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.[1] ADS-B is an electronic system that allows an aircraft to automatically broadcast its precise location via a digital link.[2] 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.[3]

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:

---

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).[4]

6.6 Rex recommended ADS-S receivers, a European mode transponder with greater air traffic control,[5] 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 fittment [sic] of transponder type equipment should be mandated. ADS-S transceivers that weigh less than 5000 gms are available to RPAS operators.[6]

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.[7]

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.[8]

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

---

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.

communications systems of RPAS, supported by 'representative radiofrequency spectrum standards'.[9]

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.[10]

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.[11]

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.[12]

---

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.[13] They expressed support for the geo-fencing of all RPAS to prevent interference with passenger aircraft near airports.[14] 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.[15]

6.16 Other submitters suggested that geo-fencing could also be used to limit the distance an RPAS travelled from its user.[16] The point was made that geo-fencing could potentially thwart trespassing and privacy invasion by preventing access to private property.[17]

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.[18]

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?[19]

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.[20] CASA explained:

---

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 me be made mandatory.[21]

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.[22] 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.[23]

6.21 CASA has also initiated discussions with Airservices Australia to consider development of the necessary datasets required to geo-fence RPAS in Australia.[24] 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.[25] 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.[26]

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

---

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.[27]

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.[28] 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'.[29]

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.[30] This is particularly important in readying the aviation sector for BVLOS operations that are said to utilise the 'clear comparative advantages' of RPAS technology.[31]

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.[32]

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

---

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.[33]

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'.[34]

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.[35] 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.[36]

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.[37] As such, technical problems are the primary cause for RPAS accidents.[38] The RMIT study

---

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.[39] 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'.[40]

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.[41]

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.[42] The introduction of commercial aircraft-type regulations to standardise communications systems could also be considered.[43] RPAS fitted with these mechanisms could then be issued a certificate of airworthiness, similar to manned aircraft.[44]

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

---

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].

> the risk mitigation relies on operational safety controls such as operator and crew licencing together with operational limitations.[45]

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.[46] 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).[47]

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'.[48]

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.[49] 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.[50]

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.[51] According to the University of Adelaide, RPAS could be regulated at the border through the *Customs Act 1901*. An importation regime would enforce national

---

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.[52]

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)[53] noted that import controls typically rely on an import permit regime, sponsored by a policy agency.[54] However, as RPAS are not currently 'prescribed in that way' nor 'prohibited', no such permit regime is under way.[55]

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.[56] 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.[57]

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.

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].

> This approach has kept aviation safe and it should do the same for RPAS and drones.[58]

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.[59]

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.[60]

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.[61]

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,

---

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.[62] 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.[63]

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'.[64] As a major UAS operator, Defence added that it would 'be a stakeholder' in the development of an Australian UTM system.[65]

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.[66] 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.[67]

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,

---

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].[68]

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.

68 Australian Certified UAV Operators, *Submission 73*, p. 36.