of Representatives Standing Committee on Social Policy and Legal Affairs' report, titled *Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy*, and the subsequent Australian Government response provided in December 2016. As the focus of this Senate inquiry was on safety and regulation, the committee leaves the issues of privacy that were raised in the House of Representatives' report to the ongoing consideration of government.

### **192 ways to use RPAS <sup>6</sup>**

1.13 Early reports of RPAS use dates back to World War I. However, RPAS were reported to have been used commercially for the first time in Japan in the early 1980s to spray pesticides on rice fields.<sup>7</sup>

1.14 Since then, RPAS have increasingly been used not only in military operations but across a growing range of industries for a diverse range of purposes.<sup>8</sup> This diversity is reflected in the growth of commercial, scientific and security applications.

1.15 Today, RPAS are used to perform hazardous work; conduct monitoring and aerial mapping; gather data and undertake surveillance; assist law enforcement and public safety agencies;<sup>9</sup> monitor road conditions and telecommunications infrastructure; deliver humanitarian aid; carry medicines and urgent medical

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6 In 2014, US Futurist Mr Thomas Frey published a list of 192 future uses for flying drones. 2 September 2014, <http://www.futuristspeaker.com/business-trends/192-future-uses-for-flying-drones/> (accessed 12 December 2017).

7 PwC, *Clarity from above, PwC global report on the commercial applications of drone technology*, May 2016, p. 4.

8 RPAS have reportedly been used in at least seven countries throughout the United States' ongoing war on terror. They have been used to gather information, provide battlefield intelligence and find and kill terrorists and insurgents. See: Author unknown, 'History of Drone Warfare', *The Bureau of Investigative Journalism*, <https://www.thebureauinvestigates.com/explainers/history-of-drone-warfare> (accessed 5 October 2017).

9 The Queensland Police Service has used RPAS 52 times in the last year. It was the first agency to use an RPAS operationally in Australia when the Special Emergency Service made use of an RPAS during a siege. See: Thomas Chamberlin, 'Drones become integral part of Queensland Police operations', *The Courier Mail*, 4 December 2017, <http://www.couriermail.com.au/news/queensland/crime-and-justice/drones-become-integral-part-of-queensland-police-operations/news-story/cd2cb6b8812c381b7a23278911f9837f> (accessed 12 December 2017).

provisions including lifesaving blood supplies;<sup>10</sup> perform search and rescue services; deliver resources to remote and geographically-isolated places; deliver takeaway in residential areas;<sup>11</sup> and in industries such as mining, aerial photography, media, and entertainment.<sup>12</sup> This list is not exhaustive, as the range of applications continues to grow at a rapid pace. At the same time RPAS have become the fastest growing segment of the civil aviation market.<sup>13</sup>

1.16 The RPAS economy, which is valued at \$137 billion a year, continues to grow at a rapid pace. United States (US) futurist Thomas Frey has predicted that by 2030, there will be one billion RPAS in the world.<sup>14</sup> According to the Civil Aviation Safety Authority (CASA), there were 1283 remote operator certificate (ReOC) holders and 7380 remote pilot licence (RePL) holders registered as at 26 February 2018.<sup>15</sup> This does not account for the much greater number of operators that are neither registered nor hold any form of licence or operating certificate.

1.17 The power of RPAS lies primarily in their software. Increasingly, RPAS are outfitted with business-grade software to serve as data-collecting platforms. RPAS have been referred to as the 'flying smartphone' for this reason.<sup>16</sup> As a disruptive technological advancement, RPAS capability changes the cost and labour equation for many operational tasks.

1.18 In the agricultural sector, RPAS are recognised as integral to the next phase of innovation, given their capacity to change the way food and fibre are produced.<sup>17</sup> To this end, Australian farmers are increasingly applying UAV technology to improve

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- 10 In 2016, Rwanda became the first country in the world to have a national RPAS delivery service which is used to deliver blood to patients in remote areas of the country. See: Amar Toor, 'Drones being delivering blood in Rwanda', *The Verge*, 13 October 2016, <https://www.theverge.com/2016/10/13/13267868/zipline-drone-delivery-rwanda-blood-launch> (accessed 29 September 2017).
- 11 Doug Dingwall, 'Project Wing to trial food delivery by drone to homes in Tuggeranong', *Canberra Times*, 22 February 2018, <http://www.canberratimes.com.au/act-news/project-wing-to-trial-food-delivery-by-drones-to-homes-in-tuggeranong-20180222-h0whll.html> (accessed 23 February 2018).
- 12 Brian Barrett, 'Inside the Olympics opening ceremony world-record drone show', *Wired*, 9 February 2018, <https://www.wired.com/story/olympics-opening-ceremony-drone-show/> (accessed 23 February 2018).
- 13 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 11.
- 14 Meghna Bali, '1 billion drones in world by 2030, US futurist Thomas Frey says', *ABC News*, 31 August 2017, <http://www.abc.net.au/news/2017-08-31/world-of-drones-congress-brisbane-futurist-thomas-frey/8859008> (accessed 5 October 2017).
- 15 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19.
- 16 Chris Anderson, 'The Drone Economy', *Harvard Business Review*, 7 June 2017.
- 17 National Farmers' Federation, *Submission 33*, p. 1; Dr Greg Leach, AgForce, *Committee Hansard*, 16 March 2017, p. 20.

agricultural techniques, manage large areas of land, improve risk management approaches, predict weather and yields with greater accuracy, and maximise returns.<sup>18</sup>

1.19 In coastal regions, the Little Ripper Lifesaver uses state of the art UAV technology to enhance existing search and rescue services. The Little Ripper Group is developing and integrating lifesaving devices into lightweight marine, land and snow pods that can be mounted and deployed from the Little Ripper UAV.<sup>19</sup> In partnership with the University of Technology Sydney's School of Software, the group also developed best practice aerial detection of sharks using real-time sensor and pattern recognition algorithms.<sup>20</sup>

1.20 In September 2017, Little Ripper UAVs equipped with the shark-spotting system began patrolling a number of Australia's beaches. The UAVs are able to detect a shark, with swimmers then warned by megaphone.<sup>21</sup> In January 2018, in a world-first, the Little Ripper UAV was used to save two swimmers at Lennox Head, New South Wales. According to lifeguard supervisor, Jai Sheridan, who was piloting the UAV at the time, the use of a UAV shaved minutes off the time it would have taken a lifeguard to locate the swimmers and then reach them with a flotation device.<sup>22</sup>

1.21 Throughout the inquiry, the committee heard that Australia is at the forefront of RPAS technology as we have been 'doing it longer, better and in more diverse ways than anyone else'.<sup>23</sup> This is primarily because Australia was the first country in the world to allow commercial RPAS activities.<sup>24</sup> However, as RPAS grow in popularity and application across the country, a number of opportunities and challenges have arisen as a result.

## **Opportunities and challenges**

1.22 Whilst providing considerable opportunities, the prospect of an RPAS-driven society raises a number of difficult questions not only for the committee but for all Australians.

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18 National Farmers' Federation, *Submission 33*, p. 1.

19 Little Ripper Lifesaver, *ULB Lifesaving Pods*, <http://littleripper.com/innovation-technology/ulb-lifesaving-pods/> (accessed 19 September 2017).

20 Little Ripper Lifesaver Pty Ltd, *Submission 16*, p. 2.

21 James Redmayne and Darren Schuettler, 'Shark-detecting drones to patrol Australian beaches', *Reuters*, 25 August 2017, <https://www.reuters.com/article/us-australia-sharkdrone/shark-detecting-drones-to-patrol-australian-beaches-idUSKCN1B51KB> (accessed 19 September 2017).

22 Adella Beaini, 'Drone used to save two swimmers', *Sydney Morning Herald*, 19 January 2018, p. 1.

23 Dr Catherine Ball, Private capacity, *Committee Hansard*, 16 March 2017, p. 30.

24 Mr Scott Bush, Domino's Pizza New Zealand, *Committee Hansard*, 16 March 2017, p. 31.

1.23 The increasing application of RPAS, including for routine daily purposes such as the delivery of parcels and pizza,<sup>25</sup> together with the growth in the number of RPAS purchased and used in Australia, raises fundamental questions about safety, privacy and security. The use of RPAS by non-state actors to drop bombs or poisons, as well as the potential use of RPAS to traffic drugs, including into prisons, also highlights concerns about regulation and enforcement.<sup>26</sup>

1.24 Across Australia, RPAS are used by an increasing number of recreational or hobbyist users. As RPAS have become more popular, affordable and accessible, the number of recreational RPAS users has skyrocketed. Having first been made available in retail stores in 2010, rapid advances in technology and falling prices have led to a substantial rise in off-the-shelf RPAS purchases. Reports suggest that recreational RPAS have been amongst the highest selling Christmas gifts in Australia every year since 2014.<sup>27</sup>

1.25 While the total number of RPAS sales in Australia is difficult to determine, particularly given the rise of internet-based and second-hand sales, CASA estimates that there are now more than 50 000 users of recreational RPAS across Australia, as well as over 1000 commercial operators.<sup>28</sup> By way of comparison, in the US, 2.4 million hobbyist RPAS were purchased in 2016 alone, which was more than double the 1.1 million purchased the previous year.<sup>29</sup> These figures also do not

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25 To provide an indicative figure on delivery, Australia Post currently delivers over one million parcels around the country on a daily basis by way of traditional forms of delivery. See: Mr Tien Ti Mak, Australia Post, *Committee Hansard*, 16 June 2017, p. 37.

26 Tim Johnson, 'Something Else to Fret About: ISIS Mounting Dirty Bombs on Drones', *In Homeland Security*, 8 September 2017, <http://inhomelandsecurity.com/isis-dirty-bombs-drones/> (accessed 5 October 2017); Nathan Stitt, 'Drone crackdown targets operators smuggling contraband into SA prisons', *ABC News*, 31 August 2017, <http://www.abc.net.au/news/2017-08-31/prison-drone-drops-could-lead-to-jail-time/8859402> (accessed 12 December 2017).

27 Tim Jeanes, 'Surge in drones as Christmas gifts will show need for greater regulation: peak body', *ABC News*, 24 December 2014, <http://www.abc.net.au/news/2014-12-24/christmas-gift-drone-pace-fire-risk-warn-peak-body/5986844> (accessed 28 September 2017); Jennifer Dudley-Nicholson, 'It's six months away yet drones already tipped to be the top gift for Christmas 2015', *News.com.au*, 19 June 2015, <http://www.news.com.au/technology/gadgets/its-six-months-away-yet-drones-already-tipped-to-be-the-top-gift-for-christmas-2015/news-story/96c9cdc816f9297ee8ef01ec99f8b8eb> (accessed 28 September 2017); Jennifer Dudley-Nicholson, 'Drones expected to take off in Australia this Christmas, but experts warn of dangers', *The Courier Mail*, 10 December 2017, <http://www.couriermail.com.au/technology/techknow/drones-expected-to-take-off-in-australia-this-christmas-but-experts-warn-of-dangers/news-story/e7e9e9f065ee5b7b8e3e1715c1a4e4f9> (accessed 8 January 2018).

28 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19. Also see: Brett Williamson, 'How CASA drone laws apply to the fast-growing breed of new high-flyers', *ABC News*, 10 February 2017, <http://www.abc.net.au/news/2017-02-10/how-drone-laws-apply-to-a-new-breed-of-high-flyers/8258908> (accessed 19 September 2017).

29 April Glaser, 'DJI is running away with the drone market', *Recode*, 14 April 2017, <https://www.recode.net/2017/4/14/14690576/drone-market-share-growth-charts-dji-forecast> (accessed 28 September 2017).

account for the number of home-made RPAS, now made available through 3D printing technology.<sup>30</sup>

1.26 One of the most attractive features of an RPAS is that it can be operated by almost anyone. However, this factor also raises a series of challenges. First and foremost, it means that anyone can fly an RPAS without any training, safety awareness or aviation experience. For this reason, the proliferation of the incidental recreational user was central to the committee's inquiry and a primary concern of many witnesses and submitters.<sup>31</sup>

1.27 Mr Mike Mrdak, then-Secretary of the Department of Infrastructure, Regional Development and Cities (DIRDC),<sup>32</sup> and Chair of the Aviation Policy Group, noted some of the challenges at Budget Estimates on 23 May 2017:

...the whole aviation regulatory system has been built for the best part of a century on creating a regulatory structure where you have to reach certain qualifications to enter into the system. The system's safety is built on the qualifications and the protections built in around the airworthiness of the aircraft, the training of the pilot and the training of the air traffic controllers, as appropriate. What unmanned drones or unmanned aerial vehicles do is create a new category of operator that operates outside that closed system. That is the real challenge for policymakers and regulators.<sup>33</sup>

1.28 The rapid rise of RPAS brings new challenges that were not considered in historical aviation regulatory frameworks. Civil aviation has historically been based on the notion of a pilot operating an aircraft from within it. Removing the pilot from the aircraft has thus raised serious technical and operational questions. The required shift away from an aircraft-centric approach to that of an operation-centric approach places responsibility directly onto the RPAS operator. As noted by the International Civil Aviation Organization:

The functions and responsibilities of the remote pilot are essential to the safe and predictable operation of the aircraft as it interacts with other civil aircraft and the air traffic management (ATM) system.<sup>34</sup>

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30 Mr Greg Hood, Australian Transport Safety Bureau, *Committee Hansard*, 29 August 2017, p. 19. Also see: DJI, *Submission 60*, pp. 2–3.

31 See, for example: Mr Ben Smart, Smart Air Services, *Committee Hansard*, 16 March 2017, p. 7; Australian Airline Pilots' Association, *Submission 39*, pp. 4–5; Mr Vince Sofia, *Submission 7*, [pp. 1–2]; Austec Aerial Solutions, *Submission 13*, [p. 1].

32 The Department of Infrastructure, Regional Development and Cities (DIRDC) was formerly known as the Department of Infrastructure and Regional Development. Whilst evidence provided by DIRDC is submitted under its former designation, the committee has chosen to identify DIRDC by its new title so as to make recommendations to the Department in its new form.

33 Mr Mike Mrdak, Department of Infrastructure, Regional Development and Cities, *Budget Estimates Hansard*, 23 May 2017, p. 30.

34 International Civil Aviation Organization, *Unmanned Aircraft Systems (UAS)*, Circular 328, 2011, p. 3, [https://www.icao.int/Meetings/UAS/Documents/Circular%20328\\_en.pdf](https://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf) (accessed 29 September 2017).

1.29 Mr Mrdak observed that the current regulatory structure is designed to prevent the operator of an RPAS interfering with the operations of an aircraft. However, noting that the number of recreational RPAS users in Australia continues to rise, he also acknowledged that questions remain as to whether the current regulatory requirements are adequate and balanced.<sup>35</sup> Dr Rob Weaver of Airservices Australia highlighted the rapid pace at which the RPAS sector is moving, and the challenges associated with 'responding to the changing environment in terms of both the number of drones and the technology that's available'.<sup>36</sup>

1.30 The question of how to facilitate and integrate RPAS into a pre-existing, conventionally piloted aviation system is central to the challenge.<sup>37</sup> Although many submitters raised the question of how to safely integrate RPAS into Australia's national airspace system, whilst keeping RPAS out of controlled airspace, those within the aviation sector brought forward key concerns about unregulated RPAS which pose a growing threat to aviation security.

1.31 A primary and growing concern of aviation authorities and experts is that of the number of incidents whereby RPAS have come into contact with or within close range of aircraft.<sup>38</sup> According to the Australian Airline Pilots' Association (AusALPA) there were over 160 'air proximity events' involving RPAS reported from 2015 to 2016.<sup>39</sup> The Australian Transport and Safety Bureau (ATSB) provided a figure of 180 near-encounters with RPAS reported to air traffic control between 2012 and 2016. It informed the committee that none of the involved RPAS were operated by commercial operators.<sup>40</sup> In 2017, there were 151 reported near-encounters with manned aircraft, representing a 119 per cent increase from the previous year.<sup>41</sup>

1.32 As the rate of incidents continues to increase, there are growing concerns that an RPAS will eventually be ingested into an aircraft engine or helicopter rotor and cause a catastrophic aviation accident. Australian aviators are not alone in their concerns, with the number of RPAS-related incidents and complaints increasing throughout the US, United Kingdom (UK), Canada and New Zealand.

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35 Mr Mike Mrdak, Department of Infrastructure, Regional Development and Cities, *Budget Estimates Hansard*, 23 May 2017, p. 31.

36 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 16.

37 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 11.

38 Australian Airline Pilots' Association, *Submission 39*, p. 3; Mr Simon Bourke, Australian Airports Association, *Committee Hansard*, 29 August 2017, p. 2.

39 AusALPA further noted that in the US, where there is a larger RPAS market, there are approximately 100 reports per month from pilots who have sighted RPAS flying near aircraft and airports. See: Australian Airline Pilots' Association, *Submission 39*, p. 3.

40 Mr Greg Hood, Australian Safety Transport Bureau, *Committee Hansard*, 29 August 2017, p. 20.

41 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19.

1.33 At the same time, the committee was made acutely aware of growing public anxiety regarding RPAS. This anxiety is stimulated by reported incidents of RPAS coming into close range of buildings and events, and over people on their own property as well as in public spaces. According to CASA, on average, 15 people are prosecuted for flying RPAS dangerously in Australia every year alongside scores of others who are subject to monetary penalties.<sup>42</sup> Between 1 November 2015 and 8 November 2017, CASA issued 23 counselling letters to individuals in relation to apparent breaches of the regulations relating to the operation of RPAs.<sup>43</sup> However, these figures do not reflect the large number of illegal drone operations that remain unreported.

1.34 In light of these concerns, the committee has focused its attention on the impact of relaxing the regulations regarding RPAS use, and how the regulations contribute to keeping Australia's skies and the Australian public safe. Throughout the course of the inquiry, the committee considered the various challenges arising from the proliferation of RPAS in Australia. Key amongst them is the question of balance between safety, privacy, security, social benefits and economic impost.

1.35 The challenge is in establishing a regulatory regime which does not impede continued innovation, whilst also instilling community confidence and providing assurances with regard to safety and privacy. During the inquiry, the committee considered these matters and the fundamental question of whether current regulations have kept up with the growth and increasing application of RPAS technology in Australia.

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42 Brett Williamson, 'How CASA drone laws apply to the fast-growing breed of new high-flyers', *ABC News*, 10 February 2017, <http://www.abc.net.au/news/2017-02-10/how-drone-laws-apply-to-a-new-breed-of-high-flyers/8258908> (accessed 29 September 2017).

43 Civil Aviation Safety Authority, answers to questions on notice, *Supplementary Estimates*, 27 October 2017 (received 22 February 2018).

# Chapter 2

## RPAS laws in Australia

2.1 The regulation of RPAS in Australia is administered via the *Civil Aviation Act 1988* (the Act) and the Civil Aviation Safety Regulations 1998 (CASR) established under the Act. Part 101 of the CASR, introduced in 2001, specifically regulates unmanned aircraft.

2.2 In 2016, Part 101 of the CASR was amended in an effort to reflect the drastically changed operating environment for RPAS since Part 101 first took effect in 2001. This chapter explains the 2016 amendments and considers the evidence about the impact of these changes to RPAS use in Australia.

2.3 The chapter also considers the international and domestic legislative framework in place to regulate the operation of RPAS; the penalty regime for RPAS misuse; and the concerns raised by witnesses and submitters.

### **The Chicago Convention and the International Civil Aviation Organization**

2.4 The Convention on International Civil Aviation, also known as the Chicago Convention, was signed in 1944. The convention establishes rules of airspace, aircraft registration and safety, whilst also detailing the rights of signatories regarding air travel. It applies to civil aircraft and excludes aircraft used in military, customs or police services.<sup>1</sup> Article 8 of the convention provides that 'pilotless aircraft', including RPAS, are prohibited from flying over the territory of a contracting State, without special authorisation. Article 8 notes:

Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.<sup>2</sup>

2.5 The Chicago Convention also established the International Civil Aviation Organization (ICAO), a specialised United Nations agency responsible for coordinating and regulating international air travel. The goal of ICAO in relation to RPAS is to provide an international regulatory regime through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material, to 'underpin [the] routine operation of UAS

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1 Article 3 of the Convention on International Civil Aviation, Ninth Edition, 2006.

2 Article 8 of the Convention on International Civil Aviation, Ninth Edition, 2006.

throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations'.<sup>3</sup>

2.6 According to ICAO:

The principal objective of the aviation regulatory framework is to achieve and maintain the highest possible uniform level of safety. In the case of UAS, this means ensuring the safety of any other airspace user as well as the safety of persons and property on the ground.<sup>4</sup>

***Addressing a growing global concern***

2.7 In light of the proliferation of RPAS worldwide, a growing number of ICAO member states expressed concern to the international body about reported incidents of RPAS flying near airports and creating hazards for commercial aircraft. To support the development of appropriate regulations, ICAO formed a UAS Advisory Group in March 2016 to share best practice and develop guidance material for the 191 ICAO member states.<sup>5</sup>

2.8 In October 2016, the member states requested that ICAO consider developing a management tool for UAS operating at low altitudes and to explore registration and identification solutions.<sup>6</sup> ICAO acknowledged the concerns and released a publication ahead of Christmas in December 2016 to provide recreational RPAS users with tips on safe RPAS use. The publication noted that RPAS can 'pose a serious threat to manned flights and people and property on the ground'.<sup>7</sup>

2.9 Whilst ICAO has been involved in further discussions about harmonising UAS regulations, and continues to hold symposiums across the globe to facilitate this

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3 International Civil Aviation Organization, *Unmanned Aircraft Systems (UAS)*, Circular 328, 2011, p. iii, [https://www.icao.int/Meetings/UAS/Documents/Circular%20328\\_en.pdf](https://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf) (accessed 29 September 2017).

4 International Civil Aviation Organization, *Unmanned Aircraft Systems (UAS)*, Circular 328, 2011, p. 4.

5 International Civil Aviation Organization, *Training Education General Recommendations*, <http://www4.icao.int/uastoolkit/Home/Narrative#training> (accessed 1 November 2017).

6 International Civil Aviation Organization, *Unmanned Aircraft Systems Advisory Group (UAS-AG)*, [https://www.icao.int/safety/UA/Pages/Unmanned-Aircraft-Systems-Advisory-Group-\(UAS-AG\).aspx](https://www.icao.int/safety/UA/Pages/Unmanned-Aircraft-Systems-Advisory-Group-(UAS-AG).aspx) (accessed 7 March 2018).

7 UK Civil Aviation Authority, *Ten things to know before buying a drone this Christmas*, <http://www.unitingaviation.com/general-interest/ten-things-to-know-before-buying-a-drone-this-christmas/> (accessed 1 November 2017).

work, the responsibility for regulation at the national level falls to the individual states, as per Article 8 of the Chicago Convention.<sup>8</sup>

2.10 According to Article 8, standards relating to the maximum weight or authorised flying altitude for various categories of RPAS are a responsibility for national civil aviation authorities, with ICAO serving only an advisory role. To this end, in December 2016, ICAO launched a UAS toolkit to guide member states in developing their own UAS regulations.<sup>9</sup>

2.11 The toolkit highlights the multitude of challenges facing member states in developing appropriate UAS regulation, including managing the expectations of the UAS industry; providing training materials to educate operators; advancing harmonization with international counterparts; engaging legal authorities to strengthen enforcement capacity; and managing large volumes of new operators or new types of operations.<sup>10</sup>

### **Australia's legal framework**

2.12 In Australia, the *Civil Aviation Act 1988* (the Act) establishes the regulatory framework for maintaining, enhancing and promoting the safety of civil aviation, with a particular emphasis on preventing aviation accidents and incidents.

2.13 The Act provides for the establishment of regulations and gives effect to the provisions of the Chicago Convention relating to safety. Subsection 9(1) of the Act outlines the role and responsibilities of CASA. It states that CASA:

...has the function of conducting the safety regulation of...civil air operations in Australian territory by means that include...developing and promulgating appropriate, clear and concise aviation safety standards; and issuing certificates, licences, registrations and permits.<sup>11</sup>

2.14 In terms of the overall civil aviation framework, CASA is the regulator; DIRDC is responsible for policy; the ATSB is responsible for the investigation of aviation incidents and accidents; and Airservices Australia is responsible for service provision, including air navigation, and aviation rescue and firefighting services.

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8 International Civil Aviation Organization, *DRONE ENABLE, ICAO's Unmanned Aircraft Systems (UAS) Industry Symposium*, <https://www.icao.int/Meetings/UAS2017/Pages/default.aspx> (accessed 4 October 2017); Author unknown, 'Drone tracking plan by ICAO to avoid air disasters', *The Australian*, 12 May 2017, <http://www.theaustralian.com.au/business/aviation/drone-tracking-plan-by-icao-to-avoid-air-disasters/news-story/d635abe479d6f442321c0e06abca1c02> (accessed 5 October 2017).

9 International Civil Aviation Organization, *UAS Toolkit*, <https://www4.icao.int/uastoolkit/Home/About> (accessed 5 October 2017).

10 International Civil Aviation Organization, *Development of UAS Regulation*, <https://www4.icao.int/uastoolkit/Home/Narrative#regulation> (accessed 9 January 2018).

11 *Civil Aviation Act 1988*, ss. 9(1).

### ***Part 101 of the Civil Aviation Safety Regulations 1998***

2.15 As noted in Chapter 1, Australia was the first country to allow commercial UAV activities, with CASA the first body in the world to regulate the operation of RPAS. Part 101 of the Civil Aviation Safety Regulations 1998 (CASR) was first introduced in December 2001 to provide a regulatory framework for RPAS, with the aim of enabling the technology to progress without compromising the safety of other airspace users, people and property. It is the primary instrument governing the civil operation of all types of 'unmanned' aircraft in Australian airspace including model aircraft, remote controlled aeroplanes and helicopters, blimps, rockets, kites and RPAS.<sup>12</sup>

2.16 When first introduced in 2001, the regulations contained in Part 101 of the CASR were considered ground-breaking. According to many within the industry, the success and advancement of Australia's UAV industry is largely due to the flexible approach outlined in the regulations.<sup>13</sup> However, CASA developed the regulations at a time when there were only a few operators in the country, with the majority of them commercial.<sup>14</sup>

2.17 Since the introduction of the CASR in 2001, the number of RPAS users has grown rapidly. In 2007, there were less than 25 certified RPAS operations in Australia. By the end of March 2016, the number had grown to 500.<sup>15</sup> Similarly, the number of ReOCs issued by CASA rose from 70 in February 2014 to 1106 in July 2017.<sup>16</sup> By February 2018, CASA reported approximately 1283 ReOC holders and 7380 RePL holders in Australia, with an estimated 50 000 additional unregistered RPAS being operated for sport and recreational purposes.<sup>17</sup> A review of the regulations, to encompass the increased number of hobbyist and amateur operators, was therefore considered necessary to keep pace with the evolution of RPAS use.<sup>18</sup>

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12 Civil Aviation Safety Regulations 1998, Part 101 – Unmanned aircraft and rockets.

13 See, for example: Parrot ANZ Pty Ltd, *Submission 28*, [pp. 2–3]; Canberra UAV, *Submission 47*, [pp. 1–3]; DJI, *Submission 60*, [pp. 1–2]; Australian Pork, *Submission 32*, [p. 1].

14 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 1.

15 Reece Clothier and Jonathan Roberts, 'New relaxed drone regulations will help the industry take off', *The Conversation*, 7 April 2016, <https://theconversation.com/new-relaxed-drone-regulations-will-help-the-industry-take-off-57201> (accessed 4 October 2017).

16 Civil Aviation Safety Authority, *Submission 17*, p. 1; Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations*, August 2017, p. 3.

17 Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations*, August 2017, p. 3; Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19.

18 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 1.

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*Civil Aviation Legislation Amendment (Part 101) Regulation 2016*

2.18 On 29 September 2016, following a review of the regulations, amendments by way of the Civil Aviation Legislation Amendment (Part 101) Regulation 2016 came into force. CASA noted the following in relation to the changes:

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.<sup>19</sup>

2.19 Prior to the 2016 amendments, all RPAS, regardless of weight or operation, were regulated under the CASR as a single category.<sup>20</sup> Operators of UAV were required to obtain a RePL or ReOC in order to conduct operations. However, under the new regulations, operators of RPAS below 2kg are no longer required to obtain these qualifications. Along with the introduction of weight categories, the new regulations also make the distinction between commercial operators, and those using RPAS 'for the purpose of sport and recreation'.<sup>21</sup>

2.20 CASA explained that the intention of the amended Part 101 was to seek a balance between managing risk and encouraging innovation.<sup>22</sup> It noted that the changes enhanced the existing safety framework by introducing new provisions to strengthen and clarify the requirements and limitations governing the safe operation of RPAS. At the same time, the changes aimed to reduce the 'cost and legal requirements for lower-risk RPA operations',<sup>23</sup> and effectively 'cut red tape'.<sup>24</sup>

2.21 The committee noted that the amendments made a number of significant changes to the CASR, including:

- new weight classifications for RPA;
- reduced regulatory requirements for 'excluded' category RPA;

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19 Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations*, August 2017, p. 3.

20 Military drones are regulated by the Chief of Air Force as the Defence Aviation Authority. See: Department of Defence, *Submission 44*, p. 3.

21 Civil Aviation Legislation Amendment (Part 101) Regulation 2016, para. 21.

22 Civil Aviation Safety Authority, *Submission 17*, p. i.

23 Civil Aviation Safety Authority, *Flying drones/remotely piloted aircraft in Australia*, 13 August 2017, <https://www.casa.gov.au/aircraft/landing-page/flying-drones-australia> (accessed 19 September 2017).

24 Civil Aviation Safety Authority, *New drone rules cut red tape*, 28 September 2017, <https://www.casa.gov.au/media-release/new-drone-rules-cut-red-tape> (accessed 1 November 2017).

- the establishment of standard operating conditions for RPA; and
- the establishment of a series of new offences relating to the environment in which RPA can be operated.

*New weight classifications*

2.22 The amended regulations recognise five types of RPA based on size and weight as provided in Table 2.1 below.

**Table 2.1: New weight classification for Remotely Piloted Aircraft<sup>25</sup>**

<b>RPA</b>	<b>Gross weight</b>
<i>Micro RPA</i>	100 g or less
<i>Very small RPA</i>	More than 100 g but less than 2 kg
<i>Small RPA</i>	At least 2 kg but less than 25 kg
<i>Medium RPA</i>	At least 25 kg but not more than 150 kg
<i>Large RPA</i>	More than 150 kg

*New 'excluded' category*

2.23 The amendments introduced the concept of 'excluded' RPAs for lower risk categories of use. The meaning of 'excluded' category RPA is laid out in Regulation 101.237 of the CASR, but generally includes both commercial and recreational operators of RPAS below 2kg.

2.24 Operators of 'excluded' RPAS have reduced regulatory requirements and are permitted to use their RPAS without a ReOC or RePL, and can therefore operate without formal training or safety education.<sup>26</sup> Excluded category RPAS are not subject to formal registration requirements, unless being flown for commercial purposes, in which case an aviation reference number is required.<sup>27</sup>

2.25 In addition, the 2016 amendments introduced the following provisions:

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25 Civil Aviation Safety Authority, *Discussion Paper: Review of RPAS operations*, August 2017, p. 7.

26 Prior to 29 September 2016, the ReOC was called an operator's certificate and the RePL was called a controller's certificate. A RePL is held by individual controllers, whilst a ReOC is required by the commercial entity to conduct commercial operations.

27 Civil Aviation Safety Authority, *Commercial unmanned flight – remotely piloted aircraft under 2kg*, <https://www.casa.gov.au/standard-page/commercial-unmanned-flight-remotely-piloted-aircraft-under-2kg> (accessed 8 March 2018).

- persons conducting operations for 'hire and reward' using very small RPAs (100g to 2kg) are not required to have a ReOC or a RePL. They do, however, have to notify CASA at least five days before flying, and must operate in accordance with the standard operating conditions. Notification is valid for 24 months;
- private landowners are permitted to carry out some commercial-like operations on their land under the 'standard RPA operating conditions' without requiring a ReOC or RePL on two conditions: the RPA in use is below 25kg, and none of the parties involved should receive remuneration; and
- for RPA weighing between 25kg and 150kg, the operator needs to hold a RePL in the category of aircraft being flown.<sup>28</sup>

### *Standard operating conditions*

2.26 The standard operating conditions applicable to RPA are set out in Regulation 101.238 of the CASR. Under the standard operating conditions, RPA operators must abide by the following rules:

- the RPA is operated within the visual line of sight of the person operating it;
- the RPA is operated at or below 400 feet (120 metres) above ground level (AGL) by day;
- the RPA is not operated within 30 metres of a person who is not directly associated with its operations;
- the RPA is not operated:
  - in a prohibited area or in specified restricted areas
  - over a populous area
  - within 3 nautical miles (5.5 kilometres) of the movement area of a controlled aerodrome;
- the RPA is not operated 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.<sup>29</sup>

2.27 These requirements were expressly noted in a Notice of Final Rule Making (NFRM) on August 2017,<sup>30</sup> and later in a direction issued under Regulation 11.245 of the CASR on 17 October 2017.<sup>31</sup>

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28 Explanatory statement, Civil Aviation Legislation Amendment (Part 101) Regulation 2016, pp. 1–2.

29 Civil Aviation Safety Regulations 1998, reg. 101.238.

30 Civil Aviation Safety Authority, *Notice of Final Rule Making – Remotely piloted aircraft systems*, NFRM1309OS, August 2017, pp. 9–15.

2.28 According to CASA, standard operation conditions apply when using excluded RPAs, both for recreational or commercial purposes. Those using RPAs in breach of those conditions must notify CASA and may have to apply for a licence or exemption.

#### *CASA 96/17 Direction*

2.29 Following the introduction of the 2016 amendments, CASA told the committee that there was a need to remove some ambiguity about the rules around the use of recreational RPAS, including the prohibition of flights above 400 feet and within 3 nautical miles of an aerodrome.<sup>32</sup> Whilst the standard operating conditions instructed RPAS operators not to operate within 3 nautical miles of a controlled aerodrome, the new rules established that RPAS operations should also not occur near a non-controlled aerodrome, should the operator become aware that a manned aircraft is being operated to or from the site.<sup>33</sup>

2.30 Other changes included the imposition of a weight limit on RPAS operating in the movement area of aerodromes,<sup>34</sup> and clarification around the operation of RPAS over emergency operations.

#### *Penalties and offences*

2.31 A breach of the regulatory requirements set out in Part 101 of the CASR constitutes a strict liability offence in most cases for which:

- a penalty of a fine of up to 50 penalty units or \$10 500 (imposed by a court on conviction) may be applied; or
- the issuance of an aviation infringement notice by CASA requiring the payment of an administrative penalty of up to 5 penalty units or \$1050 (in default of which the matter would be referred for prosecution) can be applied.<sup>35</sup>

2.32 The reckless operation of an unmanned aircraft which endangers the life of another person, or endangers another person or another person's property, is

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31 CASA 96/17 – Direction—operation of certain unmanned aircraft [F2017L01370].

32 Mr Shane Carmody, Civil Aviation Safety Authority, *Supplementary Estimates Hansard*, 27 October 2017, p. 27.

33 CASA 96/17 – Direction—operation of certain unmanned aircraft [F2017L01370].

34 RPAS weighing 100g or below are permitted to operate within 3 nautical miles of an aerodrome. See: Mr Shane Carmody, Civil Aviation Safety Authority, *Supplementary Estimates Hansard*, 27 October 2017, p. 27.

35 The penalties prescribed for offences under Part 101 of the CASR are specified in the regulations as penalty units, ranging in value from 10 to 50 penalty units depending on the seriousness of the offence. The value of a penalty unit is fixed under section 4AA of the *Crimes Act 1914*, and adjusted periodically. As of 1 July 2017, the value of a penalty unit was \$210.

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recognised as a serious offence under the Act. Upon conviction, a person may be sentenced to a period of up to 5 years in prison for endangering another person's life, and up to two years for otherwise endangering another person or another person's property.<sup>36</sup>

### *Aviation Infringement Notices*

2.33 CASA informed the committee that a penalty specified in a regulation is the maximum amount a court may impose on a person convicted or found guilty of an offence against that regulation. CASA may issue an aviation infringement notice (AIN) for offences under the CASR. The amount of the penalty imposed by an AIN is specified in regulation 296A of the Civil Aviation Regulations 1988 (CAR) as follows:

- if the maximum penalty a court could impose for the offence is 5 or 10 penalty units, the prescribed penalty for an AIN issued for that offence is 1 penalty unit;
- if the maximum penalty a court could impose for the offence is 15, 20 or 25 penalty units, the prescribed penalty for an AIN issued for that offence is 3 penalty units;
- if the maximum penalty a court could impose for the offence is more than 25 penalty units, the prescribed penalty for an AIN issued for that offence is 5 penalty units.

2.34 Converted into dollar amounts, the range of penalties a court may impose for offences against the provisions in CASR Part 101 is any amount from \$2100 to \$10 500 (depending on the penalty specified in the regulation).<sup>37</sup> The range of penalties that CASA may impose through AINs issued under those regulations are also fixed amounts between \$210 and \$1050, depending on the penalty specified in the regulation.<sup>38</sup>

2.35 Information provided by CASA in September 2017 revealed that since 2015, nine AINs related to RPAS had been issued. The first prosecution was made in January 2015 when an RPAS operator in Townsville received an \$850 fine for operating the RPAS within the Townsville Control Zone. The RPAS was flown within 3 nautical miles of Townsville Airport, above 400 feet, at night, over populous areas, and within 30 metres of people not directly associated with the operation of the RPAS.

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36 Civil Aviation Safety Authority, *Submission 17*, p. 4.

37 Civil Aviation Safety Authority, answers to written questions on notice, 19 September 2017, p. 2 (received 3 October 2017).

38 Civil Aviation Safety Authority, *Infringement notices and demerit points*, <https://www.casa.gov.au/regulations-and-policy/standard-page/infringement-notices-and-demerit-points> (accessed 8 March 2018).

Whilst the offender had breached the regulation multiple times, a single fine was issued.<sup>39</sup>

2.36 A more recent prosecution was made on 10 July 2017 when an RPAS operator was fined \$900 for 'hazardous flying at and near guests' at a wedding in Kangaroo Valley. CASA told the committee that another person was fined \$900 on the same day after their RPAS came too close to a group of children at an Easter egg hunt in Canberra.<sup>40</sup>

2.37 Noting the range of offences and fines applied over some years, the committee questioned whether the penalty regime for RPAS-related offences had been applied consistently. However, CASA noted that '[i]n the exercise of its discretion, and consistent with the approach reflected in CASA's *Enforcement Manual*, CASA may issue a single AIN for more than one offence of the same kind committed by the same person', as was the case with the incident in Townsville.<sup>41</sup> The committee was further advised that varying fines were the result of the changing value of a penalty unit, as defined in the *Crimes Act 1914*.<sup>42</sup>

### **Concerns raised in evidence regarding the regulations**

2.38 Inquiry participants' primary concern with the regulations related to the classification of the recreational or hobby user as an 'excluded category' RPAS operator, particularly given the growing number of hobbyists reported in recent years. The argument was put to the committee that the amendments leave recreational users effectively untouched as they are not required to undergo any training or safety induction prior to operating an RPAS.<sup>43</sup>

2.39 Concerns were also raised about the extent of due diligence taken prior to the introduction of the amendments, the complex nature of the regulations, and the effectiveness of the current penalty regime. These concerns are detailed in the following section.

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39 Civil Aviation Safety Authority, answers to written questions on notice, 19 September 2017, p. 1. Also see: Chris Griffith, 'Airspace regulator CASA on collision course with drones', *Australian Business Review*, 3 February 2015, <http://www.theaustralian.com.au/business/technology/airspace-regulator-casa-on-collision-course-with-drones/news-story/d998fc507203885bc701a56b00d92ddc> (accessed 26 October 2017).

40 Civil Aviation Safety Authority, answers to written questions on notice, 19 September 2017, p. 1.

41 Civil Aviation Safety Authority, answers to written questions on notice, 19 September 2017, p. 2.

42 Civil Aviation Safety Authority, answers to written questions on notice, 19 September 2017, p. 2.

43 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 9.

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### ***Concerns raised about 'excluded' category operators***

2.40 Many witnesses raised concerns that under the amended regulations, excluded category operators are not required to undergo any formal training or licensing commensurate to the risks that they pose. Yet, according to evidence before the committee, there are now more than 5000 'excluded category' operators in Australia, many of whom do not have an aviation background.<sup>44</sup>

2.41 Inquiry participants argued that differentiating between recreational and commercial RPAS operations did not justify relaxed requirements for new users. The Australian Association for Unmanned Systems (AAUS) argued that under a risk-based regulatory approach, 'regulations applicable to hobbyists and recreational drones should be the same as those presented by commercial RPAS operators'. In parallel, AAUS noted, effort is required to 'address issues surrounding education and enforcement of the regulations'.<sup>45</sup>

2.42 AusALPA suggested that there is a diminishing argument for the regulatory divide between commercial and recreational RPAS operations, particularly as passenger-carrying RPAS are a likely next step. It submitted that:

While we recognise that several years ago, the division between private/recreational and commercial use was a reasonable proxy for [consideration of RPA mass, frequency of use and location of use], the explosion of availability of affordable RPAs has undermined that connection...<sup>46</sup>

2.43 AusALPA further stated that the new rules would '[broaden] the base of barely constrained users while undermining the market for the highly invested and highly constrained commercial users'.<sup>47</sup>

2.44 For many submitters, the development of the 'excluded' category appeared to be 'a de-reg[ulation] of the entire UAV (drone) industry', allowing untrained operators to fly their RPAS without first understanding the potential hazards.<sup>48</sup> The International Aerospace Law and Policy Group (IALPG) commented that it is 'alarming' to roll back the very protections that had allowed safe operation before the changes to CASR

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44 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 1.

45 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, pp. 1–2. Also see: Australian Airline Pilots' Association, *Submission 39*, p. 4.

46 Australian Airline Pilots' Association, *Submission 39*, pp. 4–5.

47 Australian Airline Pilots' Association, *Submission 39*, p. 5.

48 Mr Vince Sofia, *Submission 7*, [pp. 1–2]. Also see: Mr John Reidy-Crofts, *Submission 89*, p. 1; Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 9.

Part 101,<sup>49</sup> while Austec Aerial Solutions went further to describe the legislation as a 'complete failure' that would lead to injuries, and reckless and illegal RPAS use.<sup>50</sup>

### ***Concerns about due diligence conducted prior to the amendments***

2.45 Submitters also raised concerns about the extent to which CASA undertook its due diligence before introducing the amendments. In particular, witnesses pointed to the extremely short consultation period prior to the introduction of the amendments.<sup>51</sup>

2.46 CASA engaged in consultation with industry and the public about the proposed amendments for approximately one month between 14 May 2014 and 16 June 2014 through a Notice of Proposed Rulemaking (NPRM 1309OS). CASA received 90 responses, including two which had established petitions with a total of 430 signatures.<sup>52</sup> In response to feedback on the amendments, CASA then prepared a new draft of the regulations and submitted it to the UAS Standards Sub-committee (UASSC),<sup>53</sup> and CASA's RPAS Operations Office, for review.<sup>54</sup>

2.47 The IALPG pointed out that the 2016 regulations came into force more than two years after the initial consultation period, and did not reflect the 'leaps and bounds' that had been made in understanding the risks associated 'with all sizes of drone' since that time.<sup>55</sup> This concern was echoed by Maurice Blackburn Lawyers who were critical of CASA's lack of research on the likelihood of injury occurrence from RPAS, compared to other countries.<sup>56</sup>

2.48 Mr Joseph Urli of Australian Certified UAV Operators argued that the decision made by CASA to relax the regulations went directly against the recommendations of the wider aviation industry. He stated:

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49 International Aerospace Law & Policy Group, *Submission 19*, p. 12.

50 Austec Aerial Solutions, *Submission 13*, [p. 1].

51 See, for example: Drone Solutions Pty Ltd, *Submission 63*, p. 4; Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 9; Australian Airline Pilots' Association, *Submission 39*, p. 4; International Aerospace Law & Policy Group, *Submission 19*, p. 5; Maurice Blackburn Lawyers, *Submission 22*, p. 2.

52 Civil Aviation Safety Authority, *Notice of Final Rule Making: Remotely Piloted Aircraft Systems*, August 2017, pp. 7–9.

53 The UASSC includes representatives from the RPAS industry, as well as CASA, Airservices Australia and major Australian airlines. Following a committee meeting on 4 September 2017, the UASSC was subsumed into the Aviation Safety Advisory Panel (ASAP). A full list of members is available at: <https://www.casa.gov.au/rules-and-regulations/standard-page/aviation-safety-advisory-panel>.

54 Explanatory statement, Civil Aviation Legislation Amendment (Part 101) Regulation 2016, p. 2.

55 International Aerospace Law & Policy Group, *Submission 19*, p. 5.

56 Maurice Blackburn Lawyers, *Submission 22*, p. 2.

CASA's notice of proposed rulemaking was not a fair and open process. More than one person between CASA and industry had preconceived ideas about deregulating the industry and both the public consultation process and [the UAS Standards Sub-committee's] support was manipulated to achieve the desired outcome. The large majority of the actual industry certified commercial operators, numbering just over 100 operators at the time of the [notice of proposed rule-making], were against the deregulation for good reason.<sup>57</sup>

2.49 The committee was also informed that, during risk assessments of the key changes proposed in the amendments, CASA's own risk matrix, which incorporates both likelihood and consequence values for a collision, was misinterpreted to produce a low risk rating. It was noted in evidence that the conclusions made by the two CASA-commissioned studies undertaken by Monash University diverge significantly from the conclusions made in similar studies overseas.<sup>58</sup>

2.50 In addition to these concerns, the committee heard criticism that CASA did not fully grasp or consider how the relaxation of rules may impact on the number of 'undesirable' RPAS operations undertaken by excluded category users.<sup>59</sup> According to submitters, CASA effectively 'opened the flood gates',<sup>60</sup> and abrogated responsibility in a way that was out of step with its usual regulatory rigour.<sup>61</sup> To this end, questions were raised about the proliferation of recreational RPAS operating in Australia, with some witnesses questioning how CASA could relax the regulations without having a clear picture of the total number of recreational RPAS users in the country. Airservices Australia acknowledged these concerns, noting that the number of RPAS in Australia presents 'an emerging and insufficiently understood transport safety risk'.<sup>62</sup>

### ***Concerns about the complexity of regulations***

2.51 An additional concern of many submitters was that the regulations are in and of themselves too complex. Mr Chris Bird stated:

CASA has tried to apply a full size aviation solution to something that is now in the hands of the common person. To fly a full size aircraft you need a lot of training and getting access to a plane is not easy without having a license [sic]. The common person hasn't had this training and the

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57 Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 9.

58 Chapter 3 considers the two Australian studies commissioned by CASA as well as the research undertaken in other jurisdictions.

59 Australian Airline Pilots' Association, *Submission 39*, p. 4.

60 Mr Mark Leuschner, *Submission 82*, [p. 1].

61 Virgin Independent Pilots Association, *Submission 11*, [p. 3].

62 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 11. Also see: Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems*, March 2017, [p. iii].

expectation is that they just know about these things. Right now the regulations are just too complex for the common person to understand.<sup>63</sup>

2.52 Representatives from law firm Piper Alderman supported this view, stating:

...the language used in the CASA Regulations is likely to be difficult for a lay person to navigate and interpret; for example, Reg 101.280 provides various strict liability offences in respect of the operation of RPAs in "populous areas" but the definition of "populous area" provided in Reg 101.025 is legalistic and not easily translated for real world application...

As noted above, it is hardly accurate to describe the CASA Regulations as "simple".<sup>64</sup>

2.53 The committee heard that it is not only the regulations that are perceived as convoluted, but also the advice provided directly by CASA. Mr John Reidy-Crofts suggested that CASA's advice is overly technical and hard for the public to understand. He referred to correspondence he received from CASA which used terminology such as 'VFR', 'deconfliction' and 'uncontrolled air space'. According to Mr Reidy-Crofts:

Until I read the CASA Advisory Circular, and made further enquiries by gaining web site access to how airspace is managed in Australia, I was not aware of what these terms meant.

...I hold serious concern that under the current CASA Licensing and Operational rules for RPAS, a child or person of unsound mind, can operate a small (excluded) RPA without any pre-requisite [sic] training or license requirements. I have also concerns over adults who may be of sound mind but have no understanding of VFR or other terms as mentioned above.<sup>65</sup>

### ***Concerns regarding the recording of aviation occurrences***

2.54 According to the ATSB, an aviation occurrence is reported and recorded when it is deemed to be:

- an accident involving death or serious injury, aircraft destruction or serious damage, or property destruction or serious damage;
- a serious incident involving circumstances indicating that an accident nearly occurred; or
- an incident associated with the operation of an aircraft which affects or could affect the safety of operation.<sup>66</sup>

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63 Mr Chris Bird, *Submission 52*, [p. 3].

64 Piper Alderman, *Submission 65*, p. 2.

65 Mr John Reidy-Crofts, *Submission 89*, p. 2.

66 Australian Transport Safety Bureau, *ATSB National Aviation Occurrence Database – Terminology*, <https://www.atsb.gov.au/avdata/terminology.aspx> (accessed 7 March 2018).

2.55 However, submitters highlighted a number of issues with the current system of recording aviation occurrences, particularly with regard to RPAS incidents. Such information is an important means of measuring the effectiveness of the regulations.

2.56 Aviation occurrence reporting requirements are provided under the *Transport Safety Investigation Act 2003* and the Transport Safety Investigation Regulations 2013. Airservices Australia is responsible for collecting occurrence data, and recording it in their Corporate Integrated Reporting and Risk Information System (CIRRIS). According to an Airservices Australia representative, the database captured by CIRRIS is not publically available, but reports can be sent to the ATSB when required under the *Transport Safety Investigation Act 2003*.

2.57 Airservices Australia told the committee that, while there is currently a 'very high reliance on pilot reports', it is working on enhancements to the safety performance, monitoring and reporting systems 'to improve the management of RPAS operational safety', such as through accurate occurrence reporting.<sup>67</sup>

2.58 In addition to the CIRRIS database, the ATSB also records RPAS-related incidents on the National Aviation Occurrence Database. The occurrence notifications recorded in this database must meet a number of criteria, including that the incident is deemed a 'transport safety matter'. Notifications not meeting the criteria are classified as 'events' and excluded from the database.<sup>68</sup>

2.59 As Australia's national transport safety investigator, the ATSB is currently resourced to investigate around 140 aviation accidents and incidents per year from approximately 5500 reported.<sup>69</sup> ATSB told the committee that it historically 'has not had sufficient resources to investigate all accidents and serious incidents'. However, it does record data 'for safety research, analysis and education'.<sup>70</sup> Information made available by CASA showed that, in the past five years, the ATSB has published 10 investigations into RPA incidents, including two research investigations in 2017. This is from a total of 151 reported RPA near encounters with manned aircraft in 2017.<sup>71</sup>

2.60 Along with these resourcing pressures, witnesses raised concerns that there are also gaps in the current methodology for gathering aviation occurrence data. According to Regional Express (Rex), the criterion for reportable activity is too

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67 Airservices Australia, *Submission 29*, [pp. 1–2]. Also see: Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 11.

68 Australian Transport Safety Bureau, *ATSB National Aviation Occurrence Database*, <https://www.atsb.gov.au/avdata/> (accessed 29 January 2018).

69 Australian Transport Safety Bureau, *Submission 62*, p. 2.

70 Australian Transport Safety Bureau, *Submission 62*, pp. 2–4.

71 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19.

narrow, causing many instances of illegal or dangerous RPAS activity to be deemed to be 'non-reportable events'.<sup>72</sup>

2.61 Another issue raised was the heavy onus on members of the public to provide information to CASA before a complaint can be verified, or an infringement notice issued to the offending operator. According to CASA's website:

We are unable to pursue enforcement action unless we have sufficient evidence.

Please provide photographic/video evidence showing the possible safety breach. If this footage does not clearly display the individual operating the drone/RPA, further evidence may be required.<sup>73</sup>

2.62 Austec Aerial Solutions likened this requirement to 'reporting a burglary to Police and the Police ask[ing] you to provide all evidence so they can charge the offenders'.<sup>74</sup>

2.63 Mr Vince Sofia added that 'it should not fall into the hands of licensed drone operators to become a "watchdog" for CASA, nor do we want too [sic]'.<sup>75</sup> A lack of regulatory resources, as well as the fact that recreational RPAS and their operators are not registered, was blamed for the poor reporting system in place.<sup>76</sup>

2.64 By CASA's own admission, a vast majority of cases remain unresolved as 'it is often extremely difficult to identify who was responsible for the alleged conduct, and challenging to obtain sufficient evidence to support any enforcement action'.<sup>77</sup>

### ***Concerns about the penalty regime***

2.65 The evidence provided to the committee with regard to the penalty regime raised two key issues. The first is that the penalty regime in its entirety is an insufficient enforcement mechanism, as it does little to discourage unsafe RPAS operations. Under the existing regime, a fine of up to 50 penalty units for a breach of CASA's rules equates to approximately \$10 500.<sup>78</sup> AusALPA noted that this amount

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72 Regional Express Airlines, *Submission 70*, p. 4.

73 Civil Aviation Safety Authority, *Unsafe drone operations complaints form*, <https://www.casa.gov.au/webform/unsafe-drone-operations-complaint-form> (accessed 9 November 2017).

74 Austec Aerial Solutions, *Submission 13*, [p. 1].

75 Mr Vince Sofia, *Submission 7*, [p. 3].

76 See, for example: International Aerospace Law & Policy Group, *Submission 19*, p. 18; Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 15; Model Aeronautical Association of Australia, *Submission 50*, p. 5.

77 Civil Aviation Safety Authority, *Submission 17*, p. 13.

78 The penalty regime applying to RPAS in Australia was discussed earlier in this chapter.

is 'inadequate or at best unclear' in the case of a serious incident involving manned aircraft.<sup>79</sup>

2.66 NSW Farmers highlighted that RPAS misuse can also pose a hazard to other operations, particularly agricultural activities. The lack of civil remedies available to farmers that have caught RPAS trespassing on their property was of particular concern.<sup>80</sup> NSW Farmers advocated for a base penalty of at least \$50 000, contingent upon 'the potential for harm and the amount of due diligence not undertaken by the UAS operator'.<sup>81</sup>

2.67 The Aerial Application Association of Australia was of the view that penalties should be raised in order to account for the potential loss of income for aircraft that are forced to stand down when an RPAS flies into restricted airspace.<sup>82</sup> Elevo agreed that the current level of penalties should be increased, and should include a temporary or permanent prohibition measure for companies or individuals found guilty of illegal operations.<sup>83</sup>

2.68 Under the current system, CASA publishes formal enforcement decisions online. It does not publish information on suspensions, cancellations or fines.<sup>84</sup> However, a number of submitters including the Australian Miniature Aerospots Society took the view that the publication of all such breaches would serve as a stronger disincentive to RPAS misuse.<sup>85</sup> The Aerial Application Association of Australia suggested that the publication of RPAS prosecutions would act as a major deterrent for reckless RPAS users, whilst AAUS agreed that it would 'establish a precedent' and deter operators that may have ill-intent or are simply unaware of the rules.<sup>86</sup>

2.69 The second major issue regarding the penalty regime is that of inadequate resources allocated to the regulator. The committee received evidence indicating that,

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79 Australian Airline Pilots' Association, *Submission 39*, p. 5. At the time of submission, the value of 50 penalty units was equivalent to \$9000.

80 NSW Farmers, *Submission 45*, [pp. 6–8].

81 NSW Farmers, *Submission 45*, [p. 5].

82 Aerial Application Association of Australia, *Submission 49*, p. 3.

83 Elevo Pty Ltd, *Submission 8*, [p. 2].

84 CASA's policy on publishing enforcement decisions was laid out by Dr Jonathan Aleck at a public hearing. See: Dr Jonathan Aleck, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 34.

85 Australian Miniature Aerospots Society Inc, *Submission 71*, p. 4. Also see: Helistar Aviation, *Submission 23*, [p. 4]; Australian Airline Pilots' Association, *Submission 39*, p. 5; Australian Association for Unmanned Systems, *Submission 46*, p. 11; Aerial Application Association of Australia, *Submission 49*, pp. 2–3; Elevo Pty Ltd, *Submission 8*, [p. 2].

86 Aerial Application Association of Australia, *Submission 49*, p. 3; Australian Association for Unmanned Systems, *Submission 46*, p. 5.

without sufficient staff training and resources, CASA is unable to effectively enforce the regulations in a way that responds to the growing cohort of amateur RPAS operators. This includes being unable to investigate the multitude of incidents breaching the standard operating conditions, and issue aviation infringement notices to offenders.<sup>87</sup> The issue of cost-effective solutions for RPAS management is discussed further in Chapter 7.

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87 At an estimates hearing, CASA'S CEO stated that 'the allocation of resources for investigations of drones...depends a great deal on the seriousness of the matter'. See: Mr Shane Carmody, Civil Aviation Safety Authority, *Supplementary Estimates Hansard*, 27 October 2017, p. 21.

## Chapter 3

### 'Anything in the air is a risk'<sup>1</sup>: RPAS and aviation safety

3.1 This chapter discusses a number of RPAS-related incidents that have occurred both internationally and domestically, and outlines how aviation bodies have responded through research and regulatory reform.

#### RPAS in aviation incidents worldwide

3.2 Many submitters and witnesses argued that the amendments to Part 101 of the CASR, implemented on 29 September 2016, have undermined air safety in Australia, in particular by increasing the likelihood of a collision between manned and unmanned aircraft.<sup>2</sup>

3.3 Although there have been no reported instances of RPAS colliding with passenger aircraft in Australian airspace,<sup>3</sup> the committee heard that incidents of airport closures, flight delays and near-collisions with commercial aircraft in the US, UK and elsewhere are now commonplace.<sup>4</sup>

3.4 In the US, RPAS-related near-misses with commercial aircraft rose by 46 per cent from 2015 to 2016, while the number of reported safety incidents involving RPAS (including RPAS flying improperly or getting too close to other

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1 Mr Chris Manning, Australian Transport and Safety Bureau, *Budget Estimates Hansard*, 23 May 2017, p. 134.

2 See, for example: International Aerospace Law & Policy Group, *Submission 19*, p. 23; Interspatial Aviation Services Pty Ltd, *Submission 74*, pp. 1–2; Austec Aerial Solutions, *Submission 13*, p. 1; Captain Phillip Stevens, *Submission 87*, p. 1; Virgin Independent Pilots Association, *Submission 11*, p. 1; Australian Airports Association, *Submission 12*, pp. 1–3; Mr John Reidy-Crofts, *Submission 89*, p. 1; Maurice Blackburn Lawyers, *Submission 22*, pp. 2–3; Helistar Aviation, *Submission 23*, [p. 5], Qantas Group, *Submission 34*, p. 1; Australasian Fire & Emergency Service Authorities Council and National Aerial Firefighting Centre, *Submission 35*, p. 2; Australian Airline Pilots' Association, *Submission 39*, p. 3; Aeroeye, *Submission 41*, [p. 2]; NSW Ambulance, *Submission 48*, p. 1; Australian Certified UAV Operators, *Submission 73*, pp. 25, 31; Regional Express, *Submission 70*, p. 2; Regional Aviation Association of Australia, *Submission 58*, [p. 2]; Civil Air Operations Officers Association of Australia, *Submission 21*, pp. 1–2.

3 Australian Transport Safety Bureau, *Submission 62*, pp. 6, 27.

4 Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems 2012 to 2016* (ATSB Transport Safety Report AR-2017–016), 16 March 2017, p. 2.

aircraft) now exceeds 250 each month.<sup>5</sup> In the UK, RPAS-related complaints increased twelvefold in the space of two years, and in 2016 alone, 70 near-misses between planes and RPAS were reported.<sup>6</sup> As at October 2017, Canada had seen 1567 RPAS incidents in 2017, including 131 incidents that were deemed an 'aviation safety concern'.<sup>7</sup>

### **Major incidents**

3.5 On 21 September 2017, a civilian RPAS collided with a US Army UH-60 Black Hawk helicopter east of Staten Island, New York. Reports suggest that the Army helicopter sustained damage to its main rotor blade, window frame and transmission deck.<sup>8</sup> The US Federal Aviation Administration (FAA) stated that this was the first confirmed in-flight collision between an RPAS and a piloted US aircraft in the country.<sup>9</sup>

3.6 On 12 October 2017, a commercial passenger Skyjet plane heading to Québec City's Jean Lesage International Airport was struck by an RPAS. Emergency measures were put in place and the plane, which sustained minor damage, was able to land safely. The collision took place about three kilometres from the airport at an altitude of 450 metres.<sup>10</sup>

3.7 At Las Vegas' international airport earlier this year, an RPAS captured footage of its flight from directly above an 180-passenger airplane. Although the jet landed successfully, many in the RPAS community condemned the actions of the

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5 Ryan Browne, 'Drones: How disruptive are they and what is being done to regulate them?', *CNBC*, 4 July 2017, <https://www.cnn.com/2017/07/04/drones-how-disruptive-are-they-and-what-is-being-done-to-regulate-them.html> (accessed 29 September 2017); Alan Levin, 'Surge in Drone Safety Reports Prompts 'Emergency' Action at FAA', *Bloomberg*, 14 October 2017, <https://www.bloomberg.com/news/articles/2017-10-13/surge-in-drone-safety-reports-prompts-emergency-action-at-faa> (accessed 17 October 2017).

6 Ryan Browne, 'Drones: How disruptive are they and what is being done to regulate them?', *CNBC*, 4 July 2017 (accessed 29 September 2017); Mariella Moon, 'UK reports 70 drone near-misses at Heathrow in 2016', *engadget.com*, 31 March 2017, <https://www.engadget.com/2017/03/31/uk-drones-near-misses-planes-heathrow/> (accessed 13 December 2017).

7 The Hon Marc Garneau, Minister for Transport, Government of Canada, 'Statement by Minister of Transport about a drone incident with a passenger aircraft in Quebec City', *Statement*, 15 October 2017.

8 'NTSB Investigating Collision Between Drone, U.S. Army Helicopter', *sUAS News*, 6 October 2017, <https://www.suasnews.com/2017/10/ntsb-investigating-collision-drone-u-s-army-helicopter/> (accessed 17 October 2017).

9 Author unknown, 'Unmanned drones pose a tricky prospect for regulators', *The Week*, 3 November 2017, <http://www.theweek.co.uk/81642/islamic-state-killer-drones-prompt-fears-of-future-attacks-abroad> (accessed 6 November 2017).

10 The Hon Marc Garneau, Minister for Transport, Government of Canada, 'Statement by Minister of Transport about a drone incident with a passenger aircraft in Quebec City', *Statement*, 15 October 2017.

operator, and the US FAA launched an investigation into the incident.<sup>11</sup> Professor Ron Bartsch of the Asia-Pacific RPAS Consortium stated that the incident demonstrates that 'it's not a matter of if a drone is going to bring down a commercial airliner – it's simply a matter of when'.<sup>12</sup>

3.8 Another incident in the US involving RPAS occurred in February 2018. A student pilot and instructor flying a helicopter reported seeing a small RPAS appear directly in front of them whilst in the air. When the instructor took over the controls in an attempt to avoid a collision, the tail of the helicopter hit a tree or bush, triggering a crash landing.<sup>13</sup>

3.9 In addition to these incidents, reports of RPAS-related disruptions to ordinary aircraft services have also risen in number. The committee's attention was drawn to an incident on 9 July 2017 at Gatwick Airport in the UK, where an RPAS flying close to the airport caused the closure of a runway and diversion of five incoming aircraft.<sup>14</sup>

3.10 Further events were reported at Dubai Airport in June, September and October 2016 where 'unauthorised drone activity' caused flight delays and an approximate total financial loss of 16.62 million United Arab Emirates Dirham, equivalent to approximately AUD \$5.6 million.<sup>15</sup>

## **RPAS incidents and encounters in Australia**

3.11 Despite some fluctuations in the data, the ATSB provided evidence that 'there has been an increase in the number of reported RPAS sightings and near encounters with manned aircraft' in Australia. In its submission, the ATSB noted that the rise of such events was a 'cause for concern'.<sup>16</sup>

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11 Author unknown, 'Drone expert has dire warning after close call with US flight', *Nine News*, 3 February 2018, <https://www.9news.com.au/national/2018/02/03/20/21/near-miss-as-drone-flies-above-passenger-plane-in-us> (accessed 5 February 2018). Also see: Stephen Shankland, 'Drone hovers right above jet landing at Las Vegas airport', *Cnet*, 2 February 2018, <https://www.cnet.com/news/drone-hovers-over-jet-landing-at-las-vegas-airport/> (accessed 15 February 2018).

12 Author unknown, 'Drone expert has dire warning after close call with US flight', *Nine News*, 3 February 2018 (accessed 5 February 2018).

13 Alan Levin, 'What may be U.S.'s first drone-linked aircraft crash is being investigated', *Bloomberg*, 16 February 2018, <https://www.bloomberg.com/news/articles/2018-02-16/what-may-be-first-drone-linked-copter-crash-being-investigated> (accessed 22 February 2018).

14 Author unknown, 'Drone causes Gatwick Airport disruption', *BBC News*, 3 July 2017, <http://www.bbc.com/news/uk-40476264> (accessed 26 October 2017).

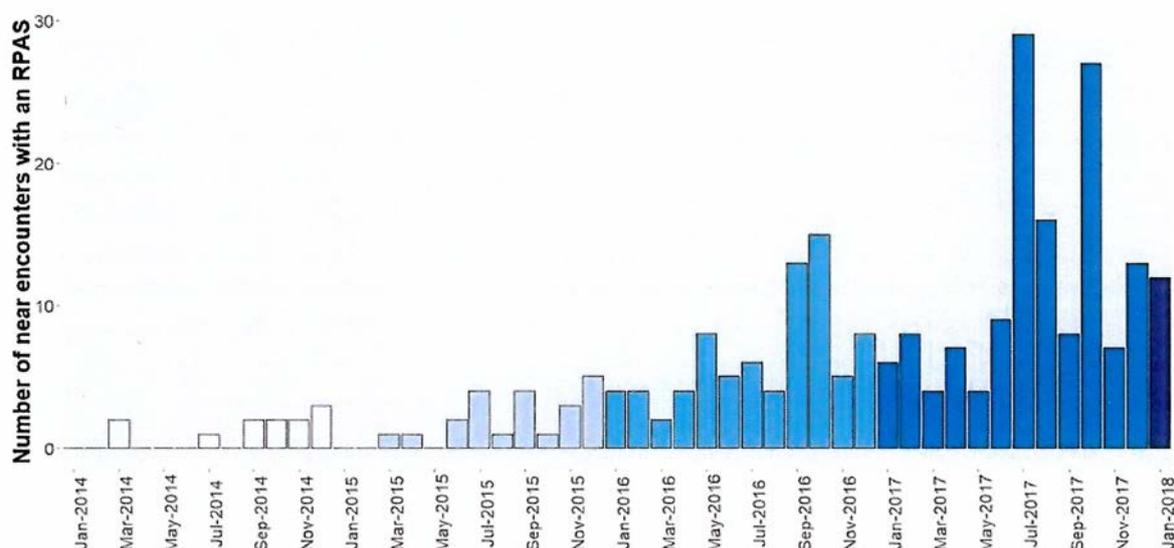
15 Parag Deulgaonkar, 'Shutting down Dubai International Airport due to a drone costs \$100,000 a minute', *Arabian Business*, 9 July 2017, <http://www.arabianbusiness.com/content/375851-drone-costs-100000-minute-loss-to-uae-airports> (accessed 26 October 2017).

16 Australian Transport Safety Bureau, *Submission 62*, p. 27.

3.12 A safety analysis report published in March 2017 revealed that the number of RPAS-related safety occurrences reported to the ATSB has grown exponentially from 2012 to 2016. The ATSB further estimated that half of the 180 occurrences reported over this period involved near encounters with manned aircraft. Whilst there have been no direct collisions between RPAS and manned aircraft reported to date, approximately 52 occurrences have involved collisions with terrain.<sup>17</sup>

3.13 At an Additional Estimates hearing in February 2018, the ATSB provided updated data showing a jump in reported RPAS near-encounter occurrences from mid-2015. This is shown in Table 3.1 below:

**Table 3.1: Reported near encounters involving a Remotely Piloted Aircraft System—January 2014 to January 2018**



Source: Australian Transport Safety Bureau, tabled at an Additional Estimates hearing of the Rural and Regional Affairs and Transport Legislation Committee on 26 February 2018.

3.14 Reports of incidents involving RPAS and vehicles have also received attention. In May 2017, an RPAS crashed into a moving vehicle on the Sydney Harbour Bridge. The driver of the vehicle reported damage to the car's radiator, and parts of the RPAS were later found in the motor of the car.<sup>18</sup> A second incident on the

<sup>17</sup> Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems 2012 to 2016* (ATSB Transport Safety Report AR-2017-016), 16 March 2017, p. 1.

<sup>18</sup> Matt O'Sullivan, 'Dashcam captures drone crashing into car on Sydney Harbour Bridge', *Sydney Morning Herald*, 11 May 2017, <http://www.smh.com.au/nsw/dashcam-captures-drone-crashing-into-car-on-sydney-harbour-bridge-20170511-gw2h5q.html> (accessed 21 November 2017).

Harbour Bridge involving an RPAS and moving vehicle occurred in August 2016 and also resulted in vehicle damage.<sup>19</sup>

3.15 In addition to these events, RPAS have also been known to cause physical injury. An athlete suffered head injuries and was rushed to hospital after being hit by an RPAS during a West Australian triathlon race in April 2014. The operator reportedly lost control of the RPAS as it hovered approximately 10 metres above the competitors.<sup>20</sup> Following the incident, the Commonwealth Director of Public Prosecutions resolved that the incident was caused by radio interference from the event, rather than the operator's actions. However, as the RPAS was flown within 30 metres of people, thereby breaching the standard operating conditions for RPAs, CASA fined the RPAS operator \$1700.<sup>21</sup>

### **International regulatory responses to RPAS**

3.16 Combined with the lessons learned from major RPAS incidents around the world, a number of studies on the impact of an RPAS collision with aircraft have been conducted in other jurisdictions, resulting in regulatory and other reforms. This section considers the research conducted in the UK, US and Australia and notes how this research has informed those changes.

#### ***United Kingdom***

3.17 In July 2017, the UK Department for Transport, the Military Aviation Authority, and British Airline Pilots' Association produced a report titled *Small Remotely Piloted Aircraft Systems (drones): Mid-Air Collision Study*. As part of the study, laboratory collision testing and computer modelling was used to identify the lowest collision speed at which critical damage could occur to aircraft components.<sup>22</sup>

3.18 The findings of the study reflect the concerns of a number of witnesses to this inquiry, particularly in relation to the damage that RPAS can cause to helicopters in the event of a collision. The UK study found that:

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19 Bev Jordan, 'Rogue drone dive-bombs Castle Hill dentist's car on Sydney Harbour Bridge', *The Daily Telegraph*, 23 August 2016, <https://www.dailytelegraph.com.au/newslocal/hills-shire-times/rogue-drone-divebombs-castle-hill-dentists-car-on-sydney-harbour-bridge/news-story/56ca5de43e114966e8ea8ebdd19155d7> (accessed 21 November 2017).

20 Sarah Taillier, 'Triathlete injured as drone filming race falls to ground', *ABC News*, 8 April 2014, <http://www.abc.net.au/news/2014-04-07/triathlete-injured-as-drone-filming-race-drops-to-ground/5371658> (accessed 21 November 2017).

21 Sarah Taillier, 'Drone operator fined after UAV crashed into Geraldton triathlete', *ABC News*, 13 November 2014, <http://www.abc.net.au/news/2014-11-13/drone-operator-at-geraldton-marathon-fined/5887196> (accessed 10 January 2018).

22 Department for Transport and Military Aviation Authority (UK), *Small Remotely Piloted Aircraft Systems (drones): Mid-Air Collision Study*, 22 July 2017, <https://www.gov.uk/government/publications/drones-and-manned-aircraft-collisions-test-results> (accessed 4 October 2017), p. 1.

The non-birdstrike certified helicopter windscreen proved to have a low resistance to all the classes of drones tested...For the fixed-wing drone, which is itself capable of a significant speed in flight, it was found that the drone could penetrate a helicopter windscreen of this type even if the helicopter was stationary.<sup>23</sup>

3.19 In the UK Government's response to the study, it acknowledged that the study had shown 'that very small drones of even 400g can pose a critical risk to the windscreens and tail rotors of helicopters'.<sup>24</sup>

3.20 The testing on airliners yielded similarly alarming results. The study indicated that 'fixed wing drones with metallic components can do significant damage' to larger passenger aircraft, with drones of around 2kg causing 'critical damage' to the windscreen upon collision.<sup>25</sup> The study also noted that 'drone construction plays a critical part in the severity of a collision'.<sup>26</sup>

3.21 The UK study found that RPAS components 'cause significantly more damage than birds of equivalent masses at speeds lower than required to meet birdstrike certification standards'.<sup>27</sup> This conclusion appears to contrast with information provided by CASA in May 2017 that engine ingestion of a drone 'would be treated similar to a bird strike' and is therefore 'not a catastrophic failure'.<sup>28</sup>

3.22 The UK study's findings were supported by Civil Air Australia which emphasised the point that a high volume of RPAS in the sky poses a significantly larger risk than a high volume of birds. Mr Thomas McRobert highlighted a key difference:

...if you have a jet doing 120 decibels down the runway, the bird is going to try to move out of the way. Whereas, if you have 40 000 drone operators photographing something—they are not going to listen to the aircraft and

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23 Department for Transport and Military Aviation Authority (UK), *Small Remotely Piloted Aircraft Systems (drones): Mid-Air Collision Study*, 22 July 2017, p. 15.

24 Department for Transport (UK), *Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the UK – Government Response*, July 2017, p. 13.

25 Department for Transport and Military Aviation Authority (UK), *Small Remotely Piloted Aircraft Systems (drones) Mid-Air Collision Study*, 22 July 2017, p. 16; Department for Transport (UK), *Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the UK – Government Response*, July 2017, p. 13.

26 Department for Transport and Military Aviation Authority (UK), *Small Remotely Piloted Aircraft Systems (drones): Mid-Air Collision Study*, 22 July 2017, p. 5.

27 Department for Transport and Military Aviation Authority (UK), *Small Remotely Piloted Aircraft Systems (drones): Mid-Air Collision Study*, 22 July 2017, p. 5.

28 Mr Graeme Crawford, Civil Aviation Safety Authority, *Budget Estimates Hansard*, 23 May 2017, p. 114.

think to get out of the way for their own safety. It is not a like-for-like risk in that case.<sup>29</sup>

3.23 The UK study followed 2016 research undertaken by the UK Civil Aviation Authority in association with the industry to consider RPAS user behaviour and attitudes towards responsible RPAS use. The study considered the current level of awareness of the UK regulatory framework regarding RPAS.<sup>30</sup> In addition, a consultation on the benefits of RPAS to the UK economy was undertaken. These studies informed significant changes to UK RPAS laws that were announced in 2017.

3.24 In July 2017, the UK government announced that it would introduce new rules to better regulate the growing use of RPAS. Changes would include the mandatory registration of RPAS weighing over 250g and would require RPAS users to sit safety awareness tests in order to prove competency and an understanding of UK safety, security and privacy regulations.<sup>31</sup> The new requirements, which are expected to come into force in 2018, may include a ban on RPAS flights above 400 feet or near airports.

3.25 Along with registration and competency testing, police are to be given powers to prevent the unsafe or criminal use of RPAS under the new rules. As part of measures to increase police powers, officers will be able to investigate RPAS misuse, order operators to ground RPAS when appropriate, and seize device components where there is reasonable suspicion of the RPAS being involved in an offence.<sup>32</sup>

3.26 In addition to these measures, the UK government also announced plans to bring forward and expand the use of geo-fencing. It is currently working with RPAS manufacturers to use geo-fencing to prevent RPAS from entering restricted zones.<sup>33</sup>

### *Policy implications*

3.27 At a hearing on 29 August 2017, the committee asked CASA whether the results of the UK study had led it to pursue any additional measures to minimise the

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29 Mr Thomas McRobert, Civil Air Australia, *Committee Hansard*, 16 June 2017, p. 27.

30 Drone Safe, *Consumer Drone Users*, 2016, [http://dronesafe.uk/wp-content/uploads/2016/11/CAA\\_Consumer\\_Drone\\_Users\\_report.pdf](http://dronesafe.uk/wp-content/uploads/2016/11/CAA_Consumer_Drone_Users_report.pdf) (accessed 29 January 2018).

31 UK Government Department of Transport, *Drones to be registered and users to sit safety tests under new government rules*, 22 July 2017, <https://www.gov.uk/government/news/drones-to-be-registered-and-users-to-sit-safety-tests-under-new-government-rules> (accessed 29 January 2018).

32 The Rt Hon John Hayes CBE MP, UK Minister of State at the Department for Transport, 'Drones update, 27 November 2017', *Written statement*, 27 November 2017; UK Government, *New powers for police to address illegal and unsafe use of drones*, <https://www.gov.uk/government/news/new-powers-for-police-to-address-illegal-and-unsafe-use-of-drones> (accessed 28 November 2017).

33 UK Government, *New powers for police to address illegal and unsafe use of drones* (accessed 28 November 2017). Geo-fencing is discussed further in Chapter 6.

risk of a mid-air collision in Australia. In response, CASA's Mr Graeme Crawford advised:

Obviously, we're aware of some of the information...We're aware that helicopter windshields and [general aviation] windshields, which aren't bird-strike certified, wouldn't handle a drone either. So, we are considering that data as we consider our response to the safety risks...Yes, we are considering it and we are taking a sector view at CASA more so than we have perhaps done in the past...so, in agricultural applications, potentially.<sup>34</sup>

### ***United States***

3.28 The US Department of Transportation has been engaged in UAS integration planning since 2013. The publication of a comprehensive roadmap to achieve 'safe integration of UAS operations into national airspace' in November 2013 marked the beginning of civil RPAS regulation in the US.<sup>35</sup>

3.29 When the number of pilot sightings of RPAS doubled between 2014 and 2015, the US Department of Transportation established the Unmanned Aircraft Systems Registration Task Force Aviation Rulemaking Committee (the RTF) to consider if and how registration requirements could be implemented for RPAS. According to the FAA Administrator, Mr Michael Huerta, registration would mitigate the troubling trend of disruptive RPAS incidents by '[making] sure that operators know the rules and remain accountable to the public for flying their unmanned aircraft responsibly'.<sup>36</sup>

3.30 In November 2015, the RTF produced a report recommending registration apply to all RPAS over 250g. Before this time, registration was optional for hobby or recreational RPAS purposes.<sup>37</sup> A 'standard aviation risk assessment formula', and findings from a 2012 MITRE Corporation report were used to determine the impact of an RPAS collision and the probability of a lethal event occurring.<sup>38</sup>

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34 Mr Graeme Crawford, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 30.

35 Department of Transportation, *Operation and Certification of Small Unmanned Aircraft Systems*, 21 June 2016, p. 24.

36 U.S. Department of Transportation. 'New Task Force to Develop Recommendations by November 20', *Press release*, 19 October 2015, <https://www.transportation.gov/briefing-room/us-transportation-secretary-anthony-foxx-announces-unmanned-aircraft-registration> (accessed 30 January 2018).

37 Federal Aviation Administration, FAA Announces Small UAS Registration Rule, *Press release*, 14 December 2015, [https://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=19856](https://www.faa.gov/news/press_releases/news_story.cfm?newsId=19856) (accessed 29 January 2018).

38 Unmanned Aircraft Systems Registration Task Force Aviation Rulemaking Committee, *Task Force Recommendations Final Report*, 21 November 2015, pp. 6–9.

3.31 At the weight of 250g, the RTF concluded that the probability of a catastrophic event occurring presented an acceptable risk level of  $4.7 \times 10^{-8}$ . This decision was made given that general aviation actual risk levels are on the order of  $5 \times 10^{-5}$ . The RTF report stated that the 250g or less exclusion provided a satisfactory weight threshold 'that is easy to understand and apply and would therefore encourage compliance'.<sup>39</sup>

3.32 As part of the UAS integration roadmap, a Notice of Proposed Rule Making was issued in February 2015.<sup>40</sup> In June 2016, following the consideration of over 4600 comments received, the FAA announced new rules for non-hobbyist UAS operations for RPAS weighing less than 25kg. The changes are laid out in Part 107 of the US Federal Aviation Regulations, and require that RPAS operators are at least 16 years old, hold a remote pilot certificate with a small UAS rating, or are directly supervised by someone with a certificate.<sup>41</sup> Operations must be conducted:

- within visual line of sight of the remote pilot in command;
- not over any persons not directly participating in the operation;
- in daylight or civil twilight;
- within 400 feet above ground level; and
- at a maximum speed of 100 mph (87 knots).<sup>42</sup>

#### *Policy implications*

3.33 When compared to the rules set out by Part 107 of the US Federal Aviation Regulations, submitters to the inquiry expressed concern that Australia's regulations appeared to be significantly more lenient. Interspatial Aviation Services suggested that the 'huge discrepancy' between the risk assessment of RPAS between 250g and 2kg between CASA and the FAA demands an explanation,<sup>43</sup> while Captain John Lyons of Virgin International Pilots Association (VIPA) issued praise for the US approach:

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39 Unmanned Aircraft Systems Registration Task Force Aviation Rulemaking Committee, *Task Force Recommendations Final Report*, 21 November 2015, pp. 6–9.

40 For a short period in 2016–17, the registration requirements were rescinded. A case brought before the US Court of Appeals challenged the FAA's authority to regulate non-commercial RPAS and was won. However, since this time, the requirement for civilian RPAS to be registered has been revived through the signing of the *National Defense Authorization Act 2018*.

41 According to the FAA website, qualification for the remote pilot certificate requires the individual to either pass an initial aeronautical knowledge test or have an existing non-student Part 61 pilot certificate.

42 Federal Aviation Administration, *Fact Sheet – Small Unmanned Aircraft Regulations (Part 107)*, 21 June 2016, [https://www.faa.gov/news/fact\\_sheets/news\\_story.cfm?newsId=20516](https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20516) (accessed 21 November 2017).

43 Interspatial Aviation Services Pty Ltd, *Submission 74*, p. 3.

They have been very conservative in the capacity of their legislation allowing any form of flight at all because the Americans see UAVs can be used for both good and evil.<sup>44</sup>

3.34 Australian Certified UAV Operators submitted:

[Australian Certified UAV Operators] maintain that CASA's risk assessments are flawed and are not supported by international research. Recent assessments from the United States, the United Kingdom, South Africa and Canada all tell an entirely different story to the CASA position. Most international assessments strongly suggest a weight limit of only 250 grams should be considered 'harmless', whilst everything above that weight has the potential to kill or seriously injure people if operated negligently, and should require mandatory registration and minimum knowledge and experience levels to operate them.<sup>45</sup>

### Australian research

3.35 As noted in Chapter 2, a number of submitters raised questions about the due diligence undertaken by CASA to inform the Part 101 amendments. The committee was told that more research should have been undertaken to develop a comprehensive evidence base before the amendments were drafted. Furthermore, the point was made that such research could have provided a baseline on which to assess the effectiveness of the regulatory changes.<sup>46</sup>

3.36 AusALPA held the view that regulators in Europe and the US had undertaken more in-depth research before setting the rules for RPAS operators. It provided an overview to the committee of the differences with the Australian approach:

Both [the European Aviation Safety Agency] and the FAA have taken the potential hazards into account in the development of their rules which require registration and licensing for drones above 250gms. Australian CASR Part 101 subpart G provides no clear distinction between a UAV/Drone and a model aircraft. The European and US legislation is backed by research which acknowledges the potential hazards posed by larger sub-2kg RPAs to both other aircraft and the community at large.<sup>47</sup>

3.37 In response to this assertion, CASA made note that, in developing the amendments, it commissioned research into the potential damage that a mid-air

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44 Captain John Lyons, Virgin Independent Pilots Association, *Committee Hansard*, 28 June 2017, p. 5.

45 Australian Certified UAV Operators, *Submission 73*, p. 21.

46 See, for example: Australian Airline Pilots' Association, *Submission 39*, p. 4; Maurice Blackburn Lawyers, *Submission 22*, p. 2; International Aerospace Law & Policy Group, *Submission 19*, p. 25; Civil Air Operations Officers Association of Australia, *Submission 21*, p. 2; Mr John Thynne, JT Aviation Consulting Pty Ltd, *Committee Hansard*, 28 June 2017, p. 34.

47 Australian Airline Pilots' Association, *Submission 39*, p. 4.

collision with a small RPA would cause to manned aircraft and to people on the ground.<sup>48</sup> The two resulting reports—*Potential damage assessment of a mid-air collision with a small UAV* and *Human injury model for small unmanned aircraft impacts*—were prepared by Mr Alexander Radi, a PhD candidate in aerospace engineering at Monash University.<sup>49</sup>

### ***Commissioned studies***

3.38 The first report by Monash University reviewed published experimental data and performed 'original computations using a semi-empirical model' to assess the likely results of a commercial airliner colliding with an RPAS weighing less than 2kg.<sup>50</sup> The author found that the collision is 'most likely to result in the ingestion of the UAV into one of the engines', assuming '[r]eduction or loss of engine thrust with potential debris'. The report concluded, based on 'past experience', that, 'engine loss and uncontained engine failure can be regarded as non-catastrophic events'.<sup>51</sup>

3.39 When asked in May 2017 about the results of the study, Mr Graeme Crawford of CASA explained that:

Aeroplane engines do have failures that are typically contained. It is not a catastrophic failure because [pilots] can shut down the engine and they are able to land the aircraft. What I am suggesting to you is that, if a sub-two-kilogram drone goes into a large gas turbine engine, it is likely to go down the bypass. The engine would most likely have to be shut down then, I agree, because it will be treated similar to a bird strike. But it is not a catastrophic failure.<sup>52</sup>

3.40 Considering the impact of a similar sized RPAS on a windscreen at cruise velocity, the report stated that an RPAS was 'likely to be deflected without penetration'. However the report also stated that:

No experimental data exist to validate the predictions of windscreen penetration by a solid object. It is recommended to commission an experimental study, impacting actual UAV parts into common windscreen

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48 Civil Aviation Safety Authority, *Submission 17*, pp. 8–9; Captain Murray Butt, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 8.

49 Civil Aviation Safety Authority and Monash University, *Potential damage assessment of a mid-air collision with a small UAV*, 12 June 2013, p. 5.

50 Civil Aviation Safety Authority and Monash University, *Potential damage assessment of a mid-air collision with a small UAV*, 12 June 2013, p. 2; Civil Aviation Safety Authority and Monash University, *Human injury model for small unmanned aircraft impacts*, 23 December 2013, p. 2.

51 Civil Aviation Safety Authority and Monash University, *Potential damage assessment of a mid-air collision with a small UAV*, 12 June 2013, p. 18.

52 Mr Graeme Crawford, Civil Aviation Safety Authority, *Budget Estimates Hansard*, 23 May 2017, p. 114.

materials. Until then, the results presented in this report should be treated as rough estimates.<sup>53</sup>

3.41 The second report concluded that 'practically any RPA mass is likely to cause unacceptably severe injuries' in a 'loss-of-control scenario, in which the RPA descends from altitudes over 60 metres reaching its terminal velocity'.<sup>54</sup>

3.42 Whilst CASA submitted that 'the regulations, supported by published guidance and safety educational material, assist in minimising the likelihood of a person or another aircraft being hit by an unmanned aircraft',<sup>55</sup> it remains unclear how the two commissioned reports supported the development of the Part 101 regulations.

### ***ATSB Safety Analysis***

3.43 In March 2017, the ATSB released a safety analysis study, which drew on five known collisions, and one suspected collision, that occurred outside of Australia.

3.44 In its report, the ATSB noted the lack of data available with regard to actual collisions, and explained that, as minimal testing has been conducted, mathematical models are the prime method for predicting the damage expected from RPAS-related incidents. These models are informed by birdstrike data, with approximately 2000 birdstrikes being recorded in Australia in 2015.<sup>56</sup> However, the ATSB acknowledged the limitations of birdstrike data in determining the impact of RPAS:

As remotely piloted aircraft are rigid and generally heavier than most birds, the overall proportion of collisions resulting in aircraft damage is expected to be higher than for birdstrikes, and the distribution of damage across an airframe will probably also differ.

Without more information, it is difficult to thoroughly assess the risk of occurrence and the severity of the outcome for an RPAS collision.<sup>57</sup>

3.45 Despite this, the ATSB report concluded that a number of observations could be made, including that RPAS collisions with manned aircraft are likely to:

- penetrate the wing or fuselage of an air transport aircraft;
- cause engine damage and engine shutdown resulting from ingestion in high capacity air transport aircraft;

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53 Civil Aviation Safety Authority and Monash University, *Potential damage assessment of a mid-air collision with a small UAV*, 12 June 2013, p. 18.

54 Civil Aviation Safety Authority and Monash University, *Human injury model for small unmanned aircraft impacts*, 23 December 2013, pp. 4–5, 25.

55 Civil Aviation Safety Authority, *Submission 17*, p. 8.

56 Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems 2012 to 2016* (ATSB Transport Safety Report AR-2017–016), 16 March 2017, p. 2.

57 Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems 2012 to 2016* (ATSB Transport Safety Report AR-2017–016), 16 March 2017, p. 2.

- pose a high risk of penetration to a general aviation aircraft's windscreen;
- damage a general aviation aircraft's flight surfaces, including wings and tail, potentially resulting in a loss of control; and/or
- cause a degree of propeller damage resulting in a precautionary or forced landing, if contacted.<sup>58</sup>

3.46 The committee consulted CASA as to whether these conclusions were to be taken into account by CASA in the development of its regulatory framework. In response, Mr Crawford acknowledged that CASA was aware of the information and was 'considering' its implications for the RPAS sector.<sup>59</sup>

### ***CASA Review into RPAS operations***

3.47 In October 2016 the then-Minister for Infrastructure and Transport, the Hon Darren Chester MP announced a review into RPAS safety to be undertaken by CASA. The terms of reference were released on 15 June 2017.

3.48 On 11 August 2017, CASA published a discussion paper (DP1708OS) presenting a range of safety related issues and solutions to RPAS management. These included registration of RPAS, training and/or demonstrated proficiency requirements, geo-fencing, counter-drone technology, and CASA's overall approach. Responses were received through an online questionnaire, and enabled respondents to provide additional commentary as free text. A total of 910 responses were received.

3.49 After publishing an initial analysis of responses in late 2017, CASA published its final review paper on 11 May 2018.

### ***Concerns about the research base***

3.50 Submitters to the inquiry raised concerns not only about the lack of a comprehensive research approach but also of the way in which the research had been interpreted for the development of the regulations. Captain David Booth of AusALPA told the committee that 'no impact study has yet been completed' that supports the current regulations. AusALPA argued that:

The 2 kg limit was justified on the basis of [a] single research project which acknowledges that there is little specific research data regarding the consequences of a collision between an aeroplane or helicopter and one of these devices, while focusing on a highly contestable approach to health consequences for persons on the ground.<sup>60</sup>

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58 Australian Transport Safety Bureau, *A safety analysis of remotely piloted aircraft systems 2012 to 2016* (ATSB Transport Safety Report AR-2017-016), 16 March 2017, pp. 2-3.

59 Mr Graeme Crawford, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 30.

60 Australian Airline Pilots' Association, *Submission 39*, p. 4.

3.51 Suggestions were also made that the assessment of kinetic energy in NPRM 1309OS was misinterpreted to report only minor consequences, rather than a fatal injury. For these reasons, a number of submitters called for more comprehensive research to be undertaken. Captain Booth suggested that 'a rigorous damage assessment exercise' be funded by the Australian Government and other regulators to determine the possible extent of damage.<sup>61</sup>

3.52 Maurice Blackburn Lawyers submitted that international research has now superseded the commissioned reports by Monash University, rendering Australia's definition of 'low-risk' RPAS inconsistent with other jurisdictions. The point was made that:

...the rest of the world has pursued further research on this area and come up with rules which suggest that only very small (micro-or under-250g drones) pose little risk and can be operated under more relaxed rules.<sup>62</sup>

3.53 Civil Air Australia suggested that a rigorous evaluation of Australia's regulations against those of regulators worldwide should be undertaken. It argued that:

...the risk analysis performed by CASA, and assumptions that underlie them, should be tested against the research by other regulators. This will not only provide more confidence that Australian regulations will be strong and suited to their purpose, but will also ensure that Australia can influence international debates and rule-making thereby reducing transition issues when ICAO implement universal standards.<sup>63</sup>

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61 Captain David Booth, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 9.

62 Maurice Blackburn Lawyers, *Submission 22*, p. 2.

63 Civil Air Operations Officers Association of Australia, *Submission 21*, p. 2.

## Part II

### Chapter 4

#### Safer Skies: Registration and education

4.1 In the previous chapter, the committee considered the widespread concern that unrestricted use of RPAS will lead to a serious aviation incident in Australia. This chapter examines in greater detail the concerns of witnesses and submitters, and evaluates registration and education as solutions proposed by a variety of RPAS and aviation industry stakeholders.

##### Identifying all RPAS operators

4.2 A key concern raised by inquiry participants was that many RPAS cannot be traced to their operators and that such operators are not required to report to CASA on where and how their RPAS will be flown. Unsure of just how many RPAS are in the sky, AusALPA highlighted a series of other unknowns:

We do not know the geographical distribution of operations, nor do we know what the operator demographics are. We also do not know if the operator population has the same distribution of cowboys and criminals as the general population. We do not know with any scientific vigour the probability of an aircraft-RPA collision either in general, by industry sector or by aircraft type. Critically, we do not know with any certainty what the consequences are likely to be of an aircraft-RPA collision.<sup>1</sup>

4.3 Under the new regulations, formal registration requirements do not apply to model aircraft or RPA unless being flown for commercial purposes.<sup>2</sup> RPAS flown for recreation, and weighing less than 150kg need not be registered.<sup>3</sup>

4.4 However, evidence provided by the ATSB suggested that Australia is out of step with other aviation nations who have taken a more comprehensive regulatory response. The US, UK, Canada, France and New Zealand have all either established

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1 Captain Murray Butt, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 7.

2 Civil Aviation Safety Authority, *Commercial unmanned flight – remotely piloted aircraft under 2kg*, <https://www.casa.gov.au/standard-page/commercial-unmanned-flight-remotely-piloted-aircraft-under-2kg> (accessed 12 January 2018).

3 Civil Aviation Safety Authority, *Flying drones or model aircraft recreationally*, <https://www.casa.gov.au/modelaircraft> (accessed 12 January 2018).

or are moving towards a registration system and a requirement for RPAS to display identification markings.<sup>4</sup>

4.5 Current legislation in the US distinguishes between RPAS flying under the Special Rule for Model Aircraft, and those flying for commercial purposes.<sup>5</sup> The Special Rule for Model Aircraft is similar to the excluded category of RPAS under the CASR Part 101. RPAS below 250g that fly exclusively under the Special Rule for Model Aircraft may be registered on a voluntary basis.<sup>6</sup> However, RPAS above 250g are subject to mandatory registration, costing the operator USD \$5.00. Once registered, an RPAS operator is provided with a unique identification or tail number which must be displayed on the RPAS. Registration is valid for three years and failure to comply results in severe civil penalties.<sup>7</sup> In 2018, it was announced that over one million RPAS had been registered.<sup>8</sup>

4.6 In Canada, all recreational RPAS below 35kg must be clearly marked with the owner's name, address and telephone number.<sup>9</sup> Furthermore, Transport Canada conducted a public consultation in October 2017 about proposed registration rules for RPAS operators. The proposed rules seek to introduce additional registration requirements in 'small complex' areas such as aerodromes and urban spaces.<sup>10</sup>

4.7 The UK Civil Aviation Authority is considering a similar regulatory change to mandate the registration of RPAS over 250g,<sup>11</sup> whilst in South Africa, registration for

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4 Mr Greg Hood, Australian Transport Safety Bureau, *Committee Hansard*, 29 August 2017, p. 19.

5 Federal Aviation Administration (US), *Unmanned Aircraft Systems (UAS) Frequently Asked Questions*, 11 July 2017, <https://www.faa.gov/uas/faqs/> (accessed 14 November 2017).

6 Professor Des Butler, *Submission 18*, p. 6; Federal Aviation Administration (US), *Flying for Fun under the Special Rule for Model Aircraft*, 31 July 2017, [https://www.faa.gov/uas/getting\\_started/fly\\_for\\_fun/](https://www.faa.gov/uas/getting_started/fly_for_fun/) (accessed 14 November 2017).

7 Federal Aviation Administration, *Press Release – FAA Announces Small UAS Registration Rule*, [https://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=19856](https://www.faa.gov/news/press_releases/news_story.cfm?newsId=19856) (accessed 16 November 2017).

8 Hobbyists may receive one identification number for all RPAS they own, whilst commercial users must register each device individually. See: Miram McNabb, 'DOT secretary says more than 1,000,000 drones registered', *Dronelife.com*, 11 January 2018, <https://dronelife.com/2018/01/11/dot-secretary-says-1000000-drones-registered/> (accessed 19 January 2018).

9 RPAS over 35kg or being used for commercial purposes must be operated with a Special Flight Operator's Certificate. See: Transport Canada, *Interim Order No. 8 Respecting the Use of Model Aircraft*, <https://www.tc.gc.ca/eng/mediaroom/interim-order-respecting-use-model-aircraft.html> (accessed 22 February 2018).

10 Transport Canada, *Flying your drone safely and legally*, <https://www.tc.gc.ca/eng/civilaviation/opssvs/flying-drone-safely-legally.html> (accessed 3 November 2017).

11 Department for Transport (UK), *Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the UK – Government Response*, July 2017, pp. 17–19. Also see: Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations (DP 1708OS)*, August 2017, p. 11.

RPAS of all sizes is mandated by law.<sup>12</sup> In Ireland, all RPAS weighing more than 1kg must be registered while RPAS weighing less than 1kg are limited to operating at a height restriction of 50 feet, unless they are registered. Since December 2015, when RPAS registration became mandatory, the Irish Aviation Authority (IAA) has registered over 8000 RPAS and model aircraft.<sup>13</sup> Upon registration, RPAS users in Ireland have access to the IAA official aeronautical data, mapping and RPAS registry.<sup>14</sup>

4.8 Submitters also drew the committee's attention to a Joint Statement issued in September 2016 by 16 aviation sector parties (including the International Air Transport Association) in support of a European Union-wide regulatory safety framework for RPAS.<sup>15</sup> The signatories made seven recommendations relating to public education, training, research, and technical performance limitations by way of geo-fencing. In relation to registration, the signatories called for the registration of all RPAS to 'occur compulsorily at the time of purchase or resale'.<sup>16</sup> The signatories noted that:

If the owner/pilot can be traced, it will encourage compliance with rules & regulations and could also serve as a motivation for training.<sup>17</sup>

4.9 The IALPG argued that Australia's regulations are out of step with the measures set out in the Joint Statement. It suggested that the regime in Australia 'sends a message that the skies are free to 2kg and under RPAS operators, and encourages rogue flights'.<sup>18</sup>

4.10 As a starting point, the IALPG and other witnesses expressed support for a mandatory registration scheme for RPAS users in Australia as well as the provision of

12 South African Civil Aviation Authority, *Remotely Piloted Aircraft Systems*, <http://www.caa.co.za/Pages/RPAS/Registration%20of%20RPAS.aspx> (accessed 3 November 2017). Also see: Drone Solutions Pty Ltd, *Submission 63*, p. 6.

13 Irish Aviation Authority, IAA Launch Drone Safety Awareness Campaign, *Press Release*, 17 November 2017, <https://www.iaa.ie/media-centre/2017/11/17/iaa-launch-drone-safety-awareness-campaign> (accessed 30 January 2018).

14 Irish Aviation Authority, *Two Step Drone Registration Process*, [https://www.iaa.ie/docs/default-source/misc/two-step-drone-registration-process.pdf?sfvrsn=17d80bf3\\_2](https://www.iaa.ie/docs/default-source/misc/two-step-drone-registration-process.pdf?sfvrsn=17d80bf3_2) (accessed 30 January 2018).

15 Other signatories included the Airports Council International Europe, International Federation of Air Line Pilots' Associations, International Federation of Air Traffic Safety Electronics Associations, International Air Carriers Association, International Council of Aircraft Owner and Pilot Associations and the Civil Air Navigation Services Organisation.

16 European Cockpit Association, *Joint call to safely integrate drones into Europe's airspace*, September 2016, <https://www.eurocockpit.be/positions-publications/joint-call-safely-integrate-drones-europes-airspace> (accessed 12 January 2018).

17 European Cockpit Association, *Joint call to safely integrate drones into Europe's airspace*, September 2016.

18 International Aerospace Law & Policy Group, *Submission 19*, pp. 15, 24–25.

an identifying code or marking attached to individual RPAS.<sup>19</sup> These views were echoed in CASA's review of RPAS operations, whereby 86 per cent of the 910 respondents indicated support for at least some form of registration. According to CASA's analysis report, the majority voiced a preference for RPA registration by weight, with 250g being the most commonly cited cut-off.<sup>20</sup> This is consistent with registration requirements in the US and UK.

### ***Identification in incidents or otherwise***

4.11 A number of submitters argued that a compulsory registration system rightfully places the onus of responsibility on the RPAS operator who could be easily traced in the case of an incident.<sup>21</sup> The Executive Director of AAUS, Mr Greg Tyrrell, noted that registration could act as a disincentive for non-compliant use of RPAS:

I think registration might help with deterring people from doing the wrong thing, if they think they are going to get caught. It is like if you are going to get caught with your car speeding, with your registration number. I think that will help as a deterrent as long as people are aware of what the rules are. So I think there is some merit in going down that track.<sup>22</sup>

4.12 Submitters suggested that the RPAS operator should be required to register themselves online and that registration markings should be physically attached to the RPAS, by way of an engraved registration number or identifying code.<sup>23</sup> Helistar Aviation observed that the mandatory requirement should be similar to the registration process for road vehicles.<sup>24</sup>

4.13 Alternatively, Mr Chris Roberts, Managing Director of Parrot ANZ proposed that registration be attached to the operator rather than the RPAS, much like a driver's licence:

A registration system could be created that encourages a user-friendly process and is suitable for mass-market product. We believe strongly that it should be online, free of charge and faster—basically instant. If you buy a product, you need to register today and be approved today. It should be the

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19 See, for example: Australian Airline Pilots' Association, *Submission 39*, p. 5; Helistar Aviation, *Submission 23*, p. 3; Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 10.

20 Civil Aviation Safety Authority, *Analysis of responses – Review of RPAS operations (DP1708OS)*, 1 December 2017, pp. 6–7.

21 Global Drone Solutions, *Submission 15*, [p. 1]; International Aerospace Law & Policy Group, *Submission 19*, p. 21; ProUAV Australia, *Submission 20*, p. 1; Regional Express, *Submission 70*, p. 5; Maurice Blackburn Lawyers, *Submission 22*, p. 2.

22 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 10.

23 Aerial Application Association of Australia Ltd, *Submission 49*, p. 3. Also see: Professor Des Butler, *Submission 18*, pp. 5–6.

24 Helistar Aviation, *Submission 23*, [p. 3].

operator that is assigned a unique number. It should not be the drone; it should be the operator, a bit like a driving licence. The applicable rules and what the operator is signing up for and complying with should be clearly stated.<sup>25</sup>

4.14 Other submitters argued that visual displays of registration alone are insufficient for identification purposes, and should be accompanied by a technological component such as an in-built chip.<sup>26</sup> Representatives from Parrot ANZ noted that this technology already exists within their products, whereby users may opt-in to a registration regime through the company app, thus consenting to provide global positioning system (GPS) and mapping data for the purpose of technical analysis.<sup>27</sup> The committee was also made aware of the AeroScope technology built into new products by DJI, one of the largest manufacturers of civilian RPAS. According to DJI:

AeroScope uses the existing communications link between a drone and its remote controller to broadcast identification information such as a registration or serial number, as well as basic telemetry, including location, altitude, speed and direction. Police, security agencies, aviation authorities and other authorized parties can use an AeroScope receiver to monitor, analyze and act on that information. AeroScope has been installed at two international airports since April, and is continuing to test and evaluate its performance in other operational environments.<sup>28</sup>

4.15 AusALPA stated that a registration regime would be consistent with the identification requirements that currently apply to the purchase of mobile phones and SIM cards. It argued that it should be 'necessary to provide valid identification to purchase a regulated RPAS in big primary and secondary markets'. In doing so, CASA would be empowered 'to prevent collisions rather than investigate the aftermath',<sup>29</sup> with the added benefit of improving data gathering of the types, numbers and use of RPAS in Australia.<sup>30</sup> The opportunity for data collection was also reflected in CASA's review into RPAS operations:

Registration provides a mechanism to gather data on total RPA numbers, RPA types, locations, and the operational categories (commercial versus recreational) RPAs are being used in. This data would be useful to determine the resources required to adequately oversight the safety of RPA

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25 Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, p. 3.

26 Mr Mike Snabaitis, Australian Miniature Aerosports Society Inc., *Committee Hansard*, 28 June 2017, pp. 18–19.

27 Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, pp. 3–4.

28 DJI, *DJI Unveils Technology To Identify and Track Airborne Drones*, 12 October 2017, <https://www.dji.com/newsroom/news/dji-unveils-technology-to-identify-and-track-airborne-drones> (accessed 9 November 2017).

29 Australian Airline Pilots' Association, *Submission 39*, p. 5.

30 Department of Defence, answers to written questions on notice, 22 March 2018, p. 3 (received 24 April 2018).

operations in Australia and to more accurately determine the likely impacts of proposed legislative changes.<sup>31</sup>

### *A deterrent for misconduct*

4.16 Many inquiry participants upheld the view that registration should apply to all RPAS operators, including commercial and recreational users.

4.17 Concern was expressed that by simply 'recommending' that commercial operators stamp their aviation reference number on to their RPA, the current regulations do not go far enough to deter RPAS misconduct.<sup>32</sup> Mr John Tessarolo of regional airline, Rex, told the committee:

CASA basically says that operators that are required to notify CASA should either attach to or insert into their aircraft a fireproof identification plate or write in the identification details in indelible ink. That is about as far as the regulator has gone in actually saying, 'Let's identify these drones.' So, it really comes down to the regulations keeping up with technology.<sup>33</sup>

4.18 According to AusALPA, the tightening of regulations and implementation of a mandatory registration regime could send a message to all RPAS operators that 'they are operating in a highly regulated system'. CASA's review paper supported this, stating that 'a person would be less likely to operate unlawfully when their RPA is more readily identifiable by authorities in the instance were [sic] the RPA operator operates unlawfully'.<sup>34</sup> AusALPA expressed hope that a review of the regulations would lead operators to further explore and understand the legal and safety constraints on RPAS operations.<sup>35</sup>

### *Insurance*

4.19 Drone Safety Services suggested that multi-step processes could be added to the registration system over time to enable the provision of insurance, or to confirm the applicability of an existing policy.<sup>36</sup> By requiring the registration of all RPAS, Helistar Aviation noted that it would then be possible to ensure that devices are insured for third party liability whilst also enabling the tracking of operators after incidents.<sup>37</sup>

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31 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 11.

32 Interspatial Aviation Services, *Submission 74*, p. 3.

33 Mr John Tessarolo, Regional Express, *Committee Hansard*, 26 June 2017, p. 19.

34 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 11.

35 Australian Airline Pilots' Association, *Submission 39*, p. 5.

36 Drone Safety Services, *Submission 78*, [p. 5].

37 Helistar Aviation, *Submission 23*, [p. 3].

4.20 In many jurisdictions overseas, insurance requirements for RPAS are already in place. In the European Union, all RPAS weighing less than 500kg are required to have public liability cover of approximately AUD \$1.1 million.<sup>38</sup> Public liability insurance of at least \$100 000 is also required in Canada for all RPA weighing more than 250g.<sup>39</sup> Insurance cover is made possible through mandatory registration that allows RPAS operators to be accountable in the event of an accident or incident.

4.21 In Australia, there is no requirement for RPAS operators to purchase insurance. However, commercial RPAS operators are typically expected to have public liability coverage as part of state and territory business obligations.<sup>40</sup> Whilst the committee heard that club membership with the Model Aeronautical Association of Australia (MAAA) and associated clubs includes insurance cover of \$20 million public liability,<sup>41</sup> the vast majority of recreational RPAS operators are unlikely to be insured to cover damage or injury caused by devices under their control. The Insurance Council of Australia stated that this leaves many amateur RPAS operators financially vulnerable in the case of RPAS system failure or operator error resulting in personal or property damage.<sup>42</sup>

4.22 According to submitters, the benefits of public liability insurance cover extend far beyond individual compensation. Coupled with a robust registration regime, operators with insurance cover would become more visible, accountable, and traceable in the case of an accident or incident. According to Mr Ashley Fairfield, the possession of an operators certificate and the associated insurance policy for his business, regularly acts as a deterrent for unsafe flight. In contrast, amateur or recreational operators who have 'no skin in the game' may be more inclined to illegally take on jobs or unsafe operations as 'they will most likely lose nothing but the fee they got for the job anyway'.<sup>43</sup>

4.23 The Little Ripper Group likened this behavioural change to the 'self-regulation' of the automotive industry, in which drivers must be licenced, and cars insured. They suggested that this seemingly risk-averse culture could be emulated in the RPA industry through implementing similar insurance coverage requirements.<sup>44</sup>

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38 Australian Certified UAV Operators, *Submission 73*, p. 32.

39 Transport Canada, *Proposed rules for drones in Canada*, <https://www.tc.gc.ca/eng/civilaviation/opssvs/proposed-rules-drones-canada.html#liability> (accessed 22 November 2017). Amount is in Canadian dollars.

40 Department of Industry, Innovation and Science, *Arrange insurance for your business*, 10 May 2016, <https://www.business.gov.au/info/run/insurance-and-workers-compensation/arrange-insurance-for-your-business> (accessed 2 February 2018).

41 Mr Tim Nolan, Aeromodellers New South Wales, *Committee Hansard*, 26 June 2017, p. 26.

42 Insurance Council of Australia, *Submission 59*, [p. 4].

43 Mr Ashley Fairfield, *Submission 51*, [p. 2].

44 Little Ripper Lifesaver Pty Ltd, *Submission 16*, p. 5.

4.24 The IALPG pointed out that, without the introduction of a registration requirement allowing RPAS to be easily identified, strict liability compensation under the *Damage by Aircraft Act 1999* would be 'nearly impossible to enforce'. They remarked:

The legal regime which could act to provide the injured with remedies against drone operators...has little ability to operate as intended if the relevant aircraft operator is unable to be found.<sup>45</sup>

4.25 Additional evidence from Australian Certified UAV Operators demonstrated how the lack of registration and insurance has previously resulted in a bystander footing the bill for an RPAS operator's mistake:

In August 2016 a DJI Inspire 1 RPAS collided into the front of a new Mercedes GLS as it was being driven across the Sydney Harbour Bridge. The impact left part of the RPAS embedded in the car bodywork and other debris scattered across the road. Because of heavy traffic the vehicle was travelling at a slow speed; had the traffic been moving faster the incident could have affected several vehicles and resulted in greater damage in general. Because the operator of the RPAS remains unknown, and despite police investigations, the owner of the motor vehicle has been left with the repair bill.<sup>46</sup>

4.26 Noting that the cost impost of insurance would be 'problematic' for many recreational RPAS operators, Professor Des Butler suggested that an alternative solution could involve the issuance of educational material that highlights the significant legal liability associated with irresponsible RPAS operation.<sup>47</sup>

### ***Evidence against mandatory registration***

4.27 Although the committee received a large amount of evidence supporting mandatory registration, a number of submitters, particularly those involved in drone racing, argued that registration is unnecessary. According to these submitters, the creation of a mandatory registration requirement would be ineffective in policing those who are already prone to breaching the rules. Drone racing club member and member of the MAAA, Dr Chris Thompson, stated:

The same people now who break the rules or don't care about them will keep on doing so, and those of us who fly safely will get registered but we aren't the problem and won't cause any problems...

The people who are the problem won't get registered, and the resources required to catch them vastly outweighs the actual risk they pose.<sup>48</sup>

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45 International Aerospace Law & Policy Group, *Submission 19*, p. 21.

46 Australian Certified UAV Operators, *Submission 73*, p. 31.

47 Professor Des Butler, *Submission 18*, pp. 6–7.

48 Dr Chris Thompson, *Submission 81*, [pp. 7, 8]. Also see: Mr Egon Kuster, *Submission 9*, [p. 2].

4.28 Another drone racer questioned how mandatory registration would be applied to RPAS consisting of custom made parts. Mr John Cotterill suggested that risk assessment and verification are made more difficult in the case of operators who frequently change the parts on their RPAS to modify its function.<sup>49</sup> Mr Robert Carpenter of One Giant Leap Australia also alerted the committee to the increasing number of second-hand RPAS sales that may further complicate registration.<sup>50</sup>

4.29 The ease with which individuals are able to access RPAS presents one of the most significant challenges to the establishment of a registration system. CASA suggested that operators who are able to purchase an RPAS straight off the shelf are unlikely to take active steps to register their device, while those that choose to register 'would most likely comply with the relevant safety requirements in any case'.<sup>51</sup>

4.30 To address these challenges, the committee heard that registration should therefore be required before the time of use, to enable basic safety awareness training before operation.<sup>52</sup> The IALPG also suggested that registration could take place through an in-built technological mechanism to be activated upon sale.<sup>53</sup> Additionally, the registration of RPAS used for racing purposes could be captured by a dedicated sports administration body such as MAAA or Recreational Aviation Australia (RA-Aus), as is the case with other specialised aircraft such as balloons and sport rotorcraft.<sup>54</sup>

### **Educating all RPAS operators**

4.31 The lack of training and education of RPAS operators presented another issue with the existing regulatory framework for RPAS. As highlighted in evidence to the committee, there is currently no formal procedure by which RPAS operators must learn the standard operating conditions or certify compliance with the rules. The only exceptions to this are commercial operators of RPAS over 2kg who are required to obtain a ReOC or RePL.<sup>55</sup> Yet, submitters suggested that there is a real prospect that

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49 Mr John Cotterill, *Submission 86*, p. 1.

50 Mr Robert Carpenter, One Giant Leap Australia Pty Ltd, *Committee Hansard*, 26 June 2017, p. 3.

51 Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations (DP 1708OS)*, August 2017, p. 10.

52 Mr Simon Bourke, Australian Airports Association, *Committee Hansard*, 29 August 2017, p. 3. Also see: Department of Defence, answers to written questions on notice, 22 March 2018, p. 3.

53 International Aerospace Law & Policy Group, *Submission 19*, p. 16.

54 CASA overlooks a number of self-administering organisations including MAAA and RA-Aus that operate under a series of exemptions from the ordinary regulations. See: Civil Aviation Safety Authority, *Self-administering organisations*, <https://www.casa.gov.au/standard-page/self-administering-organisations> (accessed 2 May 2018).

55 According to CASA, a RePL allows individuals to fly an RPA for an operator, who in turn needs to hold a ReOC. Therefore those working for themselves will need both. See Chapter 2 for an overview of current regulations.

RPAS will be increasingly manned by inexperienced operators who are unable or unwilling to understand the operating restrictions placed on their RPAS use.<sup>56</sup>

### *Inexperienced operators*

4.32 Submitters noted that the mass introduction of RPAS on the consumer market has rapidly expanded the availability of RPAS from specialist military stakeholders to everyday retail consumers with limited training or aviation knowledge.<sup>57</sup> At the same time, RPAS technology has become more advanced, offering technological enhancements such as greater reliability, increased battery life, and longer operating ranges, all at a decreasing cost. The Australian Airports Association noted that these factors have contributed to a growing cohort of inexperienced operators accessing and operating sophisticated technology:

Familiarity and enthusiasm with the technology encourages amateur operators to upgrade to more and more sophisticated RPAS devices. As the sophistication grows, so do the operating capabilities of these systems and therefore the potential risk to aviation safety.<sup>58</sup>

4.33 The IALPG commented further:

Australia's very wide and clear skies are a temptation for all untrained, and amateur operators – the problem with the deregulation of commercial operation is simply that it makes the problematic malicious, uncaring, or untrained recreational operator, a *legitimate* operator, and thus one who can make money through their exploits.<sup>59</sup>

4.34 VIPA suggested that many RPAS users, particularly those without a RePL, have little regard for public safety and the risks associated with operating an unmanned aerial vehicle. It highlighted numerous reports of illegal flights over populated areas and at night, both of which are contrary to the current regulations.<sup>60</sup>

4.35 The Australian Certified UAV Operators took the view that many illegal operations were borne 'out of naivety' as many such operators 'have not read the regulations correctly or interpreted them correctly'.<sup>61</sup> Research from the UK Civil Aviation Authority revealed that only 36 per cent of buyers receive guidance about

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56 Virgin Independent Pilots Association, *Submission 11*, p. 3.

57 Australian Airports Association, *Submission 12*, p. 1.

58 Australian Airports Association, *Submission 12*, p. 2. Also see: Australian Airline Pilots' Association, *Submission 39*, pp. 2–3.

59 International Aerospace Law & Policy Group, *Submission 19*, p. 13.

60 Virgin Independent Pilots Association, *Submission 11*, [p. 3].

61 Mr Bradley Mason, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 14.

safe flying when buying an RPAS.<sup>62</sup> In Australia, it is difficult to quantify the number of recreational RPAS users, due to the lack of a registration system, let alone the number who take the time to understand the rules for safe operation. When an RPAS is purchased, the operator is provided with a yellow brochure titled 'Flying with Control?' and is directed to the CASA website for further details.<sup>63</sup> However, submitters stated this piece of information was 'very simplistic' and provided only the bare minimum amount of guidance to new RPAS users.<sup>64</sup>

4.36 Contrarily, hobbyist users were keen to establish that their RPAS operations are conducted under strict flying conditions and are generally without incident. Mr John Cotterill, a recreational RPAS user, reported that unauthorised or dangerous behaviour is frowned upon by the RPAS community, which in many ways 'self-regulates'.<sup>65</sup>

4.37 Other recreational RPAS operators, particularly those with model aircraft club membership, were regarded by submitters as 'a risk-averse and mature set of operators' from which 'many lessons can be learned'.<sup>66</sup> Indeed, with the strict oversight of CASA's Sport Aviation team, Aeromodellers New South Wales reported that all events and sites used by its members have the 'full support' of the regulator. Safe flying practices are promoted through a comprehensive Manual of Procedures, and members undertake education programs and direction from the MAAA.<sup>67</sup>

4.38 Another educative initiative brought to the committee's attention was the roll-out of DJI's mandatory RPAS flight quiz. Since 14 February 2018, RPAS pilots using DJI products are now required to correctly answer nine questions about the rules for flying RPAS in Australia. The pre-flight quiz is built into the mobile app used to fly DJI GO or DJI GO 4 products, and is also posed to foreign flyers that have brought their DJI products to Australia to fly. Australia is the third country to receive the DJI

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62 Author unknown, 'Getting a drone for Christmas? The UN releases its 10 tips on operating it safely', *BBC Newsbeat*, 11 December 2016, <http://www.bbc.co.uk/newsbeat/article/38275128/getting-a-drone-for-christmas-the-un-releases-its-10-tips-on-operating-it-safely> (accessed 5 October 2017).

63 At an estimates hearing, CASA CEO Mr Shane Carmody admitted that 'the piece of paper does not actually explain what the rules are; it tells them where to go for the rules'. See: Mr Shane Carmody, Civil Aviation Safety Authority, *Budget Estimates Hansard*, 23 May 2017, p. 102.

64 Piper Alderman, *Submission 65*, p. 3; Australian Miniature Aerospots Society Inc., *Submission 71*, p. 3.

65 Mr John Cotterill, *Submission 86*, p. 1.

66 International Aerospace Law & Policy Group, *Submission 19*, p. 8.

67 Aeromodellers New South Wales, *Submission 14*, [p. 1].

pre-flight quiz, following similar launches in the US in October 2017 and the UK in December 2017.<sup>68</sup>

4.39 Beyond the educational support associated with club membership, and initiatives rolled out by individual manufacturers, the committee heard that there is no overarching mandatory requirement to ensure new recreational RPAS operators are aware of their safety obligations and are able to demonstrate an appropriate standard of aviation awareness. In short, 'there are no checks and balances' at a national level to ensure RPAS users fully understand the restrictions on RPAS operation and are competent to fly.<sup>69</sup>

4.40 The Australian Certified UAV Operators suggested that, in implementing the regulations, CASA made 'sweeping assumptions' that all RPAS operators have sufficient aptitude to find the relevant aviation legislation and regulations applicable to them; understand the aviation language and terminology contained within the regulations; and grasp their legal obligations when operating an RPA.<sup>70</sup>

4.41 The IALPG agreed, noting that the standard operating conditions are ineffective if RPAS users are not educated on how to comply:

The legislation purports to preserve safety purely by having such SOCs [standard operating conditions], but in reality...there is no requirement that people take up the kind of aeronautical education that would skill them to even comply with the SOCs.<sup>71</sup>

4.42 A representative from Drone Solutions drew on personal experience to demonstrate the level of complexity inherent in aviation regulations that amateur RPA operators are unlikely to grasp:

I had no previous aviation and no model aircraft background when I started operating RPA. It is only after receiving a suitable level of training that much of the "aviation language" started making any sense. The [Civil Aviation Legislation Amendment (Part 101) Regulation 2016] and [standard operating procedures] makes many assumptions about aviation

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68 Jennifer Dudley-Nicholson, 'Drone safety: DJI forces drone pilots to pass safety test before lift-off in Australia', *News.com.au*, 13 February 2018, <http://www.news.com.au/technology/gadgets/cameras/drone-safety-dji-forces-drone-pilots-to-pass-safety-quiz-before-liftoff-in-australia/news-story/6467acb75b0920f1a61870a68cd66516> (accessed 14 February 2018). Also see: Emily Piesse, 'Australian DJI pilots forced to take quiz or face being grounded in national crackdown', *ABC News*, 14 February 2018, <http://www.abc.net.au/news/2018-02-14/australian-dji-drone-pilots-forced-to-take-quiz-to-fly/9443712> (accessed 15 February 2018).

69 Mr John Tessarolo, Regional Express, *Committee Hansard*, 26 June 2017, p. 20.

70 Australian Certified UAV Operators, *Submission 73*, pp. 22–23. Also see: Drone Safety Services, *Submission 78*, [p. 4].

71 International Aerospace Law & Policy Group, *Submission 19*, p. 15.

knowledge that are unrealistic.<sup>72</sup> How is anyone, without adequate training, going to fully understand concepts like:

- Controlled Aerodromes – What are these and how do you know how to locate them?
- Non-Controlled Aerodromes - What are these and how do you know how to locate them?
- Restricted Areas – How do you find out where they are and what hours they are operational?
- RA1, RA2, RA3 – What are these and how do you know how to locate them?<sup>73</sup>

4.43 Representatives from the Unmanned Research Aircraft Facility at the University of Adelaide acknowledged that even trained RPA operators may have difficulty interpreting airspace requirements 'with the level of accuracy required to meet the regulations, and maintain safe, regulated aircraft-RPAS distance'. They submitted that the risks involved were 'greatly amplified in pilots operating commercially under 2kg with no training, potentially fewer available information resources, and no pre- and post-flight oversight'.<sup>74</sup>

4.44 Witnesses therefore argued that at least a basic level of education and training should be a priority for lawmakers.<sup>75</sup> The point was made that any RPAS registration system should have as a minimum, the dual purpose of educating and registering RPAS operators. To this end, the committee was told that, as part of a mandatory registration system, an RPAS operator must be required to demonstrate an adequate understanding of the applicable regulations in order to be issued with an identification number and access to mapping and data information.<sup>76</sup>

4.45 Mr Chris Roberts of Parrot ANZ commented that, regardless of whether the pilot is located in or below the aircraft, 'the pilot is ultimately always responsible for the operation' and should therefore be sufficiently educated about his or her responsibilities.<sup>77</sup>

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72 Standard operating procedures refer to the standard operating conditions set out in Regulation 101.238 of the CASR by which RPAS operators must adhere, also referred to as SOCs.

73 Drone Solutions Pty Ltd, *Submission 63*, pp. 6–7. A full list of concepts can be found in the original submission.

74 Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 3.

75 See, for example: Aeroeye, *Submission 41*, [p. 2]; Interspace Aviation Services Pty Ltd, *Submission 74*, p. 2.

76 See, for example: Captain Murray Butt, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 8; Aeroeye, *Submission 41 – Supplementary Submission 1*, [p. 2]; Drone Safety Services, *Submission 78*, [p. 4].

77 Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, pp. 2–3.

### ***Education, awareness and certificates/licences***

4.46 Witnesses to the inquiry emphasised the point that RPAS have the potential to cause a breach of national security, cause damage to life or property and can invade the privacy of others. As such, there should be a requisite equivalent and proportionate requirement on the part of the operator to have some level of technical skill, as well as an appropriate understanding of the rules and regulations concerning the operation of their device. To this end, some submitters voiced their support for a certification or licensing test for RPAS operators.

4.47 Model aircraft hobbyist Mr Edward Browning proposed a requirement similar to the Basic Aeronautical Knowledge test for student pilots, which would be followed by a practical demonstration of ability.<sup>78</sup> Similarly, VIPA suggested that all RPAS operators be 'required to complete a basic air law examination'.<sup>79</sup>

4.48 In their September 2016 Joint Statement, international aviation bodies recommended mandatory training and certification as a top priority. The signatories argued that an obligation to obtain a certificate or licence creates awareness and mandates knowledge of the applicable regulations and restrictions. They continued:

Moreover, a legally required certificate or license also enhances the ability to enforce rules. Operating a drone is thereby reserved for people who have acquired permission to do so.

This requirement should be mandatory except for the harmless drones. This category of drones is understood to do no harm to people (e.g. be limited to a maximum weight of 250g and a radius of action of no more than 50 meters from the pilot).<sup>80</sup>

4.49 A number of submitters were in favour of a system whereby RPAS operators are legally bound by a licence to abide with the regulations.<sup>81</sup> The notion of legal accountability was supported by Aeroeye. It stated that education is more effective if operators 'have something to lose if they choose to operate outside of the rules', such as a licence or registration.<sup>82</sup>

4.50 Some submitters also argued a licencing test would raise the standard of operation by challenging the misconception that RPAS are harmless toys for children. Captain Phil Stevens noted in this regard:

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78 Mr Edward Browning, *Submission 10*, [p. 2].

79 Virgin Independent Pilots Association, *Submission 11*, [p. 4].

80 European Cockpit Association, *Joint call to safely integrate drones into Europe's airspace*, September 2016, <https://www.eurocockpit.be/positions-publications/joint-call-safely-integrate-drones-europes-airspace> (accessed 12 January 2018).

81 International Aerospace Law & Policy Group, *Submission 19*, p. 25.

82 Aeroeye, *Submission 41*, [p. 2]. Also see: Mr Ashley Fairfield, *Submission 51*, [p. 2].

Would you issue a pilot licence to an 8 or 10 years old child? No. So why will you allow a similar child to fly a drone?<sup>83</sup>

4.51 Maurice Blackburn Lawyers added that a standard education requirement would send the right message to the public and add to the credibility of the industry through 'weeding out' unsafe operators.<sup>84</sup>

4.52 In CASA's RPAS operations review, approximately half of the 910 respondents agreed that both proficiency and/or training should be compulsory, taking the weight of the RPAS into account.<sup>85</sup> CASA stated that, whilst many recreational and excluded category operators do so lawfully and with a sound understanding of their safety obligations, 'there is an increasing number of RPA operators...who have a poor understanding of the RPA legislation, or have interpreted it incorrectly'.<sup>86</sup>

4.53 However, the need for low-cost and time-effective training was also emphasised by submitters.<sup>87</sup> AAUS noted that the challenge was to develop a standardised syllabus that is able to deliver training at a national level and at a price that is affordable for recreational RPAS operators.<sup>88</sup>

4.54 These concerns were again reflected in CASA's review responses, with submitters suggesting a free, user-friendly education syllabus, available through e-learning platforms that are regularly updated to meet industry and technology standards.<sup>89</sup>

4.55 The example of marine radio operator certification was brought to the committee's attention. Details about the training requirements for marine radio operators are outlined in case study 4.1 below.

#### ***Case study 4.1 – Training requirements for marine radio operation***

Marine radio operators are required to complete a number of training requirements before obtaining their marine radio operators licence. Training requirements draw on

83 Captain Philip Stevens, *Submission 87*, [p. 4]. Also see: Civil Air Australia, *Submission 21*, p. 2.

84 Maurice Blackburn Lawyers, *Submission 22*, p. 4.

85 Civil Aviation Safety Authority, *Analysis of responses – Review of RPAS operations (DP1708OS)*, 1 December 2017, pp. 11–12.

86 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 15.

87 Mr Anthony Marsh, Aeroeye, *Committee Hansard*, 16 June 2017, p. 11; Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, p. 11.

88 Australian Association for Unmanned Systems, *Submission 46*, p. 6. Also see: Dr Chris Thompson, *Submission 81*, [p. 6].

89 Civil Aviation Safety Authority, *Analysis of responses – Review of RPAS operations (DP1708OS)*, 1 December 2017, pp. 11–15.

an approved syllabus, and assessment is undertaken by an independent invigilator. Operators must demonstrate proficiency before being allowed to use their vessel for recreational activity.

### **Legislative framework**

The legislative framework for the qualification of marine radio operators is authorised by the International Telecommunication Union (ITU) Radio Regulations. Like ICAO, the ITU was established by the United Nations and provides guidance on the wide range of issues affecting information and communication technologies internationally. As a member state, Australia has established training requirements for marine radio operators. Five different certificates of proficiency and one certificate of endorsement are issued to operators of marine radios as follows:

- Long Range Operator Certificate of Proficiency (LROCP);
- Short Range Operator Certificate of Proficiency (SROCP);
- Global Maritime Distress and Safety System General Operators Certificate of Proficiency (GOCP);
- GMDSS First-Class Radio Electronic Certificate (1<sup>st</sup>-Class REC);
- GMDSS Second-Class Radio Electronic Certificate (2<sup>nd</sup>-Class REC); and
- Marine Satellite Communications Endorsement (Satcom).

The type of qualification required depends on the type of equipment carried on the marine vessel.

### **Training bodies**

A number of certificates of proficiency can be obtained by undertaking private study. However, colleges of technical and further education, volunteer marine safety organisations, marine training schools and commercial companies, may also provide courses in marine radio proficiency.

The Australian Maritime Safety Authority (AMSA) is responsible for the issue of GOCPs and 1<sup>st</sup>- and 2<sup>nd</sup>-Class RECs. AMSA has accredited a number of educational institutions and registered training organisations to conduct examinations to test candidates at the conclusion of the course. Approved providers are listed on the AMSA website.

LROCPs, SROCPs and Satcoms are issued by the Australian Maritime College (AMC) on behalf of the Australian Media and Communications Authority. AMC approves invigilators to conduct examinations on its behalf. A list of both independent invigilators, and those associated with organisations, are listed on their website.

Certificates are issued on presentation of the results of approved examinations, and a small fee is charged.<sup>90</sup>

#### *A tiered education system*

4.56 Many submitters, including Mr Greg Tyrrell of AAUS, noted that training should be 'geared to risk' such that recreational operators are required to have a base level of knowledge, and operators with further commercial intent may be required to know more.<sup>91</sup>

4.57 Similarly, Helistar Aviation proposed that a tiered system be introduced whereby recreational and small RPAS operators are required to complete a recreational pilot licence theory exam, while commercial operators could be asked to complete instrument flight rule (IFR) training before conducting 'beyond visual line of sight' operations (BVLOS).<sup>92</sup>

4.58 According to submitters, a tiered system offers the prospect of limiting and controlling the capability of an RPAS in accordance with the competency, aviation awareness and education of its operator. As a starting point, 'off-the-shelf' RPAS could be equipped with technical constraints on altitude and distance. All buyers of RPAS would be required to pass a basic competency test and register their device before use. For recreational operators who are interested in unlocking additional capabilities and functions on their RPAS, a second tier requirement would have to be met by way of further education and skill development. The third tier would require operators to meet current licencing requirements before commencing commercial operations.

4.59 In this vein, proponents of the MAAA's 'wings' program advocated for a tiered accreditation system. As an example, the 'bronze wing' certification available through MAAA's program is aimed at aero-modellers who fly models below 2kg; 'silver wings' is aimed at those flying models over 2kg, and 'gold wings' is awarded to pilots who are able to complete difficult manoeuvres such as a Cuban Eight, inside loop and horizontal roll.<sup>93</sup> MAAA Secretary, Mr Kevin Dodd further explained:

Bronze and silver basically are the mandatory solo proficiencies. In most of the clubs now, if not all, if you visit and do not have your bronze or silver

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90 Australian Media and Communications Authority, *Marine radio qualifications*, <https://www.acma.gov.au/Citizen/TV-Radio/Radio/Marine-and-Amateur-Radio/marine-radio-qualifications> (accessed 29 May 2018); Australian Maritime College, *Marine Radio Operators Certificates*, <http://www.amc.edu.au/industry/omc/certificates> (accessed 29 May 2018).

91 Mr Greg Tyrrell, Australian Association for Unmanned Systems, *Committee Hansard*, 16 June 2017, p. 11.

92 Helistar Aviation, *Submission 23*, [p. 4]. Instrument ratings are detailed in Part 61 of the Civil Aviation Safety Regulations 1998.

93 Model Aeronautical Association of Australia, *Wings*, <https://www.maaa.asn.au/wings> (accessed 14 November 2017).

wings, they would probably stand an instructor with you until such time as they were happy to see you fly.<sup>94</sup>

4.60 Representatives from Aeromodellers New South Wales, who assisted in the development of the wings system, added that the program 'helps to set a culture within the clubs and our pilots of knowledge of the rules and safety'.<sup>95</sup> It also ensures consistency across state jurisdictions—a key benefit of any federally driven regulation.

4.61 A tiered training program for all RPA operators, in combination with 'off-the-shelf' technical restrictions, was generally supported in evidence to the committee. Under such a system, all RPAS operators would be required to pass a minimum level of testing before flying an RPAS, with the option to upgrade and fly further.<sup>96</sup> Representatives from Airservices Australia stated they 'would happily work with manufacturers' to implement such a program,<sup>97</sup> whilst ATSB suggested that the idea could inform further policy.<sup>98</sup> In line with DJI's in-built quiz initiative, CASA encouraged all RPA manufacturers to utilise technology to assist in enhancing user's understanding and compliance with Australian RPA legislation.<sup>99</sup>

#### *Implications for other industries*

4.62 Submitters suggested that mandated education requirements could shape the way in which insurers develop policy.<sup>100</sup> Drone Solutions recounted difficulty in finding an aviation insurance broker willing to provide public liability insurance in the absence of a RePL. It reported:

Insurance professionals are experts at using risk profiles to determine insurability and premium rates. If the insurance professionals are concluding that it is too risky to insure someone in the sub 2kg excluded

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94 Mr Kevin Dodd, Model Aeronautical Association of Australia, *Committee Hansard*, 16 June 2017, p. 17.

95 Mr Tim Nolan, Aeromodellers New South Wales, *Committee Hansard*, 26 June 2017, p. 21.

96 At a public hearing of the committee, Senator Fawcett put the following idea to witnesses: 'the first level of training is an independently invigilated exam that shows that they understand the safety implications of the current envelope—three miles or three kilometres around airports, 400 feet et cetera—and that the geo-fencing is expanded to a hard limit of 400 feet and the other area and then a final level, which is commercial, all the normal commercial considerations that currently exist, would remove those limitations from the device'. See: *Committee Hansard*, 29 August 2017, p. 26.

97 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 15.

98 Mr Greg Hood, Australian Transport Safety Bureau, *Committee Hansard*, 29 August 2017, p. 26.

99 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 16.

100 Australian Association for Unmanned Systems, *Submission 46*, p. 4; Ms Aranka Nolan, Aeromodellers New South Wales, *Committee Hansard*, 26 June 2017, p. 26.

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category without providing a RePL, then they also seem to disagree with CASA's risk assessment.<sup>101</sup>

4.63 This implied that any potential changes to CASA's regulations are likely to have an impact on the insurance industry. The IALPG agreed that the increased number of RPAS operating under the Part 101 amendments will cause the insurance market to adjust policies and prices accordingly.<sup>102</sup>

4.64 This view was seemingly illustrated in January 2018 when QBE launched a dedicated RPAS insurance policy. Created in recognition of CASA's 'relaxed regulations' for sub-2kg RPAS, the policy offers accidental damage cover, ground risk cover, and third party liability cover for bodily injury or property damage as a result of an RPAS incident.<sup>103</sup>

4.65 The committee also noted that in December 2015, Vero Insurance revised its public liability insurance policy to include fatality or major destruction caused by a commercially operated RPAS below 10kg.<sup>104</sup>

### **Public awareness**

4.66 The committee received considerable evidence in relation to CASA's public awareness and media activities. According to CASA, it has collectively reached over 1.2 million people through RPAS safety videos; with 51 000 social media followers to date.<sup>105</sup> Cinema advertising to target recreational RPAS operators has also commenced, with an estimated total audience reach of over 436 208.<sup>106</sup>

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101 Drone Solutions Pty Ltd, *Submission 63*, p. 8.

102 International Aerospace Law & Policy Group, *Submission 19*, p. 17.

103 QBE, *QBE RPAS Cover*, <https://www.qbe.com.au/business/insurance-for-businesses/specialist-business-insurance/aviation/rpas> (accessed 17 January 2018). Also see: Author unknown, 'QBE launches dedicated drone cover', *National Insurance Brokers Association*, 16 January 2018, <https://www.insuranceandrisk.com.au/qbe-launches-dedicated-drone-cover/> (accessed 17 January 2018).

104 Author unknown, 'Take Cover: Drones get PL Policy', *National Insurance Brokers Association*, 9 December 2015, <https://www.insuranceandrisk.com.au/take-cover-drones-get-pl-policy/> (accessed 17 January 2018).

105 Civil Aviation Safety Authority, *Drone safety review*, 4 December 2017, <https://www.casa.gov.au/aircraft/standard-page/drone-safety-review> (accessed 12 January 2017). Also see: Civil Aviation Safety Authority, answers to questions on notice, 23 May 2017 (received 7 July 2017).

106 Civil Aviation Safety Authority, *Drone safety review*, 4 December 2017 (accessed 12 January 2017).

4.67 In October 2017, CASA launched the 'Droneflyer' website which, it argued, features 'a very simple, plain-English, accessible explanation of the rules'.<sup>107</sup> CASA also released a Christmas safety video ahead of the 2017 holiday period to remind RPAS operators to fly responsibly.<sup>108</sup> However, of particular significance to many witnesses was the CASA mobile phone application, '*Can I fly there?*'.

#### *Can I fly there?*

4.68 *Can I fly there?* is a mobile phone application that shows the user where they are and are not permitted to fly their RPAS. It also identifies prohibited zones such as airports, helicopter landing sites and other restricted areas. Released in May 2017, the app was commissioned by CASA in response to an increasing number of reports from pilots about near-misses with RPAS.<sup>109</sup>

4.69 In August 2017, CASA's Chief Executive Officer (CEO), Mr Carmody, told the committee that the app had been downloaded over 35 000 times and that the web version had been accessed more than 60 000 times.<sup>110</sup> Updated figures released in May 2018 showed that the app had been downloaded an additional 60 000 times. As well as the existing data map available, the app also displays a 5.5km circular area around fire-affected emergency zones.<sup>111</sup>

4.70 The Unmanned Research Aircraft Facility at the University of Adelaide commented that the app's release is consistent with initiatives by the US FAA and UK National Air Traffic Control Service. The US mobile app, 'B4UFLY', provides information and alerts to RPA operators about when and where their RPAS can be flown, whilst the app produced in the UK goes further to alert operators of areas where privacy may also be a concern, such as near a school.<sup>112</sup>

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107 Civil Aviation Safety Authority, *Drone safety review*, 4 December 2017 (accessed 12 January 2017). Also see: Mr Shane Carmody, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 28; Civil Aviation Safety Authority, answers to questions on notice, 23 May 2017 (received 7 July 2017).

108 Civil Aviation Safety Authority, *CASA Christmas drone safety animation*, <https://droneflyer.com.au/#!/christmas-drone-safety-animation> (accessed 8 January 2018).

109 James Dunlevie, 'Mobile app 'Can I Fly There' released to help drone pilots, after increase in near-misses with aircraft', *ABC News*, 26 May 2017, <http://www.abc.net.au/news/2017-05-26/mobile-phone-app-can-i-fly-there-for-drone-pilots-released/8563826> (accessed 10 November 2017).

110 Mr Shane Carmody, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 28.

111 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 21.

112 Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, pp. 3, 6. Also see: Victorian Department of Environment, Land, Water and Planning, *Submission 75*, p. 11.

4.71 Submitters were generally supportive of the mobile app as a means of educating the general public about the safe use of RPAS and to enforce 'no drone' zones. However, the mobile app alone was viewed as just one step towards bolstering public education about safe RPAS use.<sup>113</sup> In addition, RPAS stakeholders expressed broad support for training and demonstrated proficiency requirements in order to make users aware of the relevant regulations, risks and responsibilities associated with RPAS operation.<sup>114</sup>

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113 Mr Simon Bourke, Australian Airports Association, *Committee Hansard*, 29 August 2017, pp. 1–2; Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, pp. 15–16; Australian Association for Unmanned Systems, *Submission 46*, p. 5; Canberra UAV, *Submission 47*, [p. 3]; UAS International, *Submission 66*, p. 4.

114 Civil Aviation Safety Authority, *Analysis of responses – Review of RPAS operations (DP1708OS)*, 1 December 2017, pp. 11–12.



# Chapter 5

## Enforcement measures

5.1 Not only are RPAS capable of congesting busy airspace and breaching privacy barriers; the technology can also cause disruptions to important emergency operations and health services. Beyond this, RPAS in the hands of non-state actors may even pose a threat to the national security of significant public buildings and critical infrastructure.

5.2 This chapter details incidents and occasions where RPAS are increasingly used inappropriately, and explores how the restriction or prohibition on the use of RPAS in certain airspace could assist in enforcing the safe and lawful use of RPAS within the national aviation system. The role of local government and police is also discussed.

### Vulnerable airspace

5.3 Submitters highlighted a number of vulnerable areas that would benefit from more stringent RPAS-use restrictions and greater enforcement, including helicopter landing sites, busy airspace, and emergency and safety operation areas.

#### *Helicopter landing sites*

5.4 NSW Ambulance informed the committee that helicopter landing sites at hospitals are vulnerable to RPAS incidents due to having busy low-flying zones. It noted that NSW Local Health Districts have 172 helicopter landing sites (HLS) that are used in a retrieval and inter-hospital transfer capacity, while NSW Ambulance Helicopter Emergency Medical Services aircraft regularly use sporting fields and public ovals to access pre-hospital accident sites. Yet, it recognised that RPAS operators would most often not be aware of hospital HLS around the country, and specifically the approach and departure paths to these HLS.<sup>1</sup>

5.5 As ambulance helicopters fly at lower levels than along coastal corridors, a collision with RPAS could have 'catastrophic consequences'. NSW Ambulance explained the context:

...in the most vulnerable stage of flight, the landing, pilots will be fully focussed on handling the aircraft, configuring the aircraft for landing, and ensuring the flight path and landing area are clear of fixed obstructions. Detecting UAV will be difficult and will be complicated further by the existing visibility at the HLS or landing area.<sup>2</sup>

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1 NSW Ambulance, *Submission 48*, p. 2.

2 NSW Ambulance, *Submission 48*, p. 4.

5.6 Both Captain Phillip Stevens and Captain David Booth informed the committee that the risk of catastrophe in such a scenario is heightened by the fragility of the helicopter tail rotor.<sup>3</sup> According to Captain Booth:

The risk to tail rotor is significant. It is a very fragile part of the helicopter. We have had many longstanding pilots tell us that a two-kilo strike to a tail rotor, from their experience seeing tail rotor damage in their careers, would almost certainly lead to an autorotation or a loss of control...we think the helicopter end of the industry is really the most vulnerable to these events.<sup>4</sup>

5.7 In December 2017, Queensland Health noted a rise in the number of RPAS sightings reported by aeromedical crews whilst on mission. In some instances, crews had taken additional measures to avoid RPAS hovering near helicopter landing pads. In response to the growing concerns, Queensland Health launched a digital campaign to remind families that all hospitals in the state were 'drone free' zones. Noting that as many as 500 patients arrive at hospitals by helicopter over the holiday period in Queensland, the campaign sought to remind RPAS operators not to fly within a 5km radius of any Queensland hospital.<sup>5</sup>

#### *Busy airspace*

5.8 Civil Air Australia explained that the busy airspace around major cities is the most likely to see RPAS collide with manned aircraft.<sup>6</sup> As such, RPAS users that may not be familiar with controlled airspace boundaries or airspace restrictions, are in danger of causing a serious incident.

5.9 CASA's aviation magazine, Flight Safety Australia, recently identified a number of hotspots where the potential for an RPAS collision with light aircraft, helicopter and regular public transport (RPT) aircraft has increased.<sup>7</sup> Included in the list were Sydney Harbour, Melbourne Docklands, Brisbane Southbank, the Gold Coast and Cairns.<sup>8</sup>

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3 Captain Phillip Stevens, *Submission 87*, [p. 1]; Captain David Booth, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 16; Captain Philip Stevens, Private capacity, *Committee Hansard*, 28 June 2017, p. 45.

4 Captain David Booth, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 16.

5 Queensland Minister for Health and Minister for Ambulance Services the Hon Steven Miles, 'Game over: hospitals a NO DRONE zone', *Media Statement*, 13 December 2017, <http://statements.qld.gov.au/Statement/2017/12/13/game-over-hospitals-a-no-drone-zone> (accessed 31 January 2018).

6 Civil Air Operations Officers Association of Australia, *Submission 21*, p. 2.

7 Craig Newlyn, 'Drone hotspots', *Flight Safety Australia*, 22 January 2018, <https://www.flightsafetyaustralia.com/2018/01/drone-hotspots/> (accessed 2 February 2018).

8 Craig Newlyn, 'Drone hotspots', *Flight Safety Australia*, 22 January 2018 accessed (2 February 2018).

5.10 In line with this advice, the ATSB informed the committee that approximately 40 per cent of reported occurrences between July 2016 and June 2017 took place in the Sydney basin.<sup>9</sup> In January 2018 alone, there were 11 RPA near-encounters with manned aircraft, six of which occurred within 20 nautical miles of Sydney Airport.<sup>10</sup> Anecdotal evidence also shows a large number of RPAS flying within the flight path of the Gold Coast International Airport.<sup>11</sup>

5.11 Airline Rex expressed its concern about collisions near airports around the country:

The area in which Rex views as the greatest threat to commercial airline operations is in the area of small unmanned aircraft operating in the vicinity of airports. Rex has had reports from its pilots, and persons on the ground, of illegal operations in the vicinity of airports, and on flight approach and departure areas.<sup>12</sup>

5.12 VIPA added:

Launching a drone close to an airport, particularly in proximity to an uncontrolled aerodrome exposes aircraft (which are often jet powered) to the risk of collision which could result in substantial damage, loss of control and potentially, loss of life.<sup>13</sup>

5.13 Many aviation industry stakeholders echoed these concerns.<sup>14</sup> Captain Murray Butt of AusALPA revealed that:

There is not a professional pilot in Australia who does not harbour some degree of concern about the risks posed by unmanned aerial systems and how these risks are being managed.<sup>15</sup>

5.14 The increased number of RPAS operating in busy airspace has heightened the risk of an accident or incident. Whilst the absolute prohibition of RPAS in these areas may be unrealistic, Civil Air Australia suggested that RPAS operations in such airspace could be limited to commercial RPAS users.<sup>16</sup>

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9 Australian Transport Safety Bureau, *Submission 62 – Supplementary Submission*, p. 2.

10 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 19.

11 Mr Michael Manning, Drone Solutions Pty Ltd, *Committee Hansard*, 28 June 2017, p. 37.

12 Regional Express, *Submission 70*, p. 2.

13 Virgin Independent Pilots Association, *Submission 11*, [p. 3].

14 See, for example: Qantas Group, *Submission 34*, p. 1; Australian Airports Association, *Submission 12*, pp. 1–2; Professor Des Butler, *Submission 18*, pp. 4–7; Australian Airline Pilots' Association, *Submission 39*, p. 3.

15 Captain Murray Butt, Australian Airline Pilots' Association, *Committee Hansard*, 26 June 2017, p. 7.

16 Civil Air Australia, *Submission 21*, pp. 2–3.

*Emergency and safety operation areas*

5.15 Many witnesses argued that the regulator should take stronger preventative action to ensure that RPAS remain clear of public safety operations. At a public hearing in Brisbane, Mr Michael Manning of Drone Solutions told the committee:

Last year in July [at Burleigh Heads on the Gold Coast] a Westpac rescue helicopter had a near miss with a drone. It was all over the news and the pilot described how close he came to a collision. I think he said 50 metres or thereabouts...

Why are we waiting for the first fatality before we take strong action to prevent this type of activity? When the drone incident happened at last year's Winter Olympics, many European countries, including Slovenia, closed down all drone activities almost overnight. We want to prevent this from happening in Australia but we need to urgently fix what is now broken.<sup>17</sup>

5.16 The Victorian Department of Environment, Land, Water and Planning informed the committee of four instances during a single season where hobbyist RPAS operators had caused a nuisance during fire suppression operations. Mr Brendan Zwanikken, Manager of Aviation Services Unit at the department reported:

Firefighting aircraft, when they are conducting bombing operations in particular, fly below 400 feet. They are getting down to 100 or 200 feet, which is where CASA currently allows unrestricted [RPAS] operations... Victoria has had four incidents in the autumn burn season where RPAS have been flying over planned burns. Luckily, those planned burns were ground ignition, not aerial ignition. However, we have seen that there is a real threat, should we be doing aerial ignition from helicopters, in that environment... However, New South Wales did have an incident in October last year where, during fire suppression operations, the RPAS were flying over the fire line and bombing aircraft had to climb suddenly to avoid it.<sup>18</sup>

5.17 Mr Zwanikken went on to explain the impact of RPAS on emergency operations:

Currently, the way we deal with unauthorised RPAS flying over emergency areas is that we will ground the aerial fleet. If we are bombing in a fire suppression operation and someone detects a RPAS, we will stop all aerial bombing, or flights, until the pilot for that RPAS is found.<sup>19</sup>

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17 Mr Michael Manning, Drone Solutions Pty Ltd, *Committee Hansard*, 28 June 2017, p. 37. Following the 2014 Sochi Winter Olympics, skier Marcel Hirscher was on his second run in a World Cup slalom race when an RPAS with a mounted camera crashed inches behind him.

18 Mr Brendan Zwanikken, Victorian Department of Environment, Land, Water and Planning, *Committee Hansard*, 16 June 2017, pp. 29–30.

19 Mr Brendan Zwanikken, Victorian Department of Environment, Land, Water and Planning, *Committee Hansard*, 16 June 2017, pp. 29–30.

5.18 The grounding of emergency aircraft and cessation of operations in emergency situations in order to avoid a collision with an RPAS adversely impacts both the emergency operation itself and public safety more generally.<sup>20</sup> The NSW Government and NSW Ambulance expressed concern that, not only are aircrew, medical crew and patients at risk when operating in uncontrolled environments, but the unauthorised use of RPAS also 'increases the potential of shutting down aerial firefighting operations'.<sup>21</sup>

5.19 The point was made that, while the regulations prescribe that RPAS should not be operated in a manner that causes a hazard to people or aircraft, and the standard operating conditions require that all RPAS remain clear of public safety operations, many such operators are 'not necessarily aware of the regulations', whilst others will 'flaunt them'.<sup>22</sup> General Manager of the National Aerial Firefighting Centre, Mr Richard Alder, told the committee that the 'risk is likely to significantly increase, not only as drones proliferate, but as their capabilities increase as well'.<sup>23</sup>

### **Airspace around public buildings**

5.20 In addition to the airspace over major cities, emergency operations sites, and HLS, the committee considered that RPAS operating over significant public buildings may also be a cause for concern.

### ***Airspace restrictions in the United States***

5.21 In the US, the National Capital Region, where the Capitol and the White House are located, is classed as a Special Flight Rules Area, meaning that additional flight restrictions apply to the airspace. The rules were put in place after the 9/11 attacks, and limit aircraft operations to those with FAA and Transportation Security Administration approval. Violators found to breach these rules are subject to stiff fines and criminal penalties.<sup>24</sup>

5.22 The airspace around Washington D.C. is more restricted than in any other part of the US. However, in 2017, similar restrictions were imposed by the FAA over a number of other public buildings. On 5 October 2017, at the request of security and law enforcement agencies, the FAA used its authority to restrict RPAS flights up to 400 feet within the lateral boundaries of 10 Department of Interior sites, including the

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20 Mr Richard Alder, National Aerial Firefighting Centre, *Committee Hansard*, 16 June 2017, p. 30.

21 NSW Government, *Submission 69*, [p. 3]. Also see: NSW Ambulance, *Submission 48*, p. 5.

22 Mr Richard Alder, National Aerial Firefighting Centre, *Committee Hansard*, 16 June 2017, p. 31.

23 Mr Richard Alder, National Aerial Firefighting Centre, *Committee Hansard*, 16 June 2017, p. 31.

24 Federal Aviation Administration (US), *No Drone Zone*, 11 July 2017, [https://www.faa.gov/uas/where\\_to\\_fly/no\\_drone\\_zone/](https://www.faa.gov/uas/where_to_fly/no_drone_zone/) (accessed 18 January 2018).

Statue of Liberty and Mount Rushmore.<sup>25</sup> In December 2017, further restrictions were issued over several Department of Energy facilities in a number of states. The FAA is also considering requests from other federal security agencies to implement additional restrictions.<sup>26</sup>

5.23 Drawing on the US experience, the committee turned its mind to the imposition of RPAS flight restrictions around significant public buildings in Australia.

### ***Airspace restrictions in Australia***

5.24 Noting the stringent restrictions in place in Washington D.C., the committee was alarmed to hear from CASA that '[t]he airspace over or in the vicinity of Parliament House is not declared as a prohibited area'.<sup>27</sup> CASA stated that:

There is currently no designated airspace for prohibited, restricted or danger areas (as defined in the Airspace Regulations 2007) over or in the vicinity of Parliament House.<sup>28</sup>

5.25 Instead, as Parliament House falls within the control zone of Canberra Airport, it is 'not appropriate' to fly an RPAS within its precinct.<sup>29</sup>

5.26 The fact that Parliament House is not recognised as a prohibited area raised questions for the committee, particularly in light of an incident in June 2017 when an RPAS was reported to have flown over Parliament House, and a nearby sports oval, without authorisation.<sup>30</sup> In addition to flying the RPAS over a public building, this action appeared to be in breach of the RPA standard operating procedures, including flight over a populous area, and within 30 metres of people.

5.27 However, CASA responded by stating that recreational RPAS operators are simply 'encouraged to adhere to the standard operating conditions'. It noted that

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25 Federal Aviation Administration, 'FAA Restricts Drones over Statue of Liberty, Other Landmarks', *News*, 28 September 2017, [https://www.faa.gov/news/updates/?newsId=88811&omniRss=news\\_updatesAoc&cid=101\\_N\\_U](https://www.faa.gov/news/updates/?newsId=88811&omniRss=news_updatesAoc&cid=101_N_U) (accessed 5 October 2017).

26 Miram McNabb, 'FAA Restricts Drone Operations Over 7 Department of Energy Facilities', *Dronelife.com*, 19 December 2017, <https://dronelife.com/2017/12/19/faa-restricts-drone-operations-7-department-energy-facilities/> (accessed 8 January 2018).

27 Civil Aviation Safety Authority, answers to questions on notice, 19 September 2017, p. 3 (received 3 October 2017).

28 Civil Aviation Safety Authority, answers to questions on notice, 29 August 2017, p. 2 (received 14 September 2017).

29 Dr Jonathan Aleck, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 32.

30 James Elton-Pym, 'Regulator promises to investigate 'illegal' One Nation drone flight over Parliament House', *SBS*, 29 August 2017, <http://www.sbs.com.au/news/article/2017/08/29/regulator-promises-investigate-illegal-one-nation-drone-flight-over-parliament> (accessed 20 November 2017).

operations under the excluded category of the regulations 'are also not restricted by location'.<sup>31</sup> As such, there is no distinction between the airspace over public buildings, schools, parks, and other public spaces, unless distinguished by 'a significant density of population' to be deemed a 'populous area' under the standard operating conditions.<sup>32</sup>

5.28 The committee considered that the seemingly unregulated airspace above Parliament House raises serious questions about the security of critical infrastructure in Australia. The lack of clear restrictions appears to be inconsistent with aviation safety principles and national security standards. The committee therefore sought to understand the process by which certain airspace can be prohibited from RPAS operations. Whilst airspace restriction is not the only measure highlighted in evidence to effectively regulate safe RPAS use, clearly defined prohibitions could act as a disincentive for oblivious operators who may otherwise be unaware of the dangers posed by their device.

### ***Process for prohibiting RPAS in certain airspace***

5.29 The committee was informed that CASA is the agency responsible for exercising the powers provided under the *Airspace Act 2007* and Airspace Regulations 2007. The CASA Office of Airspace Regulation regulates and administers all Australian airspace, including prohibited, restricted and danger areas where certain types of activities take place that may present a risk to aviation activities.<sup>33</sup>

5.30 CASA stated that, according to Regulation 6 of the Airspace Regulations 2007, it 'must not declare an area to be a prohibited area unless...it is necessary for reason of military necessity to prohibit the flight of aircraft over the area'.<sup>34</sup>

5.31 CASA CEO, Mr Shane Carmody went on to explain:

I'm the safety regulator, so my remit is around safety. We are able to make declarations on airspace, if someone puts something to us, but we have no expertise on security in Parliament House.

...I would expect a formal request from a security agency, the Federal Police, a privacy organisation or the Attorney-General to make a declaration on airspace about declaring airspace at a particular time.<sup>35</sup>

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31 Civil Aviation Safety Authority, answers to questions on notice, 29 August 2017, p. 2.

32 Civil Aviation Safety Regulations 1998, reg. 101.025.

33 Department of Defence, answers to written questions on notice, 22 March 2018, p. 3 (received 24 April 2018).

34 Civil Aviation Safety Authority, answers to questions on notice, 19 September 2017, p. 3.

35 Mr Shane Carmody, Civil Aviation Safety Authority, *Supplementary Estimates Hansard*, 27 October 2017, pp. 23–24.

5.32 The Department of Defence (Defence) added that applications for airspace restriction are subject to submission of an Airspace Change Proposal that would include consultation and development of a safety case to justify such declarations by CASA.<sup>36</sup>

5.33 The IALPG cautioned that, in the absence of an appropriate regulatory solution to enforce safe RPAS operation and effectively restrict airspace, anti-drone technologies are likely to flourish, leading to the commercialisation of security and a loss of control on the part of aviation regulators.<sup>37</sup>

5.34 This was supported by evidence of the thriving counter-drone industry, notably led by an Australian defence company called DroneShield. The committee heard that, whilst airspace restrictions were imposed for the 2018 Commonwealth Games in the Gold Coast,<sup>38</sup> the Queensland Police were also equipped with an 'arsenal' of drone guns, designed to emit a jamming signal to cause RPAS to go into emergency mode and either land in a designated area or return to their starting point.<sup>39</sup>

5.35 The importance of employing complementary technological solutions for RPAS regulation was a consistent theme throughout the inquiry. Technology-based compliance measures are discussed further in Chapter 6.

### **Local government initiatives**

5.36 In response to growing safety and privacy concerns, local governments have become increasingly active in restricting and banning RPAS operations in public spaces.

5.37 In 2015, Leichhardt Council in Sydney became the first council in Australia to ban RPAS in parks and public spaces, including playgrounds, to protect children's

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36 Department of Defence, answers to written questions on notice, 22 March 2018, p. 3.

37 International Aerospace Law & Policy Group, *Submission 19*, p. 19. Also see: Robert Wall, 'Next Step For Drones: Defending Against Them', *The Wall Street Journal*, 23 July 2015, <https://www.wsj.com/articles/next-step-for-drones-defending-against-them-1437645600> (accessed 9 November 2017).

38 Author unknown, 'Commonwealth Games temporary restrictions: what you need to know', Flight Safety Australia, 9 February 2018, <http://www.flightsafetyaustralia.com/2018/02/commonwealth-games-temporary-restrictions-what-you-need-to-know/> (accessed 13 February 2018).

39 Yolanda Redrup, 'Drone guns key part of Comm Games security', *Australian Financial Review Weekend*, 7 April 2018, p. 3. Also see: Melissa Yeo, 'Queensland Police will use anti-drone guns at the 2018 Commonwealth Games', *Business Insider Australia*, 28 February 2018, <https://www.businessinsider.com.au/droneshield-anti-drone-guns-commonwealth-games-2018-2> (accessed 6 March 2018).

safety and privacy.<sup>40</sup> A number of councils across Australia now have by-laws in place to restrict RPAS use on local government land including public reserves, parks and foreshore areas.<sup>41</sup>

5.38 IALPG was of the view that local councils can and should be integral in shaping the culture of RPAS operations, stating:

...the regulation of drone activity at a local level sends a powerful message to users about potential dangers of misuse, the level of responsibility such users would have to those they accidentally injure, and help train community members to understand the power of and maturity required to safely and responsibly operate when the possibility exists to come into accidental contact with people, vehicles, wildlife, or infrastructure.<sup>42</sup>

5.39 During discussions on the importance of signage and public information, representatives from the Australian Airports Association acknowledged that there was scope for local airports to also do more. Mr Simon Bourke, Policy Director, drew the committee's attention to jurisdictions that have begun to engage in restricting areas for RPAS use:

I know Cairns Airport identified some parkland and got in touch with local council and put in a no-fly-zone for drones and some signage to that effect. There are several airports that have done that based on their own risk assessments, the terrain around the airport and the prevalence of usage around that. So it is being looked at.<sup>43</sup>

## Delegation of enforcement powers

5.40 The primary challenge before local councils and airports, and indeed at a national level, is that of enforcing compliant RPAS operations. As a case in point, while bans on launching an RPAS within the perimeter of a park can be policed by a

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40 Deborah FitzGerald, 'Leichhardt Council is the first in Australia to ban drones in parks and public spaces amid fears for children's safety and privacy', *Daily Telegraph*, 1 December 2015, <https://www.dailytelegraph.com.au/newslocal/inner-west/leichhardt-council-is-the-first-in-australia-to-ban-drones-in-parks-and-public-spaces-amid-fears-for-childrens-safety-and-privacy/news-story/6b98ae38b3c5cead24b18a7dcfbabdc5> (accessed 31 January 2018).

41 Brett Williamson, 'Flyers beware: Councils clamp down on use of drones and model planes in public places', *ABC News*, 20 March 2017, <http://www.abc.net.au/news/2017-03-20/councils-clamp-down-on-use-of-drones-in-public/8369020> (accessed 31 January 2018); Liam Croy, 'Perth council clamps down on public drone use', *Perth Now*, 29 December 2016, <https://www.perthnow.com.au/news/wa/perth-council-clamps-down-on-public-drone-use-ng-49d76a0d66aecfdd353853c8e71bac95> (accessed 31 January 2018).

42 International Aerospace Law & Policy Group, *Submission 19*, pp. 19–20.

43 Mr Simon Bourke, Australian Airports Association, *Committee Hansard*, 29 August 2017, p. 8.

council official, there is little that officers can do when an RPAS is launched outside of a park.<sup>44</sup>

5.41 While CASA emphasised that there are rules already in place, including the 30 metre rule and a direction not to fly over crowds or groups, it also recognised that it would be difficult to find and charge the offender if there was a breach. As Mr Peter Gibson, a CASA spokesperson, noted in 2015:

If people are concerned about breaches of privacy they can report it to the police but you still have the problem of identifying who was operating the drone.<sup>45</sup>

5.42 One solution already discussed in Chapter 4 is the establishment of a registration system that would allow the operator of the RPAS to be traced and penalised. In addition to a system of registration, a number of submitters supported the provision of additional powers to local authorities.

5.43 The Australian Certified UAV Operators suggested that local authorities be granted additional powers to impose and enforce RPAS regulation, including the examination and investigation of breaches; confiscation of equipment; and the issuing of on-the-spot fines if necessary.<sup>46</sup> This recommendation was also supported by the Regional Aviation Association of Australia, which expressed the view that federal and state police are 'best placed to deter, detect, investigate and...pursue' unsafe or unlawful RPAS operations.<sup>47</sup>

5.44 Defence added:

It would be useful from a legislative/regulative perspective to positively authorise electronic, physical or other measures to stop, disrupt, bring down or prevent UAS from being utilised unlawfully. Such a law could be extended to other Government authorities such as Defence or Border Force to support the police and provide protection to other sensitive Government or agency sites.<sup>48</sup>

5.45 In the US, new laws passed on 7 June 2017 allowing authorised agencies and agency representatives to 'use reasonable force to disable, disrupt, damage or destroy a

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44 Dr Jonathan Aleck, Civil Aviation Safety Authority, *Budget Estimates Hansard*, 23 May 2017, pp. 108–109; NSW Farmers, *Submission 45*, pp. 5–7.

45 Deborah FitzGerald, 'Leichhardt Council is the first in Australia to ban drones in parks and public spaces amid fears for children's safety and privacy', *Daily Telegraph*, 1 December 2015 (accessed 31 January 2018).

46 Mr Bradley Mason, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, pp. 15–16.

47 Regional Aviation Association of Australia, *Submission 58*, [p. 1]. Also see: Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 5; Australian Miniature Aerospots Society Inc., *Submission 71*, p. 3.

48 Department of Defence, answers to written questions on notice, 22 March 2018, p. 4.

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UAS that poses a threat to safety or security'. This includes detecting and monitoring RPAS that are suspicious.<sup>49</sup>

5.46 The UK has put in place similar measures, with the Department of Transport and the Civil Aviation Authority recently announcing a proposal to increase police powers to allow officers to investigate RPAS misuse.<sup>50</sup> For the purposes of safety and security, the new rules will permit police to order RPAS operators to ground their devices, and demand registration documentation or RPAS parts if suspected to have been used to commit an offence.<sup>51</sup>

5.47 CASA told the committee that it is aware of evolving enforcement actions being taken by local and state government agencies to limit or prohibit the use of RPAS in particular areas. It expressed support for local efforts, and stated:

...local law enforcement authorities are generally in a better position than CASA's operational and investigative officers to respond in a timely way to actual, apparent and alleged contraventions of the safety regulations.<sup>52</sup>

5.48 To this end, CASA highlighted to the committee a forum that it facilitated in November 2017 with state, territory and federal law enforcement agencies. The aim of the forum was to discuss the development of a standardised approach to instances and/or reports of local RPAS-related breaches. This approach may include the issuance of aviation infringement notices, and criminal prosecutions.<sup>53</sup> According to CASA, the progression of this work 'is ongoing and is strongly supported by participating law enforcement authorities'.<sup>54</sup>

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49 Meenal Dhande, 'Changing drone laws and policies in the US', *Geospatial World*, 11 June 2017, <https://www.geospatialworld.net/blogs/uav-registration-us-drone-surveillance-policy/> (accessed 11 December 2017).

50 The Rt Hon John Hayes CBE MP, UK Minister of State at the Department for Transport, 'Drones update, 27 November 2017', *Written statement*, 27 November 2017; UK Government, *New powers for police to address illegal and unsafe use of drones*, <https://www.gov.uk/government/news/new-powers-for-police-to-address-illegal-and-unsafe-use-of-drones> (accessed 28 November 2017).

51 Malek Murison, 'Incoming UK Drone Laws: What You Need To Know', *Dronelife*, 27 November 2017, <https://dronelife.com/2017/11/27/incoming-uk-drone-laws/> (accessed 11 December 2017).

52 Civil Aviation Safety Authority, *Submission 17*, pp. 13–14.

53 Civil Aviation Safety Authority, *Submission 17*, pp. 13–14.

54 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircrafts systems*, May 2018, p. 20.



# Chapter 6

## Technological compliance

6.1 The previous chapter explored a number of potential enforcement measures to promote the safe use of RPAS, and restrict operations in vulnerable airspace. This chapter focuses on the compliance measures raised in evidence that draw on technological advancements in RPAS and aircraft technology.

### Technology-based solutions

6.2 The committee was informed that, given continued advancement in RPAS technology and growing popularity amongst the general public, a risk-based approach to regulation, including technical, safety and operational requirements, will need to be implemented. This would not only include registration of ownership but also the enforcement of nationally-consistent airworthiness standards, and the use of airborne collision avoidance systems and other technology directed at achieving safety in shared airspace.

6.3 Specifically, the committee considered the potential of automatic dependent surveillance broadcast, geo-fencing, and collision avoidance systems to support monitoring, enforcement and compliance measures.

### *Automatic Dependent Surveillance Broadcast (ADS-B)*

6.4 A number of submitters drew the committee's attention to ADS-B technology.<sup>1</sup> ADS-B is an electronic system that allows an aircraft to automatically broadcast its precise location via a digital link.<sup>2</sup> ADS-B equipment mandates for manned aircraft have been progressively implemented in Australia since 2013. A final mandate, requiring all aircraft operating under IFR to be equipped, took effect from February 2017 and has recently been extended to 2020.<sup>3</sup>

6.5 Aircraft fitted with ADS-B equipment can broadcast their position, velocity and identification information in real time. The committee heard that it may be possible to use ADS-B data to track unauthorised RPAS when flown into controlled airspace. Civil Air Australia explained:

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1 Australian Certified UAV Operators, *Submission 73*, pp. 36–38; Helistar, *Submission 23*, [p. 3]; Civil Air Australia, *Submission 21*, p. 3; Little Ripper Lifesaver, *Submission 16*, p. 3.

2 Airservices Australia, *How ADS-B works*, <http://www.airservicesaustralia.com/projects/ads-b/how-ads-b-works/> (accessed 24 October 2017).

3 Australian Certified UAV Operators, *Submission 73*, p. 36. Also see: Airservices Australia, *Surveillance Equipment Mandates*, <http://www.airservicesaustralia.com/projects/ads-b/other-mandates-2014-2017/> (accessed 1 February 2018).

The addition of ADS-B to RPAs conducting operations around busy aerodromes could enable [air traffic control operators] to more effectively monitor and/or apply separation between RPAs and manned aircraft. It could also provide another safety barrier for unauthorised RPAS in the form of a safety alert to manned aircraft (workload permitting).<sup>4</sup>

6.6 Rex recommended ADS-S receivers, a European mode transponder with greater air traffic control,<sup>5</sup> along with other measures:

Airborne collision avoidance systems (such as TCAS) have a proven risk control in the prevention of mid-air collision. Therefore if RPAS operations occupy the same airspace as commercial air transport operators then the fitment [sic] of transponder type equipment should be mandated. ADS-S transceivers that weigh less than 5000 gms are available to RPAS operators.<sup>6</sup>

6.7 The committee noted that all civil and military RPAS will soon be integrated into Australian airspace through the Civil Military Air Traffic Control Management Systems (CMATS). CMATS is the platform being delivered by the OneSKY program and is a joint initiative of Airservices Australia and Defence.

6.8 Defence advised that on the new platform, RPAS fitted with surveillance feeds, including radar and ADS-B, will be detected and integrated with manned aircraft. Therefore, the use of ADS-B technology will ensure that compliant RPAS can be safely integrated into the existing airspace management system.<sup>7</sup>

6.9 There are, however, a number of considerations with regards to fitting all RPAS with ADS-B technology. Mr Thomas McRobert of Civil Air Australia cautioned that transponders may cause issues on the air traffic management system whereby air traffic controllers' screens are at risk of 'being flooded' with ADS-B data. Whilst acknowledging that it may make the job of air traffic control simpler, he suggested that transponder-type detection for RPAS may only be viable for larger and commercial operations.<sup>8</sup>

6.10 CSIRO expressed concern that RPAS operating in close proximity to other radio transmitting systems and antennas present 'an ongoing safety risk' due to the potential interruption of command signals from the controller. It recommended that a dedicated frequency spectrum be developed for the command, control and payload

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4 Civil Air Australia, *Submission 21*, p. 3.

5 Airservices Australia, *Mode S transponders, ADS-B and VFR aircraft*, <http://www.airservicesaustralia.com/projects/ads-b/mode-s-transponders-ads-b-and-vfr-aircraft/> (accessed 6 March 2018).

6 Regional Express Airlines, *Submission 70*, p. 5. TCAS is a Traffic Collision Avoidance System.

7 Department of Defence, answers to written questions on notice, 22 March 2018, p. 6 (received 24 April 2018).

8 Mr Thomas McRobert, Civil Air Australia, *Committee Hansard*, 16 June 2017, pp. 22–23.

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communications systems of RPAS, supported by 'representative radiofrequency spectrum standards'.<sup>9</sup>

6.11 The committee was informed by Parrot ANZ that location data from its RPAS products is already accessible through an opt-in system. This allows the company to provide information to authorities when an RPAS breaches the regulations. Mr Chris Roberts, Managing Director of Parrot ANZ, explained that the system provides the company with insightful technical data:

We can look at various things, like speed of travel, GPS location, what the battery life was et cetera. So we can form a lot of technical statistics. It is formed out of technical data. But then of course we can overlay Google Maps onto it and all sorts of other things.<sup>10</sup>

### *Geo-fencing*

6.12 Another technology brought to the committee's attention was geo-fencing. Geo-fencing is a virtual barrier which can be used to prevent RPAS from entering restricted airspace. This barrier boundary is determined by a combination of hardware and software which outlines the parameters of the 'geo-fence'. The geo-fence can restrict the height and location of an RPAS flight by 'locking' its ability to enter or launch.

6.13 DJI and other manufacturers equip some RPAS with geo-fencing restrictions to ensure that they cannot fly within controlled airspaces or on restricted flight paths. RPAS that support geo-fencing regularly download databases from their manufacturers that delineate active no-go zones. If an RPAS flies toward a restricted area, its built-in GPS will sense the boundary, and the RPAS will stop mid-flight; if an operator tries to take off inside a restricted area, the RPAS won't start up at all.<sup>11</sup>

6.14 Mr Luke Gumley of CASA explained how the technology works:

For example, in the US, if you would like to be able to use a drone in an area that DJI considers perhaps you shouldn't, it will come up with an alert on your app saying you shouldn't fly here... In those zones, an alert will say, 'We don't think you should.' Then it requires you to go onto the DJI website, enter a credit card—that's a form of identification; it doesn't cost anything—and that's a way of verifying who you are. And then you'll get a licence, like a key, to be able to use the drone for a particular period of time.<sup>12</sup>

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9 CSIRO, *Submission 61*, [p. 3].

10 Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, p. 4.

11 Mr David Perks, Civil Air Australia, *Committee Hansard*, 16 June 2017, p. 24; DJI, *DJI GO App Now Includes GEO Geofencing System*, 5 July 2016, <https://www.dji.com/newsroom/news/dji-go-app-now-includes-geo-geofencing-system> (accessed 10 November 2017).

12 Mr Luke Gumley, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, p. 31.

6.15 The Australian Airports Association described geo-fencing capability and aircraft avoidance collision technology as 'the ultimate solution' for aviation safety.<sup>13</sup> They expressed support for the geo-fencing of all RPAS to prevent interference with passenger aircraft near airports.<sup>14</sup> The IALPG added that the mandatory imposition of technologies in the RPAS can prevent access to sensitive sites by way of inbuilt altitude, distance restrictions or collision avoidance technology.<sup>15</sup>

6.16 Other submitters suggested that geo-fencing could also be used to limit the distance an RPAS travelled from its user.<sup>16</sup> The point was made that geo-fencing could potentially thwart trespassing and privacy invasion by preventing access to private property.<sup>17</sup>

#### *Limitations of geo-fencing technology*

6.17 While geo-fencing, as a compliance measure, has many supporters, approximately half of the 910 respondents to CASA's RPAS review opposed geo-fencing for reasons including the additional cost to operators, and the burden placed on manufacturers.<sup>18</sup>

6.18 Mr Chris Roberts, Managing Director of Parrot ANZ also raised the issue of liability in the case of an inaccurate reading:

One concern we have with locking down specific areas is how accurate the technology is, because you are plus or minus perhaps 10, 15 or 20 metres. If we are geofencing an airport and we are plus or minus 10 or 20 metres in terms of the accuracy of pinpointing, who is then responsible should that product fly into that space? Is it us, the manufacturer, because it is a geofence technology? ...who then becomes responsible if you wander into other space?<sup>19</sup>

6.19 However, submitters' primary concern with geo-fencing appeared to be technology-based. Both CASA and Defence submitted that geo-fencing is not yet a fully reliable system, and still requires a comprehensive dataset to be developed.<sup>20</sup> CASA explained:

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13 Mr Simon Bourke, Australian Airports Association, *Committee Hansard*, 29 August 2017, p. 2.

14 Australian Airports Association, *Submission 12*, p. 3.

15 International Aerospace Law & Policy Group, *Submission 19*, p. 25.

16 ProUAV Australia, *Submission 20*, p. 1.

17 National Farmers Federation, *Submission 33*, [p. 2].

18 Civil Aviation Safety Authority, *Analysis of responses – Review of RPAS operations (DP1708OS)*, 1 December 2017, pp. 16–18.

19 Mr Chris Roberts, Parrot ANZ Pty Ltd, *Committee Hansard*, 16 June 2017, p. 13.

20 Civil Aviation Safety Authority, *Submission 17*, p. 15; Mr Shane Carmody, Civil Aviation Safety Authority, *Committee Hansard*, 29 August 2017, pp. 30–31; Department of Defence, answers to written questions on notice, 22 March 2018, p. 3.

The challenge with geo-fencing is that [it] is not utilised by all manufacturers, and it generally relies on some sort of database of geo-fenced areas. Airservices Australia provides standard data on airspace information in Australia, as well as some information on certain aerodromes; however, this is not designed for or necessarily fit for purpose for RPA manufacturers and often requires the manufacturer to overlay the data with additional information for it to be used for geo-fencing purposes. In addition, certain commercial RPA operation may be lawful at a particular location, but unlawful for a recreational RPA user, adding a layer of complexity to the administration of geo-fencing, especially if geo-fencing were to be made mandatory.<sup>21</sup>

6.20 Despite the challenges associated with geo-fencing technology, CASA advised the committee that it has commenced preliminary discussions with a senior DJI representative regarding the potential implementation of geo-fencing technology in Australia.<sup>22</sup> The committee further notes that DJI recently appointed a new head of policy, based in Canberra, for the purpose of consulting with CASA on RPAS regulation.<sup>23</sup>

6.21 CASA has also initiated discussions with Airservices Australia to consider development of the necessary datasets required to geo-fence RPAS in Australia.<sup>24</sup> In its review, CASA recommended changes 'to improve the suitability of Airservices Australia standard data for use by RPA manufacturers in applications such as geo-fencing'. However it noted that this presents an 'additional and sizeable body of work' for the air navigation service provider.<sup>25</sup> Dr Rob Weaver of Airservices Australia informed the committee of other initiatives underway:

We have recently entered into a memorandum of understanding with the Queensland University of Technology to develop a web based service for digital mapping depicting what we have termed RPAS fly zone information, and we're looking at what other ANSPs, air navigation service providers, around the world are doing to see if there's anything we can adopt or duplicate here in Australia.<sup>26</sup>

6.22 The cost of implementing geo-fencing technology was also raised throughout the inquiry. CASA cautioned that the implementation of geo-fencing capability in

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21 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 17.

22 Civil Aviation Safety Authority, answers to questions on notice, 29 August 2017, p. 3 (received 14 September 2017).

23 Jennifer Dudley-Nicholson, 'Droning on about air safety', *Daily Telegraph*, 25 January 2018, p. 21.

24 Civil Aviation Safety Authority, answers to questions on notice, 29 August 2017, p. 3.

25 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 18.

26 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 12.

RPAS of all sizes may amount to several thousand dollars. It further noted that certain geo-fencing options depend on ground-based elements which themselves involve additional costs.<sup>27</sup>

### *Collision avoidance systems*

6.23 Submitters suggested that airborne collision avoidance systems such as a traffic collision avoidance system (TCAS) may provide effective protections for aerodromes and controlled airspaces.<sup>28</sup> Also known as detect and avoid (DAA) or sense and avoid systems, Airservices Australia described the technology as the 'capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action'.<sup>29</sup>

6.24 These systems are increasingly recognised as critical to integrating unmanned aircraft into the national airspace. According to Airservices Australia, the installation of DAA systems would eventually allow RPAS to fully integrate into all airspace classes, in harmony with other airspace users.<sup>30</sup> This is particularly important in readying the aviation sector for BVLOS operations that are said to utilise the 'clear comparative advantages' of RPAS technology.<sup>31</sup>

6.25 CASA agreed that, while the restriction that a sub-2kg RPAS be in the visual line of sight of the operator currently negates the need for collision avoidance technology, such systems need to be explored. It informed the committee that minimum operational performance specifications for DAA are currently being developed by the Radio Technical Commission for Aeronautics, and the Joint Authorities for Rulemaking on Unmanned Systems (JARUS). These standards are likely to inform the development of international standards for DAA.<sup>32</sup>

6.26 In the US, Vigilant Aerospace completed a successful BVLOS flight test of its FlightHorizon DAA collision avoidance system for RPAS in early 2017. One report of the flights revealed that:

The flights tested the system's detect-and-avoid (DAA) algorithms, hardware integration and user interface performance and included nearly 100 scripted encounters between unmanned aircraft under realistic flight

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27 Civil Aviation Safety Authority, *Discussion paper: Review of RPAS operations (DP1708OS)*, August 2017, pp. 15–16.

28 See, for example: Australian Association for Unmanned Systems, *Submission 46*, p. 13; Airservices Australia, *Submission 29*, p. 26; Regional Express, *Submission 70*, p. 5; Intel, *Submission 31*, [p. 4].

29 Airservices Australia, *Submission 29*, p. 26.

30 Airservices Australia, *Submission 29*, p. 26.

31 Institute of Public Affairs, *Submission 56 – Attachment 1*, p. 12. Also see: Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 4.

32 Civil Aviation Safety Authority, *Submission 17*, p. 14.

conditions. The system successfully detected and tracked intruder aircraft and provided traffic alerts and collision warnings on 100 per cent of air traffic during the encounters.<sup>33</sup>

6.27 Intel told the committee that it had commenced development of collision avoidance technology for RPAS. According to Intel, its 'RealSense' application provides 'real time depth sensing capability for a flying UAS, and combined with GPS, altitude and other on-board sensors, can also avoid no-fly areas and comply with regulatory limits'.<sup>34</sup>

6.28 The use of a technology-based solution to ensure safe operation of RPAS received significant support from submitters. However, it is clear that before geo-fencing, collision avoidance systems, and transponder-type solutions can be introduced, a number of questions still need to be answered about how these systems can be effectively integrated into Australia's airspace. Consideration of the costs involved and the implications they might have for air traffic control should also be taken into account.

## **Airworthiness**

6.29 Underpinning many of the above technological solutions is the need for the development of clearly defined airworthiness standards. In the current regulatory environment, sub-2kg RPAS are exempt from airworthiness provisions provided in Parts 21 and 24 of the CASR, and Part 4 of the CAR.<sup>35</sup> A set of airworthiness standards would therefore clarify expectations about 'the continuum of specification, design, construction, operation and maintenance' of RPAS, and allow CASA to more effectively regulate imported and domestically-manufactured RPAS products.<sup>36</sup>

6.30 Whilst the majority of commercial aviation systems have in-built fail-safe redundancies to prevent technical errors, a 2016 report by RMIT University stated that RPAS laws have not kept pace with advances in safety technology.<sup>37</sup> As such, technical problems are the primary cause for RPAS accidents.<sup>38</sup> The RMIT study

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33 Caroline Rees, 'New Detect-and-Avoid System for Drones Completes BLOS Flight Tests', *Unmanned Systems Technology*, 30 January 2017, <http://www.unmannedsystemstechnology.com/2017/01/vigilant-aerospace-completes-blos-uas-testing-nasa-flight-research-center/> (accessed 31 January 2018).

34 Intel, *Submission 31*, [p. 3].

35 Australian Association for Unmanned Systems, *Submission 46*, p. 6; Airservices Australia, *Submission 29*, pp. 6, 23. Also see: Civil Aviation Safety Authority, *Discussion paper – UAS airworthiness framework (DP 1529US)*, June 2016, p. 9.

36 International Aerospace Law & Policy Group, *Submission 19*, p. 11.

37 Maurice Blackburn Lawyers, *Submission 22*, p. 2. Also see: Louise Handran, 'Tech issues cause most drone accidents: research', *RMIT University*, 5 September 2016, <https://www.rmit.edu.au/news/all-news/2016/september/tech-issues-cause-most-drone-accidents--research> (accessed 21 February 2018).

38 Maurice Blackburn Lawyers, *Submission 22*, p. 2.

revealed that 64 per cent of RPAS incidents between 2006 and 2016 were caused by broken communication links between an RPAS and its controller, and other technical problems.<sup>39</sup> Helistar Aviation stated that RPAS are also known to fly away and crash uncontrolled due to substandard or untested software. It submitted:

Just as modern computers often 'hang' or become unresponsive, so do the operating systems of RPAs. RPA software is often 'open-source' and not tested to the level of other aviation-related software. These 'fly-aways' can breach the 30m from people and not above 400' rules as the aircraft are not under the pilot's control. The RPA hardware has not undergone significant testing and malfunctions are common. Mean time between failure of the electric motors is not known and software is potentially 'open-source' with many 'bugs'.<sup>40</sup>

6.31 In line with the approach taken by Parrot ANZ, witnesses argued that manufacturers must play a role in ensuring RPAS technology can be used safely, whether for commercial use or otherwise. Mr Tim Nolan of Aeromodellers New South Wales suggested that this would require legislation. He proposed to the committee:

Let's work on the drone manufacturers—if they want to sell the product, that is not a problem—but it has a range of X and it has a hard ceiling of 500 feet or whatever requirements are set, so that you force that down to a set limit.<sup>41</sup>

6.32 Submitters and witnesses were of the view that safeguards such as 'return to home' functionality, or forced flight termination should be required at a minimum.<sup>42</sup> The introduction of commercial aircraft-type regulations to standardise communications systems could also be considered.<sup>43</sup> RPAS fitted with these mechanisms could then be issued a certificate of airworthiness, similar to manned aircraft.<sup>44</sup>

6.33 The committee heard that, without prescribed standards of airworthiness, the majority of RPAS being flown in Australia remain unchecked for quality assurance and safety. CSIRO summarised the situation:

Unfortunately, we continue to live in absence of airworthiness standards, certification requirements and the prescription of safety systems. Presently

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39 Graham Wild, Glenn Baxter and John Murray, 'Exploring drone accidents and incidents to help prevent potential air disasters', *Aerospace*, vol. 3, no. 3, 2016, pp. 1–11.

40 Helistar Aviation, *Submission 23*, [p. 2].

41 Mr Tim Nolan, Aeromodellers New South Wales, *Committee Hansard*, 26 June 2017, p. 27.

42 Australian Association for Unmanned Systems, *Submission 46*, p. 13; Mr Edward Browning, *Submission 10*, [p. 2].

43 Graham Wild, Glenn Baxter and John Murray, 'Exploring drone accidents and incidents to help prevent potential air disasters', *Aerospace*, vol. 3, no. 3, 2016, pp. 1–11.

44 Helistar Aviation, *Submission 23*, [p. 4].

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the risk mitigation relies on operational safety controls such as operator and crew licencing together with operational limitations.<sup>45</sup>

6.34 CASA asserted that it is currently investigating the merits of adopting appropriate airworthiness framework models that are being developed by other aviation authorities.<sup>46</sup> Indeed, CASA's 2016 discussion paper, titled *UAS airworthiness framework*, proposes the development of a suitable airworthiness framework through JARUS and the European Aviation Safety Agency (EASA).<sup>47</sup>

6.35 According to CASA, the discussion paper attracted approximately 70 comments in total, with proposals generally supported by the industry. Whilst it is expected that the UASSC (now part of the Aviation Safety Advisory Panel) and its working groups will report further on this process, the committee is yet to receive any indication that CASA is progressing airworthiness standards for RPA.

6.36 Further, the AAUS stated that the standards to be developed by JARUS and EASA are not likely to include small and very small RPAS. As such, they argued that the development of airworthiness regulations 'should be a priority for CASA'.<sup>48</sup>

### ***Import controls***

6.37 Nationally consistent airworthiness standards would also need to take into account RPAS that enter the country through foreign imports. Indeed, evidence provided to the committee indicated that a large majority of sub-2kg RPAS in Australia arrive from overseas manufacturers, with the exception of those assembled from parts by hobbyists.<sup>49</sup> However the IALPG noted that, despite being capable of causing significant harm, RPAS are neither subject to import controls nor restrictions, allowing them to be brought into the country through ordinary passenger baggage or through mail and cargo services.<sup>50</sup>

6.38 Witnesses urged the committee to give consideration to the implementation of import restrictions, akin to those currently applicable to laser pointers or model rockets.<sup>51</sup> According to the University of Adelaide, RPAS could be regulated at the border through the *Customs Act 1901*. An importation regime would enforce national

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45 CSIRO, *Submission 61*, [p. 4].

46 Civil Aviation Safety Authority, *Submission 17*, pp. 10–11.

47 Civil Aviation Safety Authority, *DP 1529US – UAS airworthiness framework*, <https://www.casa.gov.au/standard-page/dp-1529us-uas-airworthiness-framework> (accessed 12 November 2017).

48 Australian Association for Unmanned Systems, *Submission 46*, p. 9.

49 International Aerospace Law & Policy Group, *Submission 19*, p. 11.

50 See, for example: Qantas Group, *Submission 34*, p. 2; Australia Post, *Submission 30*, p. 3; International Aerospace Law & Policy Group, *Submission 19*, p. 11.

51 International Aerospace Law & Policy Group, *Submission 19*, p. 11. Also see: Qantas Group, *Submission 34*, p. 2.

airworthiness standards, and prevent unreliable or untested units from entering the Australian market.<sup>52</sup>

6.39 The committee sought the advice of the relevant government departments that may be in a position to implement such measures. In response, the Department of Home Affairs (DHA)<sup>53</sup> noted that import controls typically rely on an import permit regime, sponsored by a policy agency.<sup>54</sup> However, as RPAS are not currently 'prescribed in that way' nor 'prohibited', no such permit regime is under way.<sup>55</sup>

6.40 Mr Jim Williams, Assistant Commissioner of the Border Management Division, further advised the committee that the development of new capability to identify RPAS of concern would be 'a quite substantial undertaking' due to the range of goods potentially affected by such a control.<sup>56</sup> DHA stated that an import control on RPAS 'would be unlike any other we are responsible for enforcing at our border' and would therefore depend on the establishment of 'a nationwide capability' to examine the firmware and technical attributes of incoming RPAS.<sup>57</sup>

6.41 Despite the complexities associated with implementing technological compliance mechanisms, submitters were adamant that RPAS manufacturers should take greater responsibility for contributing to a safe aviation environment. Mr Joseph Wheeler of the IALPG summarised the need for technology-based solutions:

Technologies like geofencing must be the subject of legislative airworthiness type restrictions on drone manufacturers to ensure that aircraft do not breach airspace they should not, but also to allow the regulator to implement monitoring to help them take corrective action. And why? Because it is irresponsible to let amateurs and children loose with powerful vehicles with no guidance other than to 'follow the rules'. Many do not appreciate the implications of breaching the rules—if they even know them or know where to find them. Regulating manufacturers allows for the preservation of compliance with the standard operating conditions. That cannot be guaranteed when left to those who are untrained in aviation.

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52 Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 5.

53 The Department of Home Affairs (DHA) was formerly known as the Department of Immigration and Border Protection. Whilst evidence provided by DHA is submitted under its former designation, the committee has chosen to identify DHA by its new title for the purpose of consistency.

54 As an example, the Department of Health administers import permits for medicines, and the Australia Border Force ensures the control is enforced at the border. See: Mr Andrew Chandler, Department of Home Affairs, *Committee Hansard*, 17 October 2017, p. 2.

55 Mr Jim Williams, Department of Home Affairs, *Committee Hansard*, 17 October 2017, p. 4. Also see: Department of Home Affairs, answers to questions on notice, 17 October 2017, [p. 1] (received 9 November 2017).

56 Mr Jim Williams, Department of Home Affairs, *Committee Hansard*, 17 October 2017, p. 6.

57 Department of Home Affairs, answers to questions on notice, 17 October 2017, [pp. 2–3].

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This approach has kept aviation safe and it should do the same for RPAS and drones.<sup>58</sup>

### **Air traffic control**

6.42 As well as the technology-based compliance mechanisms applicable to RPAS design, witnesses and submitters also drew attention to the technological possibilities within the aviation system as a whole, specifically with regard to air traffic density and management.

6.43 The Asia-Pacific RPAS Consortium raised the matter of 'equivalence' whereby RPAS, now and into the future, will have to co-exist with manned aircraft in a changing air traffic management environment.<sup>59</sup>

6.44 As there is no existing framework in place to assist air traffic control operators (ATCO) in mitigating risks created by RPAS, it is up to ATCOs on duty to use their discretion in determining the level of risk. Civil Air Australia's President, Mr Thomas McRobert explained:

We have to assess if there is a hazardous risk to the rest of the aircraft and make a decision on best judgement. There is no actual rule set to say that if there is a risk on final for an airport I have to do something. It is incumbent on me to assess that risk and then decide appropriately...There is no real rule set on how we deal with an offending unauthorised operator.<sup>60</sup>

6.45 Particular concerns were raised in relation to the busy airspace around major cities, such as the Sydney basin. It is in busy airspace that Civil Air Australia recognised 'the highest likelihood of a RPAS colliding with a manned aircraft'. It submitted that a valid method of mitigating the risk of a collision is to limit and/or regulate the number of RPAS operations in such airspaces. For this reason, it suggested that only commercial operations be permitted.<sup>61</sup>

### ***Unmanned Traffic Management***

6.46 An alternative presented to the committee was the development of an unmanned traffic management system (UTM) to ensure RPAS and aircraft could effectively operate in the same airspace. UTM technology is currently being explored by many US, European, and Australian organisations, including NASA, CSIRO,

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58 Mr Joseph Wheeler, International Aerospace Law & Policy Group, *Committee Hansard*, 28 June 2017, p. 26.

59 Asia-Pacific RPAS Consortium, *Submission 68*, pp. 7–8.

60 Mr Thomas McRobert, Civil Air Australia, *Committee Hansard*, 16 June 2017, p. 21.

61 Civil Air Australia, *Submission 21*, p. 2.

Verizon, Google and Amazon.<sup>62</sup> According to Mr Joseph Urli from Australian Certified UAV Operators, a UTM system has the potential to create certified 'corridors' whereby RPAS can operate on a number of flight levels or defined routes between points. This technology would be most useful to freight and commercial stakeholders to facilitate deliveries and communications.<sup>63</sup>

6.47 Whilst a number of witnesses, including Airservices Australia, were of the view that UTM technology is not yet adequately developed for use, many expressed the hope that the Australian government's investment in the OneSKY CMATS platform would 'provide the right level of connectivity' and a 'stronger interface capability such that we can work with RPAS manufacturers and people who are starting to talk about UAS traffic management—drone traffic management outside controlled airspace'.<sup>64</sup> As a major UAS operator, Defence added that it would 'be a stakeholder' in the development of an Australian UTM system.<sup>65</sup>

6.48 While Australia embarks on further research on UTM architecture, there are initiatives underway overseas that can be monitored. Launched in December 2016, a four-year research program jointly conducted by the Civil Aviation Authority of Singapore and Nanyang Technological University aims to explore features such as designated air corridors for RPAS, no-fly zones, DAA systems, and ground coordination stations.<sup>66</sup> The Singapore Ministry of Transport noted that the project is now at an advanced stage of development and will soon trial the use of delivery drones and drone stations.<sup>67</sup>

6.49 To ensure Australia keeps pace with UTM developments in other jurisdictions, the Australian Certified UAV Operators made the following recommendation:

That the Federal Department of Infrastructure and Regional Development be tasked with conducting a national unmanned traffic management (UTM) requirements scoping study with this to be conducted as a joint government and industry initiative, including participation by Airservices Australia,

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62 Telstra, *Submission 36*, p. 4. NASA refers to the National Aeronautics and Space Administration in the United States. CSIRO refers to the Australian Commonwealth Scientific and Industrial Research Organisation.

63 Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 11.

64 Dr Rob Weaver, Airservices Australia, *Committee Hansard*, 29 August 2017, p. 17. Also see: Dr Terrence Martin, Queensland University of Technology, *Committee Hansard*, 28 June 2017, p. 40; Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 11.

65 Department of Defence, answers to written questions on notice, 22 March 2018, p. 6.

66 Australian Certified UAV Operators, *Submission 73*, pp. 34–36.

67 Karamjit Kaur, 'Five projects to kick off unmanned aircraft system trials at Singapore's first drone estate', *The Straits Times*, 7 February 2018, <https://www.straitstimes.com/singapore/transport/five-projects-to-kick-off-unmanned-aircraft-system-trials-at-singapores-first> (accessed 2 May 2018).

CASA, commercial RPAS operators, RPAS manufacturers, and commercial information technology and communications sector companies. That the study be launched by July 2017 and be specifically tasked with examining how to launch a national UTM test-bed project based on performing extended courier RPAS services in a state capital city by the end of 2018 [calendar year].<sup>68</sup>

6.50 The integration of RPAS into Australian airspace requires a balance between effective enforcement measures, such as sufficient penalties, registration and restricted flight zones, with that of technology-based solutions including geo-fencing, ADS-B and UTM. Any such enforcement and compliance measures would contribute to a culture of safety amongst the aviation community whilst also paving the way for future initiatives including BVLOS operations.

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68 Australian Certified UAV Operators, *Submission 73*, p. 36.



## Part III

### Chapter 7

#### **A comprehensive approach to RPAS safety**

7.1 The preceding chapters of this report provided an overview of the issues and concerns raised in evidence about the current regulatory environment, and some possible improvements. This chapter considers the evidence presented in support of a comprehensive, integrated approach for RPAS safety regulation and considers some of the key elements and structures required to achieve such an approach.

7.2 The committee heard that a number of additional regulatory measures are required to ensure RPAS, and RPAS operators, are appropriately integrated into the Australian aviation system. As well as the implementation of a mandatory registration regime, submitters suggested that RPAS operators be required to demonstrate basic competence by completing an online education and training package, and that stronger enforcement measures be implemented.<sup>1</sup>

7.3 In addition to these measures, and in light of the range of issues arising in relation to RPAS including privacy, import controls, local, state and federal regulations and enforcement mechanisms, the committee heard that a holistic policy approach to RPAS is now required.

7.4 Mr Joseph Wheeler of IALPG explained:

This is needed, given the cut-through of issues that drones raise. Air safety is but one of them. There are import controls, security, including national security, privacy, insurance and liability, and international obligations of Australia as a party to the Chicago Convention. There are state, federal and local level enforcement options and questions that need to be addressed and should be addressed in any new fresh rethink or policy framework when we go back to a clean slate.<sup>2</sup>

7.5 As a first step, the committee considered the need for a whole of government approach to RPAS.

#### **Whole of government approach**

7.6 The Australian Government, through the Minister for Infrastructure and Transport, sets the direction for overall aviation policy. As part of Australia's Aviation State Safety Programme, the Aviation Policy Group meets quarterly and is chaired by the Secretary of DIRDC. It comprises the key agencies involved in aviation policy,

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1 See Chapters 4 to 6 for further detail.

2 Mr Joseph Wheeler, International Aerospace Law & Policy Group, *Committee Hansard*, 28 June 2017, pp. 26–27.

regulation and service provision – DIRDC, CASA, Airservices Australia and the Department of Defence represented by the Royal Australian Air Force.<sup>3</sup>

7.7 Many submitters were not aware of the work of the Aviation Policy Group. Others suggested that it was time to bring other relevant government departments and agencies together to discuss aviation and RPAS matters.<sup>4</sup> Noting that RPAS intersect with many areas beyond traditional aviation to encompass issues such as privacy, importation, education and technology, evidence to the inquiry supported an approach which incorporated all aspects of RPAS safety.

7.8 The need for engagement across a wider range of federal agencies was contemplated as a way to achieve this, and as a means of ensuring greater coordination and communication between such agencies.

7.9 When asked to envision how a whole of government response to RPAS might be achieved, DIRDC noted the range of policy matters and agencies that would need to be incorporated. These include:

- DIRDC which has policy responsibility for aviation, including trade and travel activities regulated through the Office of Transport Security;
- the Attorney-General's Department which has policy responsibility for administration of the *Privacy Act 1988* and issues of criminality and national security;
- the Department of Home Affairs which enforces border controls including the import and export of goods such as RPAS technology;
- CASA which undertakes enforcement and investigation activities in relation to breaches of aviation safety legislation;
- the Department of Industry, Innovation and Science which supports science and commercialisation of new ideas and technology; and
- the Department of Prime Minister and Cabinet, the Department of Finance and the Treasury which provide advice on funding and consumer protection.<sup>5</sup>

7.10 In addition, the Department of Defence notified the committee of its role in regulating military aircraft and of a requirement to consult with CASA regarding the operation of Defence drones in civilian airspace.<sup>6</sup>

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3 Department of Infrastructure, Regional Development and Cities, *Australia's State Aviation Safety Programme*, [https://infrastructure.gov.au/aviation/safety/ssp/chapter\\_1.2.aspx](https://infrastructure.gov.au/aviation/safety/ssp/chapter_1.2.aspx) (accessed 5 February 2018). The ATSB does not have membership to the group, as it has independent status as a safety investigator. However, the ATSB Chief Commissioner may at times participate in briefings.

4 See, for example: Asia-Pacific RPAS Consortium, *Submission 68*, p. 18; Australian Strategic Air Traffic Management Group, *Submission 57*, [p. 1]; Mr Joseph Wheeler, International Aerospace Law & Policy Group, *Committee Hansard*, 28 June 2017, pp. 26–27.

5 Department of Infrastructure, Regional Development and Cities, answers to questions on notice, 17 October 2017, pp. 3–4 (received 7 November 2017).

7.11 To draw federal government agencies and departments together, DIRDC advised:

Our Department would...provide an overarching, facilitation role to ensure a coordinated, whole-of-Government response on RP AS policy issues and work with representatives from each relevant Department and agency to consider the safety, security, privacy and any other issues raised to progress the Government's agreed policy approach to any future RPAS controls.<sup>7</sup>

7.12 While the means by which whole of government coordination should occur was a matter of debate amongst submitters, it was clear that there was common agreement on the need for wider and more cohesive engagement.

### **Consultation beyond the aviation sector**

7.13 Along with a whole of government approach, evidence to the committee highlighted the need for a forum which provides for broad consultation and engagement beyond the traditional aviation sector, to directly inform RPAS policy and management.

7.14 The Asia-Pacific RPAS Consortium described the need for 'collective and harmonised dialogue' to ensure RPAS can be effectively and seamlessly integrated into the aviation system.<sup>8</sup>

7.15 The Australian Strategic Air Traffic Management Group (ASTRA) made the point that, as interest in RPAS grows, the sector will increasingly comprise of 'non-aviation stakeholders who do not see themselves as part of the 'traditional' aviation industry'.<sup>9</sup> Engagement with these important stakeholders may therefore extend beyond CASA's aviation regulation role, and outside of the ATSB's investigative remit. ASTRA explained:

The Civil Aviation Safety Authority's (CASA) involvement in the regulation of the RPAS sector is vital, however CASA is not a law enforcement agency in the traditional sense. Similarly, the Australian Transport Safety Bureau's (ATSB) remit does not extend to monitoring and investigating all unsafe or unlawful RPAS scenarios. Both organisational structures remain premised upon traditional airspace users, now factoring extensive growth in RPAS.<sup>10</sup>

7.16 As noted in Chapter 2, CASA's primary consultation forum is the UASSC, now part of the Aviation Safety Advisory Panel (ASAP).<sup>11</sup> Its rotating membership

6 Department of Defence, *Submission 44*, pp. 3–4.

7 Department of Infrastructure, Regional Development and Cities, answers to questions on notice, 17 October 2017, p. 1.

8 Asia-Pacific RPAS Consortium, *Submission 68*, p. 18.

9 Australian Strategic Air Traffic Management Group, *Submission 57*, [p. 1].

10 Australian Strategic Air Traffic Management Group, *Submission 57*, [p. 1].

11 Membership of the UASSC was changed on 1 July 2017. The UASSC, along with a number of other sub-committees was subsumed into the ASAP in September 2017.

includes representatives from the aviation community who advise on current, emerging and potential issues that impact on aviation safety.<sup>12</sup> However, inquiry participants presented mixed views on whether the UASSC had been effective in facilitating appropriate and timely changes to RPAS regulations.

7.17 Whilst acknowledging the existence of CASA's UASSC, Telstra suggested that a new forum such as a working group, with a clearly defined terms of reference and timetable, 'is likely to be a more effective approach' for delivering future regulatory reforms. Telstra described a number of areas the working group could explore:

The Terms of Reference (ToR) could request a report on the regulations, technology and [UAS traffic management system] standards, and educational resources that will be required to enable the widespread and safe use of drones in the future through the use of smart drone technologies, mobile networks and drone traffic management systems. The new framework should include specific consideration of operations involving BVLOS, multiple drones per operator, and night flying.<sup>13</sup>

7.18 Qantas, a current member of the ASAP, noted that '[w]hile the existing consultation measures have been effective, it may now be beneficial to broaden the focus to take account of evolving trends in device usage'. Qantas suggested that input be sought from RPAS operators, airlines, the general aviation sector, aircraft and engine manufacturers, Airservices Australia, ATSB, state, territory and local governments and other relevant agencies.<sup>14</sup>

### **Cost-effective solutions**

7.19 As the regulator, CASA would need to play a central role in the development of any registration, education and compliance requirements for RPAS users. However, submitters were of the view that an already resource-stretched CASA does not have the means to drive the comprehensive regulatory approach required for the growing number of RPAS in Australian airspace.<sup>15</sup>

7.20 Piper Alderman stated that there is industry-wide concern that CASA's enforcement capabilities are limited 'due to lack of resources and the practicalities of monitoring RPA use'.<sup>16</sup> Another submitter claimed that it is 'crazy' for CASA to have regulatory authority over RPAS operations, due to being 'woefully understaffed'.<sup>17</sup>

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12 Civil Aviation Safety Authority, *Aviation Safety Advisory Panel*, <https://www.casa.gov.au/rules-and-regulations/standard-page/aviation-safety-advisory-panel> (accessed 11 January 2017).

13 Telstra, *Submission 36*, p. 5.

14 Qantas Group, *Submission 34*, p. 5.

15 See, for example: Piper Alderman, *Submission 65*, pp. 3–4; Helistar Aviation, *Submission 23*, [pp. 5–6]; Model Aeronautical Association of Australia, *Submission 50*, p. 5; Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 15; Australian Association for Unmanned Systems, *Submission 46*, p. 5.

16 Piper Alderman, *Submission 65*, pp. 3–4.

17 Mr Chris Bird, *Submission 52*, [p. 4].

7.21 Many went as far as to suggest that resourcing restrictions have hampered CASA's ability to maintain adequate oversight of an industry as dynamic and fast-moving as that of RPAS.<sup>18</sup> The Unmanned Research Aircraft Facility at the University of Adelaide provided an example:

For instance, the current *Regulations* anticipate the issue of a *Manual of Standards* to provide clarification and certainty on a range of operational dos and don'ts. The Manual has yet to be issued. It can only be assumed that the resources to complete the task are not available.<sup>19</sup>

7.22 Although many witnesses expressed concern that CASA is not adequately resourced to effectively manage the increasing number of RPAS in Australian skies, others questioned whether it was the role of CASA to do so.

7.23 Mr Joseph Urli of the Australian Certified UAV Operators noted that CASA's resources are primarily occupied with 'processing applications rather than being out in the field and policing the industry as such'.<sup>20</sup>

7.24 Captain John Lyons of VIPA put forward the view that it was becoming increasingly difficult for CASA to enforce the regulations given the ever-growing number of amateur and commercial operators across the country:

CASA is woefully understaffed and under-resourced when it comes to any form of enforcement. Three or four years ago, when there were 30 or 40, maybe 50, licensed operators, it was containable and they carried out safety audits.<sup>21</sup>

7.25 Mr Bradley Mason of Australian Certified UAV Operators added:

CASA just does not have the resources, and I do not think that we are ever going to be able to resource CASA alone to be able to do that. They are the boots on the ground. They are the people out there daily who are encountering this sort of thing.<sup>22</sup>

7.26 The IALPG stated that critics of the regulator should take 'a closer look at resources and styles of enforcement by CASA', adding that safety concerns regarding RPAS use are 'no criticism of CASA, whose role and resources cannot allow officers to be everywhere'.<sup>23</sup> Instead, Mr Joseph Wheeler, Principal and Managing Partner of

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18 See, for example: Captain John Lyons, Virgin Independent Pilots Association, *Committee Hansard*, 28 June 2017, p. 5; Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 7; Mr Chris Bird, *Submission 52*, [p. 3].

19 Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 7. Italicised in original text.

20 Mr Joseph Urli, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 15.

21 Captain John Lyons, Virgin Independent Pilots Association, *Committee Hansard*, 28 June 2017, p. 5.

22 Mr Bradley Mason, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 15.

23 International Aerospace Law & Policy Group, *Submission 19*, pp. 17–18.

the IALPG suggested that enforcing RPAS safety needs to 'start at the top', with greater cooperation and 'information sharing' amongst relevant authorities.<sup>24</sup>

7.27 A number of submitters argued that resourcing decisions should be considered within the whole of government approach to RPAS safety, recognising that some aspects of RPAS safety are beyond CASA's legal remit.<sup>25</sup> Additionally, funding models such as the US registration fee for operators, and club-based education programs such as the 'wings' program, should be explored as cost-effective solutions to support RPAS regulation.

### **Regulatory consistency**

7.28 The committee was informed that the implementation of reforms already outlined in this chapter would contribute to a more consistent national policy framework for RPAS operations in Australia. However, the need to address regulatory inconsistencies across local and federal RPAS laws remains an ongoing concern.

7.29 Alongside federal RPAS regulations, the committee was made aware of the growing number of RPAS restrictions being put in place by local councils. In December 2017, the Casey Council in Victoria introduced a scheme which requires RPAS operators to obtain a permit before operating outside their own property, or risk a \$300 fine.<sup>26</sup> In Ballarat, a similar permit-scheme is in place, banning both commercial and recreational RPAS operators from flying over municipal land and roads without express permission.<sup>27</sup>

7.30 In addition to both local government and federal regulations regarding RPAS, there are a range of other issues which intersect with RPAS, such as privacy, for which both state and federal legislation applies. Recognising the expanding assembly of stakeholders involved in the regulation of RPAS, the AAUS argued that the federal government needs to ensure regulatory consistency across jurisdictions. It explained:

The confusing and disparate landscape of regulations has a significant impact on the commercial RPAS industry; imposing additional regulatory burden or preventing operations from taking place altogether. This situation

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24 Mr Joseph Wheeler, International Aerospace Law & Policy Group, *Committee Hansard*, 28 June 2017, p. 31.

25 See, for example: Civil Aviation Safety Authority, *Submission 17*, p. i.; Unmanned Research Aircraft Facility, University of Adelaide, *Submission 43*, p. 7; Dr Chris Thompson, *Submission 81*, [p. 6].

26 Megan Bailey, 'Drone users face Casey Council crackdown with new law aimed at nuisance operators', *Herald Sun*, 8 December 2017, <http://www.heraldsun.com.au/leader/south-east/drone-users-face-casey-council-crackdown-with-new-law-aimed-at-nuisance-operators/news-story/e0dee152db2a6094531feb8ac6d51fac> (accessed 8 December 2017).

27 Jeremy Venosta, 'Drone ban: Ballarat City Council changes laws', *The Courier*, 14 December 2017, <http://www.thecourier.com.au/story/5121648/flyers-determined-to-battle-new-council-drone-regulations/> (accessed 15 December 2017). Also see: Jeremy Venosta, 'Drone laws: councils urged to reconsider', *The Courier*, 17 December 2017, <http://www.thecourier.com.au/story/5124653/peak-body-for-drones-slams-laws-banning-hobby-businesses/> (accessed 19 December 2017).

is expected to worsen as more State and Local Governments begin to address the proliferation of drones in their jurisdictions.<sup>28</sup>

7.31 Whilst acknowledging the 'significant legal difficulties' in consolidating each piece of legislation and regulation relating to RPAS, Piper Alderman stated:

...we believe there should be at least some combined effort on the part of the Commonwealth, States and Territories to: (i) harmonise the various applicable regulations to the maximum extent possible and, at the very least, to the extent of any overlap; and (ii) prepare a comprehensive information package to be provided with every RPA sale...<sup>29</sup>

7.32 A number of submitters advocated for the involvement of the Australian Local Government Association as an appropriate first step to begin addressing the issue.<sup>30</sup>

7.33 The NSW Government suggested that the regulation of RPAS be referred to the Transport Infrastructure Council for 'proper consideration and potential regulatory reform'.<sup>31</sup> Chaired by the Commonwealth, the Transport and Infrastructure Council was established in December 2013 following an agreement by the Council of Australian Governments to focus on nationally significant reforms. It consists of members from each Australian state and territory, as well as a number of New Zealand representatives.<sup>32</sup> According to the NSW Government, the Council could help facilitate the adoption of a nationally consistent approach across all Australian jurisdictions.<sup>33</sup>

### ***Privacy and surveillance***

7.34 Privacy is one area governed by legislation at both a federal and state level. Privacy matters become even more complex when related to RPAS. It is a significant issue given the intrusive potential of RPAS equipped with cameras and surveillance capability, which are now readily available to the public.

7.35 Australia's privacy regime comprises a range of Commonwealth, state and territory statutes and common law principles. The *Privacy Act 1988* sets out 13 privacy principles which govern how organisations should collect, manage and disclose information. These principles extend to information collected by governments and large businesses. However, the privacy principles do not apply to individuals.<sup>34</sup>

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28 Australian Association for Unmanned Systems, *Submission 46*, p. 8.

29 Piper Alderman, *Submission 65*, p. 3.

30 Australian Association for Unmanned Systems, *Submission 46*, p. 8. Also see: Qantas Group, *Submission 34*, p. 2.

31 NSW Government, *Submission 69*, [p. 1].

32 Department of Infrastructure, Regional Development and Cities, *Transport and Infrastructure Council*, <http://transportinfrastructurecouncil.gov.au/> (accessed 8 November 2017).

33 NSW Government, *Submission 69*, [p. 1].

34 House of Representatives Standing Committee on Social Policy and Legal Affairs, *Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy*, July 2014, pp. 34–35.

7.36 Professor Des Butler noted that there is not a uniform approach to privacy laws as they apply to individuals. It is therefore difficult for RPAS operators to establish whether they are operating within the law or not. Professor Butler continued:

In the absence of a specific common law or statutory cause of action protecting personal privacy, [there exists] a piecemeal collection of common law causes of action such as trespass, private nuisance and breach of confidence, all of which have limitations which mean that they do not provide complete protection against invasions of privacy.<sup>35</sup>

7.37 Due to legislative inconsistency across jurisdictions, RPAS operators, particularly recreational users, are less likely to be aware of the specific circumstances in which their use of an RPAS may breach someone's privacy. At the same time, those that have their privacy invaded by a flying RPAS may find it difficult to take action. The AAUS submitted that state-based privacy laws are therefore in need of reform.<sup>36</sup>

7.38 Along with privacy legislation, surveillance devices legislation, which governs the use of optical surveillance devices and data surveillance tracking devices, has been enacted in five jurisdictions – New South Wales, Victoria, Western Australia, South Australia and the Northern Territory. Yet, these laws create further confusion about the permissible use of RPAS.

7.39 The 2014 House of Representatives report titled *Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy* made a recommendation with regard to the harmonisation of surveillance laws. It recommended that, at a 2014 meeting of the Council of Australian Governments' Law, Crime and Community Safety Council:

...the Australian Government initiate action to simplify Australia's privacy regime by introducing harmonised Australia-wide surveillance laws that cover the use of:

- listening devices
- optical surveillance devices
- data surveillance devices, and
- tracking devices'.<sup>37</sup>

7.40 In response, the Australian Government stated that it is 'appropriate that states and territories continue to modify their own surveillance device laws, if necessary'. It argued that the *Surveillance Devices Act 2004 (Cth)* strikes 'an appropriate balance between the protection of privacy and the ability to investigate serious offences'. The

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35 Professor Des Butler, *Submission 18*, p. 3.

36 Australian Association for Unmanned Systems, *Submission 46*, pp. 11–12; Liberty Victoria & Australian Association for Unmanned Systems, *The Use of Drones in Australia: An agenda for reform*, May 2015, p. 3.

37 House of Representatives Standing Committee on Social Policy and Legal Affairs, *Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy*, July 2014, p. 48.

government committed to 'monitor developments in RPAS usage' to ensure protections were provided at the Commonwealth level.<sup>38</sup>

7.41 The lack of national consistency with regard to state and federal privacy and surveillance legislation, coupled with the growth of local council by-laws relating to RPAS operations, has made compliance for RPAS operators extremely challenging. The view was put to the committee that, as part of a comprehensive approach to RPAS regulation, consideration should be given to harmonising legislation relevant to RPAS across state and federal jurisdictions. A whole of government approach should also encompass the range of policy matters and agencies that intersect with RPAS operations.

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38 Australian Government, *Australian Government response to the Standing Committee on Social Policy and Legal Affairs Report – Eyes in the Sky: Inquiry into drones and the regulation of air safety and privacy*, December 2016, p. 9.



# Chapter 8

## Committee view and recommendations

8.1 The advent and advance of RPAS technology presents a wealth of opportunities for the Australian community, and worldwide. The growth of commercial, scientific and security applications has facilitated the innovative use of RPAS in agriculture, mining, emergency services, medicine and across a range of industries. However, the proliferation of RPAS in Australia also presents a series of challenges, particularly to public and aviation safety, which require immediate address.

8.2 Of particular concern to the committee is the growing number of RPAS falling within the 'excluded' category of Part 101 of the CASR, including those used for recreational purposes and weighing less than 2kg. Contrary to CASA's assessment that these RPAS are 'lower risk',<sup>1</sup> the committee considers that even small RPA weighing less than 2kg are capable of causing damage to rotorcraft, aircraft, people and property. This concern was borne out of research conducted by the ATSB, UK Department for Transport, and the US FAA.<sup>2</sup>

8.3 Whilst it is apparent that the implementation of a blanket ban on the use of RPA would immediately 'eliminate the risks that are posed by untrained and unqualified drone operators',<sup>3</sup> the committee acknowledges that such an approach would not provide a constructive, practical solution to the issue. Such a ban would seriously jeopardise investment, innovation and advancement of RPAS technology in industries and sectors such as emergency services and agriculture.

8.4 The committee therefore recommends a series of measures to enhance public safety without stifling the myriad of innovative applications for RPAS technology. As a first step, reforms to Part 101 should be made in line with the evidence available about RPAS collision and risk. Following this, the committee recommends the introduction of a mandatory registration regime and education program for RPAS operators, combined with 'off-the-shelf' limitations on RPAS range and altitude, before exploring further initiatives such as airspace restriction and airworthiness standards. The committee strongly suggests the adoption of a whole of government policy approach, within which all RPAS-related measures can be considered. As the RPAS sector continues to transform and grow, ongoing evaluation and review of these measures will be required.

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1 Explanatory statement, Civil Aviation Legislation Amendment (Part 101) Regulation 2016, p. 1.

2 See Chapter 3.

3 Dr Jonathan Aleck, Civil Aviation Safety Authority, *Budget Estimates Hansard*, 23 May 2017, p. 109.

## Evidence-based regulatory reform

8.5 Throughout the inquiry, the committee was repeatedly informed that the September 2016 amendments to Part 101 of the CASR were not supported by sufficient evidence and that they are out of step with the regulations imposed by many of CASA's international counterparts. The committee is firmly of the view that regulatory changes should be supported by a sound evidence base, particularly with regards to aviation safety standards.

8.6 The committee shares the view of ATSB's Aviation Commissioner and former chief pilot of Qantas, Mr Chris Manning, that '[a]nything in the air is a risk to an aircraft, whether it is a bird, an animal or an RPAS'.<sup>4</sup> Accordingly, the committee is concerned by evidence presented throughout the inquiry that RPAS falling under the excluded category (weighing less than 2kg) are able to do significant damage to passenger aircraft when mid-air collisions occur.

8.7 The committee was alarmed by CASA's apparent lack of due diligence prior to introducing the amendments. Rather than providing a comprehensive evidence-base, the research conducted by CASA to inform the amendments appears to have been limited to desktop research. In addition, questions were raised about the consultation period for the Part 101 amendments, which lasted only one month, then took two years to come into effect. This approach stands in direct contrast to that taken by the UK government which used laboratory collision testing and computer modelling to undertake a mid-air collision study before implementing regulations for small RPAS. Similarly, in the US, the Department of Transport and the FAA conducted risk assessments and a community consultation process before introducing registration requirements for RPAS over 250g.

8.8 There is a growing body of evidence, demonstrated by research undertaken in other jurisdictions, to suggest that the Part 101 amendments require urgent reconsideration. The committee appreciates that CASA recently completed a review into RPAS operations, and made considerable effort to engage with the aviation community as part of this process. However, CASA must also draw on the growing body of empirical evidence produced by other jurisdictions to provide an evidence-based approach to any regulatory change, and fulfil its primary statutory objective to ensure the 'safety of air navigation as the most important consideration'.<sup>5</sup>

8.9 As CASA acknowledged in its review paper, the sharing and leveraging of international research is highly beneficial to the development of RPAS regulation.<sup>6</sup> CASA should therefore continue to draw on the research already available through the Joint Authorities for Rulemaking on Unmanned Systems, as well as other

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4 Mr Chris Manning, Australian Transport Safety Bureau, *Budget Estimates Hansard*, 23 May 2017, p. 134.

5 *Civil Aviation Act 1988*, s. 9A.

6 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 22.

jurisdictions, to inform Australian regulatory policy for RPAS operation and integration.

### **Recommendation 1**

**8.10 The committee recommends that the Civil Aviation Safety Authority draw on the growing body of international empirical research and collision testing on remotely piloted aircraft systems below 2kg to immediately reform Part 101 of the Civil Aviation Safety Regulations 1998.**

### **Mandatory registration regime**

8.11 Cognisant of the outcomes of the UK mid-air collision study, the committee recognises that even small RPAS are capable of causing considerable damage to rotorcraft and aircraft. However, under the current requirements for RPAS use, there is no way to identify the operator and owner of any RPAS involved in a near-miss incident or collision. The committee recognises that the registration of all RPAS, whether for recreational or commercial purposes, would allow enforcement agencies to monitor and penalise unlawful RPAS activity. Identification requirements for RPAS and their operators would discourage rule breaches and encourage responsible, safe RPAS use.

8.12 The development of a compulsory registration regime in Australia would align with regulations currently in force in jurisdictions across the world, including in the US and UK whereby RPAS over 250g are required to be registered prior to flight. Along with many stakeholders who provided evidence to the inquiry, the committee upholds the view that a similar requirement should be enshrined in the Australian regulations.

8.13 According to CASA's review of RPAS operations, there is abundant support from commercial, recreational, and non-users of RPAS for some form of registration.<sup>7</sup> A key preference was for registration to be determined by the weight of the RPA, with 250g being the most commonly nominated cut-off.

8.14 The committee recognises that some RPAS manufacturers have taken steps to introduce their own registration systems. As an example, DJI announced in May 2017 that firmware updates for all DJI drone models will require users to log onto its website to complete an application activation process.<sup>8</sup>

8.15 These are important initiatives. However, the committee also recognises that the implementation of a mandatory registration regime presents the opportunity to create more stringent criteria for those wishing to operate an RPAS and to educate

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7 CASA's review received 910 responses to a range of questions relating to registration, training and demonstrated proficiency, geo-fencing, counter-drone technology, and regulatory approaches. See: Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018.

8 Adam Clark Estes, 'DJI Will Cripple Your Drone If You Don't Register It On the Company's Website', *Gizmodo*, 23 May 2017, <https://www.gizmodo.com.au/2017/05/dji-will-cripple-your-drone-if-you-dont-register-it-on-the-companys-website/> (accessed 20 February 2018).

prospective operators. Inquiry participants notified the committee that new operators may not fully comprehend or even be aware of the regulations applicable to RPAS, with many potentially operating their RPAS in breach of the regulations simply 'out of naivety'.<sup>9</sup>

8.16 The introduction of a mandatory registration regime provides an opportunity to reach and inform all RPAS users whilst also requiring of them a demonstrated understanding and awareness of safe RPAS use. In particular, new operators should be required to demonstrate basic knowledge of the rules pertaining to RPAS flights, such as the requirement to stay below 400 feet and maintain a distance of at least 30 metres from people. An understanding of the penalties applied for non-compliance should also be demonstrated.

8.17 The mandatory registration of RPAS is a sensible and logical step towards effective regulation. The committee appreciates, however, that the costs associated with establishing and administering a registration scheme would not be insignificant. The matter of cost recovery was noted in CASA's review of RPAS operations, with the regulator noting that recreational RPAS operation 'is already placing a significant burden on CASA's funding' due to the lack of a regulatory services income from non-commercial operators.<sup>10</sup> This reflects a broader discussion on the need to select an appropriate body (government or third party) to maintain the proposed register, with a suitable cost structure in place.

8.18 The committee notes that cost-effective registration regimes are already in place in many jurisdictions around the world. In the US, RPAS registration costs are offset by incorporating a minor fee for operators. The UK is proposing a similar regime, with the added requirement for operators to renew their registration each year, free of charge. In Australia, other recreational aircraft, such as hot air balloons and skydiving parachutes, are required to register through one of 10 Recreational Aviation Administration Organisations (RAAOs) authorised to self-administer sport and recreational flying activities on CASA's behalf.<sup>11</sup> Beyond aviation, registration regimes are also in place for maritime distress beacons,<sup>12</sup> and even prepaid mobile phones.<sup>13</sup>

8.19 The committee therefore suggests that the establishment and implementation of a mandatory registration regime need not entail onerous financial outlays. Instead,

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9 Mr Bradley Mason, Australian Certified UAV Operators, *Committee Hansard*, 28 June 2017, p. 14.

10 Civil Aviation Safety Authority, *Review of aviation safety regulation of remotely piloted aircraft systems*, May 2018, p. 14.

11 Civil Aviation Safety Authority, *Self-administering organisations*, <https://www.casa.gov.au/standard-page/self-administering-organisations> (accessed 2 May 2018).

12 Australian Maritime Safety Authority, *Beacons*, <http://beacons.amsa.gov.au/> (accessed 24 April 2018).

13 Australian Communications and Media Authority, *ID checks for prepaid mobiles*, <https://www.acma.gov.au/theACMA/id-checks-for-prepaid-mobiles> (accessed 24 April 2018).

the models adopted in other jurisdictions and industries should be drawn on to establish a mandatory regime for RPAS that is both cost-effective and sustainable.

## **Recommendation 2**

**8.20 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.**

### **Tiered education program**

8.21 The committee recognises that more should be done to ensure that all RPAS users, whether recreational or commercial, undertake some form of mandatory education and training before flying their RPAS. The committee was alarmed by numerous reports of reckless RPAS operations which had hindered emergency operations, flown close to commercial aircraft, or intruded upon restricted airspace. The committee was equally concerned by reports of inexperienced RPAS operators who, through obliviousness to the rules, have inadvertently threatened public safety in one way or another.

8.22 The committee acknowledges the models used for training, education and certification of sport and recreational aircraft pilots through self-administering organisations such as Recreational Aviation Australia and the Model Aeronautical Association of Australia. Specialist aircraft clubs such as these have assisted in fostering a culture of safety and awareness of aviation law, in the absence of a national education and registration system. In particular, the Model Aeronautical Association of Australia has demonstrated considerable leadership in devising and delivering its wings accreditation program to club members.

8.23 Drawing on these safety initiatives, the committee is supportive of a tiered education regime for all RPAS users. In accordance with evidence to the inquiry, the committee recognises that the level of training required should be geared to the level of risk posed by each operation. For example, RPAS purchased 'off-the-shelf' would have a base level limitation on range and altitude, such as 200 feet above ground level and 200 metres from the operator. Upon completion of a rudimentary education tier as described in Recommendation 2, users would then have additional capabilities unlocked on their device, commensurate with the current operating conditions stated in the Regulations. After successful completion of additional training, limitations could then be removed entirely for operators using RPAS for commercial or exempted purposes. The final tier would equate to the current training requirements for a commercial operator's licence.

8.24 A summary is provided in Table 8.1 below:

	<b>Operation</b>	<b>Limitations</b>
<b>Tier 1</b>	Beginner	200 feet (60 metres) AGL 200 metres from operator
<b>Tier 2</b>	Recreational use	400 feet (120 metres) AGL 500 metres from operator
<b>Tier 3</b>	Commercial and other exempted use	No limitations

8.25 The committee recognises that a large majority of incidents involving RPAS in the last few years are likely to have been due to a lack of knowledge about the relevant guidelines and regulations. It is therefore appropriate that educative programs focus on the risks associated with aircraft operation, and general principles of aviation. The education curriculum should also incorporate an explanation of basic aviation terms, and the differences between airspace classes, particularly those that prohibit RPAS operations, and those that may permit operations to a certain height or distance. As previously emphasised, the tiered education program should be introduced as part of the RPAS mandatory registration regime.

### **Recommendation 3**

**8.26 The committee recommends that the Australian Government develop a tiered education program whereby remotely piloted aircraft system (RPAS) users progressively unlock RPAS capabilities upon completion of each level of training. Three tiers are proposed as follows:**

- **purchase of the RPAS – mandatory registration requires user to demonstrate knowledge the basic rules for flying RPAS, and the penalties for non-compliance (as described in Recommendation 2);**
- **recreational use of RPAS – second tier requires user to demonstrate an advanced understanding of aviation rules and safety before unlocking additional capabilities; and**
- **commercial use of RPAS – final tier requires user to demonstrate comprehensive aviation knowledge before obtaining commercial operator licence and unlocking full RPAS capability.**

### **Vulnerable airspace**

8.27 Another matter that requires attention is that of the imposition of restrictions on RPAS over vulnerable airspace. The committee was alarmed by reports of unauthorised RPAS hampering emergency operations and flying close to hospital zones. These practices present a significant risk to low-flying helicopters and small aircraft performing essential, and at times life-saving, services.

8.28 In addition to these areas, the committee considered the airspace over public buildings and critical infrastructure to be particularly susceptible to RPAS misuse. Taking into account the security risks involved, the committee is firmly of the view that such areas should be subject to explicit RPAS restriction. It suggests that restriction of airspace over public buildings, emergency operations, hospitals and major cities is an appropriate preventative measure that is commensurate with the risk posed. Stronger enforcement measures should also be considered to ensure the public is aware of restrictions, and discouraged from breaching the rules.

#### **Recommendation 4**

**8.29 The committee recommends that the Civil Aviation Safety Authority, in cooperation with the Australian Federal Police and other relevant authorities, prohibit the use of remotely piloted aircraft systems in the airspace above significant public buildings, critical infrastructure and other vulnerable areas.**

8.30 Additionally, the committee considers that further measures are required to effectively prevent RPAS from flying in such vulnerable airspace. The recommended registration and education initiatives could assist in educating RPAS operators of the risks involved in flying in these areas, and the potential penalties applied. CASA's mobile app *Can I fly there?* provides a suitable platform to both notify and remind the public about such restrictions. However, 'off-the-shelf' RPAS should ultimately be fitted with technical restrictions to ensure compliance with the rules. The committee is of the view that this will ensure both oblivious and malicious users are prevented from breaching the rules and posing an aviation and public safety threat. In this regard, Defence commented that there should be 'electronic, physical or other measures' to prevent RPAS from being utilised unlawfully.<sup>14</sup>

#### **Recommendation 5**

**8.31 The committee recommends that the Department of Infrastructure, Regional Development and Cities, in cooperation with the Civil Aviation Safety Authority, work with manufacturers of remotely piloted aircraft systems (RPAS) to develop future solutions to RPAS safety, including the implementation of technical restrictions on altitude and distance for 'off-the-shelf' RPAS.**

#### **Airworthiness standards**

8.32 To allow RPAS to fully integrate into shared airspace, they must be subject to standards of airworthiness. Airworthiness standards for recreational and other RPAS would ensure that the devices are consistent across technical design, manufacture and maintenance requirements, as is the case with all other aircraft in Australia.

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14 Department of Defence, answers to written questions on notice, 22 March 2018, p. 4 (received 24 April 2018).

8.33 The committee acknowledges the work CASA has done to consult with the aviation community regarding a UAS airworthiness framework.<sup>15</sup> The initiatives undertaken by the Joint Authorities for Rulemaking on Unmanned Systems and the European Aviation Safety Agency are also significant.

8.34 However, the committee remains concerned that the exemption of RPAS from airworthiness requirements, particularly those used by recreational operators, continues to diminish public safety through allowing unchecked devices to fly in civilian airspace. As pointed out in the 2016 RMIT study referred to by submitters, broken communication links between an RPAS and its controller, and other technical problems, account for more than half the number of reported RPAS accidents.<sup>16</sup> Yet, a nationally consistent standard of airworthiness for very small and small RPAS remains absent.

8.35 Therefore, the committee recommends that, at a minimum, prescribed standards for RPAS should include a number of fail-safe redundancies, such as return-to-home functionality and forced flight termination. In the case of a system error, these safety mechanisms will ensure that damage to people or property is minimised.

8.36 The committee is of the view that airworthiness standards should also extend to RPAS that arrive in the country through foreign imports. Just as model rockets and laser pointers are subject to import controls, so too should RPA devices be monitored at the border to ensure a consistent standard of quality and safety. Whilst complications may arise with regards to RPAS modification and part substitution, the committee suggests that the safety of the public should remain at the forefront of RPAS regulation in order to prevent all potential incidents and accidents associated with technical failure.

#### **Recommendation 6**

**8.37 The committee recommends that the Department of Infrastructure, Regional Development and Cities, in cooperation with the Civil Aviation Safety Authority, develop appropriate airworthiness standards for remotely piloted aircraft of all sizes and operations. At a minimum, fail-safe functions such as 'return to home' and safe landing functionality, and forced flight termination, should be mandated.**

#### **Recommendation 7**

**8.38 The committee recommends that the Australian Government develop import controls to enforce airworthiness standards for foreign manufactured remotely piloted aircraft systems.**

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15 Civil Aviation Safety Authority, *DP 1529US – UAS airworthiness framework*, <https://www.casa.gov.au/standard-page/dp-1529us-uas-airworthiness-framework> (accessed 12 November 2017).

16 Graham Wild, Glenn Baxter and John Murray, 'Exploring drone accidents and incidents to help prevent potential air disasters', *Aerospace*, vol. 3, no. 3, 2016, pp. 1–11.

## **Whole of government approach**

8.39 The committee considers that the wealth of reforms required to effectively regulate and support the growing RPAS industry requires a holistic approach that draws in all levels of government, a range of industry stakeholders, and utilises cost-effective solutions. As a first step, a whole of government approach is needed to address the increasingly complex set of challenges arising from the multi-faceted nature of RPAS technology, and the diverse set of stakeholders involved.

8.40 The committee was pleased to hear that the Australian Government provides aviation policy leadership through quarterly meetings of the Aviation Policy Group. However, it was apparent that many submitters and witnesses were not aware of this government mechanism, nor felt that it was sufficient to deal comprehensively with matters relating to RPAS.

8.41 During the course of the inquiry, it became clear to the committee that RPAS regulation and safety instead requires a coordinated, holistic approach which encompasses matters including national security, importation, consumer protection, and technological innovation. To this end, the committee recognises the need for a whole of government approach, whereby departments and agencies work together across portfolio boundaries, to achieve RPAS safety.

8.42 For this reason, the committee recommends that the Department of Infrastructure, Regional Development and Cities, which has policy leadership on aviation matters, work with CASA and other key agencies to establish whole of government mechanisms to develop policies and implement programs directed at achieving RPAS safety in Australia. The establishment of such mechanisms will enable comprehensive consideration of matters and areas intersecting with RPAS technology.

8.43 To ensure that a comprehensive regulatory approach to RPAS is adopted, the committee further recommends that the Australian Government explore cost-effective options for the implementation and maintenance of registration, education, and compliance initiatives outlined in this report.

### **Recommendation 8**

**8.44 The committee recommends that the Department of Infrastructure, Regional Development and Cities, in collaboration with the Civil Aviation Safety Authority, develop a whole of government policy for remotely piloted aircraft safety in Australia, and establish appropriate coordination and implementation mechanisms with relevant departments and agencies to implement the policy.**

**8.45 As part of a whole of government policy approach, the committee further recommends that the Australian Government explore cost-effective models to develop and administer new regulatory initiatives for remotely piloted aircraft systems, including a mandatory registration regime and tiered education program. The harmonisation of state and territory privacy laws should also be considered.**

### ***Comprehensive research to inform policy and practice***

8.46 Additional concerns in relation to the current RPAS regime include the lack of available data regarding RPAS operations, the limited information on RPAS incidents and occurrences, and the methodology applied to gather such information. These concerns were brought to the fore throughout the inquiry in evidence that the regulator has very little information about the number of RPAS in the sky, the characteristics of RPAS operators, where RPAS are flown, and the type of operations that are taking place.<sup>17</sup> The committee agrees that this wealth of 'unknowns' presents a key policy challenge that should be addressed.

8.47 Information captured through the National Aviation Occurrence Database has historically excluded many aviation breaches due to an overly narrow criterion for reportable activity. CASA's reporting and complaints system is also insufficient, relying heavily on witness reports and photographic evidence of RPAS that are neither identifiable nor traceable.

8.48 The committee believes that, as part of a whole of government policy approach to RPAS, a research and data gathering capability should be established. It would provide Airservices Australia, CASA, ATSB and other involved agencies access to more complex information relevant to the development of operating standards, geo-fencing, incident prevention, and the identification of commercial trends. The collection and analysis of such information would provide an evidence-base on which to assess the effectiveness of current regulatory measures, and inform future policy.

8.49 As stated earlier, the establishment of a registration regime is an essential step which would allow for the collection of much of the required data.

### **Recommendation 9**

**8.50 The committee recommends that, as part of a whole of government approach to remotely piloted aircraft systems (RPAS) safety, the Civil Aviation Safety Authority work with Airservices Australia and other relevant agencies to implement a comprehensive research and data gathering regime. Information should be collated and centralised in a way that allows for the examination of RPAS registrations, operations, trends and incidents, to provide an evidence base on which to assess the efficacy of current regulations, and to inform the development of future policy and regulations.**

### ***Consultation beyond the aviation sector***

8.51 In addition to a whole of government mechanism established at the federal level, the committee believes that ongoing consultation with the RPAS sector will ensure that the aviation regulator understands the changing opportunities and challenges faced by RPAS operators, both commercial and otherwise.

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17 See Chapter 4. Whilst some data is retained about commercial operations, recreational drone users are not required to provide the same information to CASA.

8.52 The committee is supportive of the existing consultation forums led by CASA, including the Aviation Safety Advisory Panel. However, as submitters and witnesses have suggested, stakeholders of RPAS technology are much broader than the traditional aviation sector.

8.53 As such, the committee recommends that regular input be sought from a range of industry stakeholders, such as airlines, manufacturers, insurers, emergency service bodies, agriculture representatives, air traffic control, recreational clubs, mobile networks, as well as recreational and commercial RPAS operators. Engagement with stakeholders should be guided by clear terms of reference, and focus on evolving trends in RPAS use, including the development of new technologies and capabilities such as beyond visual line of sight operations.

### ***Future solutions***

8.54 The committee recognises the evolving nature of RPAS technology and associated systems, and considers that a whole of government framework should take these advancements into account when setting policy.

8.55 In particular, the committee is interested in the array of technologies currently being developed to enhance the safety mechanisms built into RPAS, including geo-fencing, collision avoidance, and other transponder-based systems such as ADS-B. It is clear from the evidence presented to the committee that many of these systems are developing rapidly, and need to be seriously considered as regulatory tools to prevent unsafe RPAS use. This is demonstrated by the availability of safeguards such as 'return to home' and 'follow me' modes that are already available in many manufactured products. However, the committee recognises that questions remain about how the technology will be integrated with compliance regimes. For example, if an RPAS equipped with in-built restrictions on height and altitude breaches restricted airspace due to technical inaccuracy, the regulator would need to make a decision about who is legally responsible – the manufacturer or the operator.

8.56 Another outstanding matter is the need for in-built technical restrictions to keep pace with temporary or new restrictions, such as those put in place during the Commonwealth Games. Where airspace is temporarily restricted, manufacturers and regulators would need to ensure all RPAS are remotely updated and adhere to the new rules.

8.57 Recognising that geo-fencing is already available in a number of overseas jurisdictions, and in certain manufacturer's products, the committee supports the work currently being done by the Queensland University of Technology in conjunction with Airservices Australia to develop the necessary datasets to geo-fence RPAS in Australia through a web based service for digital mapping. The committee strongly encourages the government to continue to utilise the technical and industry expertise of stakeholders to develop future solutions to RPAS safety.

### **Addressing other policy challenges**

8.58 Once a whole of government policy mechanism is in place, consideration should be given to other complex policy challenges, including the steps required to achieve a nationally consistent enforcement regime in relation to RPAS.

### ***Nationally consistent regulations***

8.59 The committee acknowledges the steps being taken by local and state governments to increase public safety and mitigate the risks posed by the growing number of recreational and amateur RPAS operators. However, the committee heard that such measures will be counterproductive if they lead to confusion about RPAS rules and how and where they apply. State-based surveillance laws, which dictate the use of optical surveillance devices and data surveillance tracking devices including RPAS, are one such example.<sup>18</sup>

8.60 The committee is mindful that the concerns raised in the 2014 House of Representatives report regarding surveillance laws pertaining to RPAS use remain largely unaddressed.<sup>19</sup> Therefore, the committee recognises that a whole of government approach to RPAS management provides an opportunity to address regulatory inconsistencies across local and federal RPAS laws.

8.61 A nationally consistent policy framework and collaborative approach would ensure that local and state government restrictions on RPAS complement federal regulations and provide a consistent message regarding safety for RPAS users and the general public. The committee strongly encourages local and state governments to work with federal counterparts for the purposes of harmonising RPAS regulations.

### ***Delegation of police powers***

8.62 Another issue that requires consideration is that of the prospect of CASA delegating some of its policing powers to local authorities. It is clear that, as the number of RPAS operators continues to rise, the burden placed on CASA to enforce the regulations will become untenable. Following the example of the US and UK, the committee believes that there is merit in considering the delegation of policing powers to local authorities who are often best placed to issue timely penalties. Consideration should be given to empowering local authorities to provide on-the-spot fines and report infringements directly to CASA. As part of a coordinated approach to RPAS safety, the prospect of applying counter-drone technology, such as jamming devices and GPS tracking should also be contemplated.

8.63 The committee strongly supports the development of a nationally consistent enforcement regime, and the delegation of police powers to local authorities. However, it takes the view that a registration system and whole of government policy approach to RPAS safety should remain the first priority. Once these initiatives are in place, other enforcement mechanisms can be considered as part of a coordinated response.

## **Recommendation 10**

**8.64 The committee recommends that, following the development of a whole of government policy approach to RPAS safety, including the establishment of a**

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18 See Chapter 7.

19 See: House of Representatives Standing Committee on Social Policy and Legal Affairs, *Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy*, July 2014, pp. 33–50.

**national registration system, the Civil Aviation Safety Authority (CASA) work with state and territory enforcement bodies to implement a nationally consistent enforcement regime for remotely piloted aircraft systems. Under this regime, enforcement bodies would be delegated powers to provide on-the-spot fines and report infringements of the regulations directly to CASA.**

### **Concluding comments**

8.65 The committee's inquiry into RPAS and associated systems has identified a multitude of benefits that RPAS technology has brought to many industries. However, the amendments to Part 101 of the CASR in September 2016 have shaken public confidence that RPAS can be effectively integrated into Australian airspace, without a significant number of regulatory reforms.

8.66 The evidence has clearly shown that, in order for Australia to balance the important challenges of ensuring public and aviation safety, and encouraging innovation, the regulations for RPAS use must be expanded to include a registration requirement, education and awareness training, additional enforcement and compliance measures, and technology-based solutions.

8.67 The committee believes that its recommendations, once implemented in full, will instil community confidence by contributing to public and aviation safety, and keeping Australia's skies safe.

**Senator Glenn Sterle**

**Chair**



# Appendix 1

## Submissions received

<b>Submission Number</b>	<b>Submitter</b>
1	Mr Don Raffaele
2	Mr Ian Fraser
3	Nitestar Security Group
4	Mr John Cook
5	Department of Agriculture and Food, Western Australia
6	Mr Michael Fawcett
7	Mr Vince Sofia
8	Elevo Pty Ltd
9	Mr Egon Kuster
10	Mr Edward Browning
11	Virgin Independent Pilots Association
12	Australian Airports Association
13	Austec Aerial Solutions
14	Aeromodellers NSW
15	Global Drone Solutions
16	Little Ripper Lifesaver Pty Ltd
17	Civil Aviation Safety Authority
18	Prof Des Butler
19	International Aerospace Law & Policy Group
20	ProUAV Australia
21	Civil Air Operations Officers Association of Australia
22	Maurice Blackburn Lawyers
23	Helistar Aviation
24	Thiess Pty Ltd
25	Air Sport Australia Confederation
26	Mr Jason Tepper
27	Department of the Environment and Energy
28	Parrot ANZ Pty Ltd
29	Airservices Australia
30	Australia Post
31	Intel
32	Australian Pork
33	National Farmers' Federation
34	Qantas Group
35	Australasian Fire & Emergency Service Authorities Council and National Aerial Firefighting Centre
36	Telstra Corporation
37	Australian Industry Group
38	Victorian Farmers Federation
39	Australian Airline Pilots' Association
40	Domino's Pizza Enterprises Ltd

41	Aeroeye
42	JT Aviation Consulting Pty Ltd
43	Unmanned Research Aircraft Facility, University of Adelaide
44	Department of Defence
45	NSW Farmers
46	Australian Association for Unmanned Systems
47	CanberraUAV
48	NSW Ambulance
49	Aerial Application Association of Australia Ltd
50	Model Aeronautical Association of Australia
51	Mr Ashley Fairfield
52	Mr Chris Bird
53	Mr Graham Giles
54	RelmaTech Ltd
55	Mr Ged Griffin
56	Institute of Public Affairs
57	Australian Strategic Air Traffic Management Group
58	Regional Aviation Association of Australia
59	Insurance Council of Australia
60	DJI
61	CSIRO
62	Australian Transport Safety Bureau
63	Drone Solutions Pty Ltd
64	QBE
65	Piper Alderman
66	UAS International
67	Northern Territory Police, Fire and Emergency Services
68	Asia-Pacific RPAS Consortium
69	NSW Government
70	Regional Express
71	Australian Miniature Aerosports Society Inc
72	Office of the Australian Information Commissioner
73	Australian Certified UAV Operators Inc.
74	Interspatial Aviation Services Pty Ltd
75	Victorian Department of Environment, Land, Water and Planning
76	Mr Robin Lowe
77	Dr Helmut Mayer
78	Drone Safety Services
79	Corrections Victoria
80	Mr Chris Poole
81	Mr Chris Thompson
82	Mr Mark Leuschner
83	Mr Damian Paten
84	Mr Sam Heeps
85	Mr Yiming Teng
86	Mr John Cotterill
87	Mr Phil Stevens
88	Mr Ross Meadows
89	Mr John Reidy-Crofts
90	Mining3

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91	Mr Brian Woods
92	Mr Christopher Lesiter
93	IDS Australia
94	No Drone

## **Additional information received**

- Received on 9 December 2016, from the International Air Transport Association. Additional information;
- Received on 15 December 2016, correspondence from Dr Helmut Mayer;
- Received on 15 December 2016, from Intel Corporation, Telstra Corporation, Australia Post, Ninnox Robotics and the National Famers' Federation. Additional information;
- Received on 14 March 2017, from Liberty Victoria. Additional information;
- Received on 17 May 2017, correspondence from The Hon Darren Chester MP;
- Received on 23 June 2017, correspondence from The Hon Darren Chester MP;
- Received on 26 June 2017, from the Australian Airline Pilots' Association. Additional information;
- Received on 27 July 2017, from Australia Post. Answers to Questions taken on Notice at a public hearing in Melbourne on 16 June 2017;
- Received on 8 September 2017, from Airservices Australia. Answers to Questions taken on Notice at a public hearing in Canberra on 29 August 2017;
- Received on 14 September 2017, from CASA. Answers to Questions taken on Notice at a public hearing in Canberra on 29 August 2017;
- Received on 27 September 2017, from Dr Jonathan Aleck, General Manager, Legal Affairs, Regulatory Policy and International Strategy, CASA. Correction of evidence given at a public hearing in Canberra on 29 August 2017;
- Received on 29 September 2017, from the Australian Airports Association. Answers to Questions taken on Notice at a public hearing in Canberra on 29 August 2017;
- Received on 3 October 2017, from CASA. Answers to written Questions taken on Notice on 19 September 2017;
- Received on 17 October 2017, from the Australian Federal Police. Answers to written Questions taken on Notice on 19 September 2017;
- Received on 26 October 2017, from the Department of Parliamentary Services. Answers to written Questions taken on Notice on 17 October 2017;
- Received on 7 November 2017, from the Department of Infrastructure and Regional Development. Answers to Questions taken on Notice at a public hearing in Canberra on 17 October 2017;
- Received on 9 November 2017, from the Department of Immigration and Border Protection. Answers to Questions taken on Notice at a public hearing in Canberra on 17 October 2017;
- Received on 24 April 2018, from the Department of Defence. Answers to written Questions taken on Notice on 22 March 2018.

## **Tabled documents**

- Tabled by One Giant Leap on 26 June 2017 in Sydney. Introductions and major points;
- Tabled by Captain John Lyons of VIPA on 28 June 2017 in Brisbane. Photo of plane;
- Tabled by Mr Ross Meadows on 28 June 2017 in Brisbane. Results of a survey;
- Tabled by Australian Certified UAV Operators Inc. on 28 June 2017 in Brisbane. Graph titled 'State of the Nation';
- Tabled by the Australian Transport Safety Bureau on 29 August 2017 in Canberra. 'Birdstrike involving Glasair Sportsman GS-2, N666GM';
- Tabled by the Australian Transport Safety Bureau on 29 August 2017 in Canberra. Graph titled 'Reported near encounters involving a Remotely Piloted Aircraft System- July 2015 to July 2017'.

## Appendix 2

### Public hearings and witnesses

#### Thursday, 16 March 2017, Dalby, QLD

- BALL, Dr Catherine Marie, Private capacity
- BENNET, Mr Edward, Chief Executive Officer and Chief Remote Pilot, The Ripper Group (Westpac Little Ripper Lifesaver)
- BUSH, Mr Scott, General Manager, Domino's Pizza New Zealand Ltd
- DONALD, Mr Andrew, Director of Commercial Operations, Insitu Pacific Pty Ltd
- EHRLICH, Mr Marcus, Managing Director, Ninox Robotics Pty Ltd
- EVA, Mr Richard, Aviation and Ground Transport Manager, QGC
- HARLEY, Mr Stephen Thomas, General Manager, Chief Technology Office: Voice/Video, Security/Identity, Drones/UAV, Telstra Corporation
- HARVEY-SUTTON, Mr Mark, Manager, Rural Affairs, National Farmers' Federation
- JONES, Mr Nigel, Owner-Pilot, Horizon UAS
- KOHLER, Ms Leanne, Chief Executive Officer, Desert Channels Queensland
- KUMMEROW, Mrs Margaret Anne, Owner, Flying Ag Australia
- LEACH, Dr Greg, Senior Policy Adviser, AgForce Queensland
- McWATTERS, Mr Andy, Managing Director, Andair
- MILLER, Mr Brian, General Manager, Regulatory Operations, Telstra Corporation
- MUDFORD, Mr Rhys, Chief Remote Pilot, Insitu Pacific
- NOBLE, Mr Scott, Business Development Manager, Yamaha Australia
- SHAW, Mr James, Director, Government Relations, Telstra Corporation
- SMART, Mr Ben, Director-Chief Pilot, Smart Air Services
- SMITH, Councillor Andrew, Deputy Mayor, Western Downs Regional Council
- SMITH, Mr Colin, Chief Pilot, Ninox Robotics Pty Ltd
- TROLLOPE, Mr Ben, Chief Operations Officer, The Ripper Group
- VOGELNEST, Mr Daniel, Technical Director, Ninox Robotics Pty Ltd
- WIGGINS, Mr Simon, Acting Operations Manager, Desert Channels Queensland
- WIMAN, Mr David, Aviation Safety Specialist, Andair

#### Friday, 16 June 2017, Melbourne, VIC

- ALDER, Mr Richard, General Manager, National Aerial Firefighting Centre
- DODD, Mr Kevin, Secretary, Model Aeronautical Association of Australia
- FOGARTY, Mr Liam, Acting Director of Regulation and Compliance, Victorian Department of Environment, Land, Water and Planning
- LEE, Mr Bernard, Head of Autonomous Delivery Innovation, Australia Post
- MAK, Mr Tien Ti, Chief Technology Officer, Australia Post
- MARSH, Mr Anthony, Director; Chief Remote Pilot, Aeroeye Pty Ltd

- McROBERT, Mr Thomas, President, Civil Air Australia
- PERKS, Mr David, ATSM Delegate, Civil Air Australia
- ROBERTS, Mr Chris, Managing Director, Parrot ANZ Pty Ltd
- TYRRELL, Mr Greg, Executive Director, Australian Association for Unmanned Systems
- ZWANIKKEN, Mr Brendan, Manager, Aviation Services Unit, Victorian Department of Environment, Land, Water and Planning

**Monday, 26 June 2017, Sydney, NSW**

- ATKINSON, Mr George, Chief Flying Instructor, Aeromodellers New South Wales
- BOOTH, Captain David, Vice-President, Australian Airline Pilots' Association
- BUTT, Captain Murray, President, Australian Airline Pilots' Association
- CARPENTER, Mr Robert, Director, One Giant Leap Australia Pty Ltd
- HOY, Mr Gregory James, Vice-President, Aeromodellers New South Wales
- LONEY, Mr Shane, Safety and Technical Director, Australian Airline Pilots' Association
- MacKERRAS, Captain David (Dick), Technical, Safety and Regulatory Affairs Officer, Australian Airline Pilots' Association
- NOLAN, Mr Tim, President, Aeromodellers New South Wales
- NOLAN, Ms Aranka, Public Relations Officer, Aeromodellers New South Wales
- SLAVIERO, Ms Jackie, Director, One Giant Leap Australia Pty Ltd
- TESSAROLO, Mr John, General Manager, Human Factors Group; Group Safety, Security, Compliance & QA, Regional Express

**Wednesday, 28 June 2017, Brisbane, QLD**

- BUTLER, Professor Des, Professor of Law, Faculty of Law, Queensland University of Technology
- LYONS, Captain John, President, VIPA
- MANNING, Mr Michael John, Director, Drone Solutions
- MARTIN, Associate Professor (Adj), Terrence, Queensland University of Technology
- MASON, Mr Bradley, Secretary, Australian Certified UAV Operators
- MEADOWS, Mr Ross, Managing Director, Pro Flight Pty Ltd
- ORROCK, Mr Robert, Treasurer, Australian Miniature Aerosports Society Inc.
- SNABAITIS, Mr Mike, Secretary, Australian Miniature Aerosports Society Inc
- STEVENS, Captain Philip, Private capacity
- THYNNE, Mr John, Director, JT Aviation Consulting Pty Ltd
- URLI, Mr Joseph, President, Australian Certified UAV Operators
- WHEELER, Mr Joseph, Principal/Managing Partner, International Aerospace Law & Policy Group

**Tuesday, 29 August 2017, Canberra, ACT**

- ALECK, Dr Jonathan, General Manager, Legal Affairs, Regulatory Policy and International Strategy Branch, Civil Aviation Safety Authority

- BOURKE, Mr Simon, Policy Director, Australian Airports Association
- CARMODY, Mr Shane, Chief Executive Officer and Director of Aviation Safety, Civil Aviation Safety Authority
- CHARKER, Mr Craig, Operations Standards and Assurance Manager, Air Navigation Services, Airservices Australia
- CRAWFORD, Mr Graeme, Group Manager, Aviation Group, Civil Aviation Safety Authority
- GODLEY, Dr Stuart, Director, Transport Safety, Australian Transport Safety Bureau
- GOODWIN, Mr Stephen, General Manager, Operations, Brisbane Airport Corporation, Australian Airports Association
- GUMLEY, Mr Luke, Manager, Remotely Piloted Aircraft Systems, Civil Aviation Safety Authority
- HOLMAN, Mr Aaron, Manager, Transport Safety, Australian Transport Safety Bureau
- HOOD, Mr Greg, Chief Commissioner, Australian Transport Safety Bureau
- NAGY, Mr Nat, Executive Director, Transport Safety, Australian Transport Safety Bureau
- WEAVER, Dr Rob, Executive General Manager, Safety and Assurance, Airservices Australia

**Tuesday, 17 October 2017, Canberra, ACT**

- CHANDLER, Mr Andrew, Acting First Assistant Secretary, Traveller, Customs and Industry Policy Division, Department of Immigration and Border Protection
- SPENCE, Ms Pip, Acting Deputy Secretary, Department of Infrastructure and Regional Development
- WILLIAMS, Mr Jim, Assistant Commissioner, Border Management Division, Department of Immigration and Border Protection
- WOLFE, Mr Jim, General Manager, Air Traffic Policy, Department of Infrastructure and Regional Development

