Wing

Comments from Wing
on the National Airspace Policy Issues Paper

July 2021

Tables

Introduction

Wing welcomes the opportunity to respond to the consultation on National Strategic Airspace with the Department of Infrastructure, Transport, Regional Development, and Communications. The *National Airspace Policy Issues Paper* represents an important step towards the safe and responsible integration of Remotely Piloted Aircraft System (RPAS) operations at scale in Australia. Wing offers the following comments based on our experience as an RPAS designer, manufacturer, operator and UAS Traffic Management Service Supplier (USS) on three continents.

Recommendations

Wing supports a model for integration based on Proposal LL2 to promote safe, fair, and efficient access to airspace.

1. **Identify risk-based and performance-based requirements for operational safety.** Authorities should:
   a. Identify a target level of safety for RPAS operating Beyond Visual Line of Sight (BVLOS);
   b. Recognise that different RPAS operations may apply different mitigations for air risk to meet the target level of safety. Prescriptive “one size fits all” requirements for airspace access may have unintended consequences; and
   c. Incorporate total transport risk into the target level of safety, accounting for the substitution of higher risk transport modes (eg. cars) with lower risk transport modes (eg. RPAS).
2. **Establish a policy framework for airspace integration.** Within integrated airspace, operators should be able to determine their responsibilities in the event of an encounter with another aircraft. Authorities should ensure that responsibilities between airspace users are clearly defined. Given the variation in capabilities between RPAS and manned aircraft, minimum requirements for airspace participation may be necessary to reconcile these dissimilar operations, such as requirements for cooperation in high-demand LL airspace.
3. **Implement a framework of cooperative privileges in high-demand LL airspace.** To balance the interests of all users, authorities can develop a framework of "cooperative privileges" in high-demand LL airspace. In this airspace, RPAS operators should be responsible for avoiding cooperative manned aircraft. Non-cooperative manned aircraft may still enter that airspace. However, those aircraft would be responsible for avoidance. Cooperation may be achieved without costly coordination or control via UTM (for RPAS-RPAS interactions) and via onboard conspicuity technology such as ADS-B (for manned-RPAS interactions).

Airspace integration

RPAS operations are growing rapidly for a range of humanitarian, emergency, agricultural, delivery and recreational purposes, placing additional demand on LL airspace. The increasing volume and diversity of these operations may require a new approach to airspace management to ensure safe, fair, and efficient access for all users.

Airspace policy can play a role in helping to integrate these diverse and dissimilar airspace users. To promote safe, fair, and efficient access to airspace, Wing supports a model for RPAS integration based on Proposal LL2: declaring areas of airspace with appropriate procedures. As the Department develops these proposals, Wing offers the following suggestions to help accelerate the safe integration of RPAS at scale.

1. Identify risk-based and performance-based requirements for operational safety

Authorities should identify a target level of safety for RPAS operating BVLOS that equals or exceeds manned aviation. However, different operators may use a range of mitigations to meet the target level of safety in their specific operating environment. These could include a combination of:

- **Strategic mitigations** applied before flight (eg. strategic deconfliction via UTM or prior coordination between operators) and **tactical mitigations** applied during flight (eg. detect and avoid (DAA) systems);
- **Cooperative mitigations** (eg. UTM or cooperative DAA) and **non-cooperative mitigations** (eg. see and avoid, visual airspace observers, or radar surveillance); and
- **Operational mitigations** (eg. containment) and **design mitigations** (eg. onboard equipage).

Given these variations, Wing encourages authorities to avoid imposing “one size fits all” requirements for mitigating air risk. Blanket requirements may not be appropriate for particular operations, and may encourage design choices that are less safe overall. For example, many small RPAS operate in LL airspace that is used infrequently by manned traffic. Requiring these RPAS to carry heavy non-cooperative DAA equipment may disproportionately increase the size, weight, and thus ground risk of the RPAS without a commensurate reduction in air risk. That kind of requirement would reduce overall safety.

Instead, mitigations should be evaluated holistically through the operational approval process. Different operations will have different characteristics and apply a range of different mitigations. To that end, Wing supports the adoption of the *Specific Operations Risk Assessment* (SORA) in Australia. SORA is a risk-based and performance-based framework that acknowledges a range of mitigations for complex RPAS operations. SORA imposes requirements that reflect the risk of a specific operation in its specific operating environment, and SORA recognises that different operators may apply different mitigations to achieve the required target level of safety.

Further, the target level of safety should recognise the positive impact of a proposed operation on the safety of the transport system as a whole. For example, regulators should account for the substitution of higher risk transport modes (eg. cars) by lower risk transport modes (eg. RPAS). If operators can demonstrate that an operation reduces overall transport risk, that should be credited against the risk of the operation for the purpose of determining compliance with the target level of safety.

Example

As part of a multimodal transport system, commercial RPAS can help to support safer, better connected, and more sustainable cities. For example, RPAS can respond to growing demand for the timely pickup or delivery of goods while avoiding the accidents and emissions of road vehicles. By replacing private vehicle shopping trips, and supporting new growth in commercial delivery trips, RPAS could help to avoid 2.3 billion kilometres per year in road travel, equivalent to 5,100 road accidents per year across Australia.[1]

Wing encourages the same risk-based and performance-based approach to any requirements for security, privacy, amenity, or sustainability. Authorities should identify the desired performance, but recognise that different operations may mitigate these risks in different ways. Blanket restrictions on all operations within airspace could make valuable RPAS operations unviable. Instead, these risks should be mitigated through the operational approval process.

2. Establish a policy framework for airspace integration

In addition to meeting the target level of safety, operators should be able to determine their responsibilities in the event of an encounter with another aircraft. However, given the variation in capabilities between airspace users, regulators may need to develop additional policies to help ensure a minimum level of interoperability in shared airspace. For example, authorities can encourage cooperation. In a cooperative environment, operators can share information with other airspace users, such as flight intent or position. With that information, operators can identify potential encounters, and take action in accordance with known priority rules.

In developing any framework for airspace integration, Wing encourages authorities to apply the following principles:

- **Clear.** Responsibilities between airspace users should be clearly defined, and reasonably capable of compliance. Operators should be able to identify their responsibilities in the

[1] Accenture, *Potential impact of delivery drones in Australia*, 2021.

event of an encounter with other aircraft, and respond in accordance with known priority rules.

- **Integrated.** The sky is a shared resource, and authorities should avoid closing off airspace to legitimate users. For example, segregating RPAS operations in large operating areas may exclude legitimate manned users. Conversely, imposing prescriptive requirements for non-cooperative equipage on RPAS may exclude small RPAS that cannot reasonably comply.[2] Airspace should be reasonably accessible to all users.

- **Proportionate.** Authorities should avoid broad requirements that unreasonably interfere with existing airspace users. Instead, authorities should develop targeted requirements that balance the interests of local users. For example, a national mandate may impose an unreasonable burden on existing airspace users. Instead, authorities can impose targeted requirements on LL airspace in specific areas if the airspace is likely to be utilised by RPAS and unlikely to be utilised by regular manned traffic. Likewise, authorities may implement policies on a voluntary basis, and impose mandates only as a last resort.

Evaluating different approaches to RPAS integration at scale Enabling operators to determine their responsibilities in the event of an encounter			
	Clear	**Integrated**	**Proportionate**
Denial Denying airspace access to complex RPAS operations	Prohibiting complex RPAS operations formally prevents encounters between manned aircraft and RPAS.	Prohibiting complex RPAS operations does not promote airspace integration. It reduces overall safety in the transport system by denying the public a safer alternative to transport, inspection, or emergency response by road.	Prohibiting complex RPAS operations discriminates against a broad range of new entrants providing services in the public interest.
Non-cooperative airspace Requiring all aircraft to see / detect other non-cooperative aircraft (eg. DAA or radar surveillance)	Non-cooperative DAA cannot be implemented effectively on small RPAS given the potential reduction in overall safety; technical constraints; and environmental conditions and aircraft behaviour in LL airspace.	Non-cooperative DAA may facilitate the integration of some large RPAS or large UAM aircraft in shared airspace.	Non-cooperative DAA excludes small RPAS that cannot reasonably implement non-cooperative DAA requirements.

[2] Wing agrees that airspace policy should not assume small RPAS will be equipped with conventional communication, navigation, or surveillance technology, or that traditional mitigations will be effective in uncontrolled LL airspace: Department of Infrastructure, Transport, Regional Development, and Communications, *National Airspace Policy Issues Paper*, 2021 at 17-18.

Segregation Segregating RPAS operations from manned aircraft	Segregation formally prevents encounters between manned aircraft and RPAS during nominal operations.	Segregation does not promote airspace integration.	Segregation excludes manned aircraft from blocks of airspace. In addition, segregation unduly limits the operating area available to RPAS, and prevents RPAS operations expanding in response to changing demand for services.
Control Coordinating all flights via ATC	Control formally prevents encounters between manned aircraft and RPAS during nominal operations in controlled airspace.	Control limits integration to controlled airspace only. Airspace capacity will depend on the digitisation and automation of airspace authorisation, and the geographic extent of the controlled airspace.	Control requirements impose significant cost and complexity on all airspace users.
Cooperative airspace Requiring aircraft to see / detect other cooperative aircraft	Cooperation ensures that all operators can reasonably determine their responsibilities in the event of an encounter.	Cooperation facilitates the integration of manned aircraft and most RPAS in shared airspace.	Cooperation imposes some compliance cost on operators in high-demand airspace. Cooperative airspace policies should be proportionate to the expected composition of traffic, and minimise the burden to operators.

3. Implement the framework in a way that balances the interests of all airspace users

In LL airspace, cooperation can be implemented in a way that fairly balances the interests of different airspace users. Minimum requirements for cooperation can be implemented where they are justified by the expected volume and composition of traffic, without imposing those requirements on areas or altitudes that do not justify regulatory intervention. That approach is consistent with Proposal LL2, which would apply specific LL procedures in designated airspace.

Assessment of proposed LL airspace options	
Proposal LL1 – neutral	Any procedures for airspace access should account for variations in the expected composition of traffic in different areas. Standardised national procedures may impose prescriptive requirements on certain airspace (eg. rural airspace) where they are not necessary.
Proposal LL2 – support	Wing supports proposal LL2, which would apply LL procedures to designated airspace. Any procedures for airspace access should

	account for the expected composition of traffic in different areas. LL2 achieves this outcome by limiting additional requirements only to areas that are likely to experience high volume LL traffic. LL2 is consistent and proportional. Airspace can be designated based on objective criteria; designated airspace can be identified by all operators before flight; and specific procedures can be developed that are appropriate to different locations and are capable of compliance by all operators. Airspace will not be subject to undue requirements unless justified by the composition of traffic.
Proposal LL3 – neutral	Displacing existing airspace classifications with a new LL class of airspace may complicate airspace integration. For example, imposing a new class of airspace could result in baseline requirements that are more onerous than necessary for uncontrolled LL airspace. Further, any requirements for control or coordination in this airspace will impose undue costs on manned and unmanned airspace users. Airspace integration can be achieved without resorting to centralised air traffic services.

Preserve access to airspace

Further, authorities can develop cooperative procedures that fall short of a compulsory mandate in order to preserve access to airspace. For example, a framework of “cooperative privileges” could help to integrate manned and unmanned operations without imposing unfair or unrealistic burdens on either community.

In this framework, RPAS would be responsible for avoiding cooperative manned traffic in most circumstances. To take advantage of cooperative priority rules, manned aircraft may choose to cooperate by sharing their position (eg. via ADS-B transmitters). RPAS operating BVLOS must cooperate by receiving transmissions from participating manned aircraft (eg. via ADS-B receivers). RPAS operating VLOS may choose to cooperate in addition to relying on see and avoid. Importantly, non-cooperative manned traffic may continue to access such airspace, subject to minimum altitude and other requirements, but they would be responsible for avoiding other aircraft. That approach would help to clarify responsibilities, and ensure that all operators can reasonably comply, while minimising disruption to existing airspace users.

Example framework for cooperative privileges
Indicating responsibilities or right of way for Aircraft 1

			Aircraft 2			
			Cooperative		Non-cooperative	
			Manned	**RPAS** (BVLOS or VLOS)	**Manned**	**RPAS** (VLOS only)
Aircraft 1	**Cooperative**	**Manned**	See and avoid	Nil action required (RPAS is responsible)	See and avoid	Nil action required (RPAS is responsible)
		RPAS (BVLOS or VLOS)	Detect and avoid (ADS-B)	Strategic deconfliction (UTM)	Nil action required (manned aircraft is responsible)	Nil action required (other RPAS is responsible)
	Non-cooperative	**Manned**	See and avoid	See and avoid	See and avoid	Nil action required (RPAS is responsible)
		RPAS (VLOS only)	See and avoid	See and avoid	See and avoid	See and avoid

RPAS operating BVLOS must cooperate by detecting ADS-B transmissions from manned aircraft. RPAS operating VLOS may be cooperative. Manned aircraft may be cooperative by transmitting ADS-B.

In this model, authorities may designate cooperative airspace where they anticipate high-volume LL traffic. Designated airspace should be notified to manned and unmanned operators via a range of channels including charts, Notice to Airmen, and UTM geo-awareness or drone safety services. Notifications should include information about the extent of the airspace, maximum altitude, and any cooperation procedures.

Maximise opportunities for participation

In designated airspace, cooperation can be achieved using a range of safe, open, and scalable technologies that maximise opportunities for participation. For example, RPAS can cooperate via UTM. Authorities and industry, including CASA in Australia, have demonstrated a safe, open, and scalable approach to UTM that supports a range of equipped and non-equipped RPAS. Through a network of approved and interoperable USSs, RPAS operators can share flight intent and position for purposes such as conflict detection and strategic deconfliction. Wing has supported demonstrations of interoperability via UTM with NASA and the FAA in the United States, FOCA in Switzerland, and the Department for Transport Connected Places Catapult in the United Kingdom.

Examples

In order to allow unmanned aircraft to safely operate alongside manned aircraft in U-space airspace, rules providing for effective signalling of the presence of manned aircraft by means of surveillance technologies are necessary.

U-space service providers shall: exchange any information that is relevant for the safe provision of U-space services amongst themselves… UAS flight authorisation services [provided by U-space service providers] should ensure that authorised UAS operations are free of intersection in space and time with any other notified UAS flight authorisation within the same portion of U-space airspace.

– Implementing Regulation on a Regulatory Framework for U-space, European Union[3]

UTM is predicated on layers of information sharing and data exchange… to achieve safe operations. Operators share their flight intent with each other and coordinate to deconflict and safely separate trajectories. The primary means of communication and coordination between Operators, the FAA, and other stakeholders is through a distributed information network, and not between pilots and air traffic controllers.

– Federal Aviation Administration, United States[4]

Whilst onboard drone technology, such as 'detect and avoid' (DAA), will go some way to enabling flight BVLOS, Unmanned Traffic Management (UTM) is the key element of the ecosystem that is required to provide accurate visibility and situational awareness to enable strategic deconfliction of airspace users.

Strategic Deconfliction can be provided for trajectory-based and area-based operations conducted under both VLOS and BVLOS. These operations are represented by a series of overlapping 4-dimensional volumes.

The ASTM UTM specification allows each UTMSP a high degree of flexibility in achieving this 4D volume creation, supporting a wide range of operations… In some cases, a single volume for the duration of the entire operation extending from the ground up to the maximum altitude of the operation may suffice, especially when planning in an area with low airspace density. In

[3] Implementing Regulation 2021/664 on a Regulatory Framework for U-space (EU) at recitals 20, 22 and article 7(5).
[4] FAA, *UTM Concept of Operations 2.0*, 2020 at [2.1].

> *contrast, an operation could be defined to convey a high level of specificity of where exactly a vehicle will be in space at each specific moment in time. As operational density increases, additional requirements will be needed to ensure fairness and equitable access to the airspace.*
>
> – Connected Places Catapult sponsored by the Department for Transport, United Kingdom[5]

Manned aircraft can participate in cooperative airspace using existing, proven, and widely-available technologies such ADS-B. Manned aircraft can choose to transmit their position via low-cost ADS-B transmitters. Small RPAS can be fitted with lightweight ADS-B receivers to automatically detect and avoid these equipped manned aircraft. Alternatively, RPAS that are unable to carry onboard ADS-B receivers can obtain manned position information through supplemental data providers: entities approved to aggregate and disseminate ADS-B data, subject to minimum requirements for data quality.

To promote the adoption of ADS-B in cooperative airspace, authorities can offer full or partial subsidies to manned operators. Cooperative ADS-B is expected to improve safety between manned operators too. For example, both New Zealand and the United Kingdom have offered partial subsidies for manned ADS-B equipage ranging from AUD 460 to 2,350.[6] In addition, authorities can permit the use of affordable but non-certified ADS-B devices in low risk LL airspace. These devices can meet the requirements for cooperation where the required target level of safety is already assured through other mitigations. For example, the United Kingdom CAA is exploring pathways to approval for low-cost and portable conspicuity devices in airspace outside transponder mandatory zones.[7]

Conclusion

Australia can play a leading role in the safe and responsible integration of RPAS operations at scale. Building on Proposal LL2, the suggestions above can help to promote the safe, fair, and efficient use of airspace by all operators. Wing would welcome further opportunities to support the development of a framework for LL airspace integration in Australia.

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[5] Connected Places Catapult, *Implementing an Open Access UTM Framework for the UK,* 2021 at 11, 27.
[6] Civil Aviation Authority (NZ), 'ADS-B grant scheme', available at: https://www.aviation.govt.nz/airspace-and-aerodromes/new-southern-sky/ads-b/ (accessed July 2021); Civil Aviation Authority (UK), 'Electronic conspicuity devices', available at: https://www.caa.co.uk/General-aviation/Aircraft-ownership-and-maintenance/Electronic-Conspicuity-devices/ (accessed July 2021).
[7] Civil Aviation Authority (UK), *CAP 1391: Electronic conspicuity devices*, 2021.

The proposed framework advances the objectives of ATM outlined in GATMOC	
Access and equity	Promoting cooperation in LL airspace will help to ensure that all operators can fairly access the airspace. Complex RPAS operators will have a realistic opportunity to cooperate and interact with other airspace users using existing conspicuity technology such as ADS-B (for manned aircraft) and UTM (for unmanned aircraft). Under a framework of cooperative privileges, cooperative manned operators will be entitled to a right-of-way presumption over most RPAS operations. Non-cooperative manned operators may access that airspace but with modified priority rules that require those operators to take due care and yield to other aircraft.
Capacity	Promoting cooperation in LL airspace will help to ensure that airspace can support the expected volume and diversity of operations. Non-cooperative policy may have the effect of closing off airspace to legitimate users. For example, segregating RPAS operations in large prohibited or restricted areas may exclude legitimate manned operations. Conversely, imposing prescriptive equipage requirements on unmanned aircraft may exclude small RPAS that cannot reasonably comply.
Cost-effectiveness	Promoting cooperation in LL airspace will help to ensure that airspace can be fully utilised without resorting to centralised coordination or positive traffic control. Operators will be able to resolve any encounters between themselves with clearly defined responsibilities. Existing conspicuity technologies such as ADS-B or federated UTM offer a cost-effective and scalable way to facilitate cooperation. Cooperative policy can be supported by a range of other initiatives to mitigate cost to airspace users, such as an equipage subsidy scheme for manned aircraft, or a pathway to approval for non-certified ADS-B devices used in lower risk LL airspace.
Efficiency	Promoting cooperation in LL airspace will ensure that existing operators and new entrants can access the airspace on demand with minimal disruption or delay. In most circumstances, RPAS will take action to avoid cooperative manned aircraft.
Environment	Promoting cooperation in LL airspace will help to unlock RPAS operations at scale with significant benefits for the environmental sustainability of the transport system. For example, RPAS delivery services can help to meet growing demand for the pickup and

	delivery of goods by road while cutting emissions per package by up to 94 percent compared to a car. At scale, RPAS delivery in Australia could save 500,000-550,000 tonnes of carbon dioxide emissions each year.[8] The proposed airspace policy would help to facilitate a competitive market for scalable RPAS delivery services across Australia.
Flexibility	Promoting cooperation will ensure that operators in congested airspace can plan and execute their flights on demand without onerous pre-notification or control requirements. Encounters can be resolved between operators as they arise, or before flight, based on clearly defined responsibilities.
Global interoperability	Promoting cooperation in LL airspace will help to ensure that new entrants can access the airspace using existing conspicuity and UTM technologies. Cooperation will help to foster competition and lower barriers to entry for domestic and global RPAS operators.
Predictability	Promoting cooperation in LL airspace will ensure that manned and unmanned operators can dependably access the airspace. Encounters can be resolved between operators as they arise, or before flight, based on clearly defined responsibilities.
Safety	Promoting cooperation in LL airspace will help to improve safety for all airspace users, including manned and unmanned operators. Cooperation will help to improve the conspicuity of manned aircraft to unmanned operators; improve the conspicuity of manned aircraft to other manned aircraft; and enable unmanned operators to deconflict with other unmanned operators before flight. Further, enabling the integration of RPAS at scale could significantly reduce risk across the transport system as a whole by offering an alternative to transport by road. At scale, for example, drone delivery could help to avoid 5,100 road accidents per year across Australia.[9]
Security	Other requirements in LL airspace can improve the security of RPAS operations. For example, remote identification for RPAS can help authorities promote compliance among operators, support accident investigation, and discriminate threats. Consistent with LL2, these security requirements could be imposed on operations in areas of heightened sensitivity.

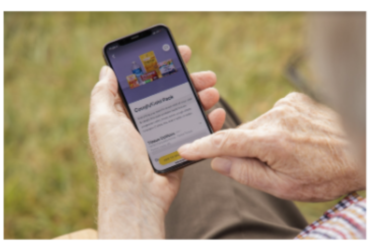
[8] Accenture, *Potential impact of delivery drones in Australia*, 2021.
[9] Accenture, *Potential impact of delivery drones in Australia*, 2021.

Annex: About Wing

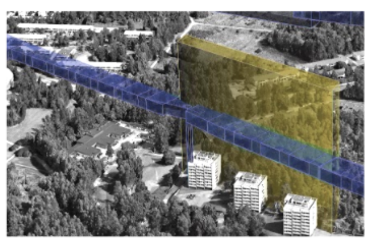
Wing is an aviation company that enables the delivery of small packages by drone as a safer, faster, and cleaner alternative to pickup or delivery by road. Wing has developed a small, lightweight, and highly automated aircraft for safe delivery to homes, and a range of UTM capabilities to help diverse operators share the airspace.

Today, Wing provides commercial drone delivery services on three continents, with operations in Australia, Finland, and the United States. Wing has completed tens of thousands of delivery flights to customers in four cities, including two capital cities (Helsinki and Canberra). Wing operates commercially Beyond Visual Line of Sight (BVLOS), over populated areas, along flexible routes, with one fleet manager supervising multiple aircraft.

Today, the Wing UAS can transport ~1.5kg of food, medication, or other supplies up to ~10km away at approximately 113km/h**.** Wing aircraft pickup and deliver packages by tether while hovering safely above the ground at ~7m. Wing aircraft deliver the package to a pre-approved location selected by the customer, such as a yard, driveway, or other clearing. The Wing UAS can deliver in under 10 minutes.



1. Order and preparation



2. Planning

3. Checks and takeoff

4. Pickup

5. Cruise

6. Delivery

In Australia and Finland, Wing is approved to operate on the basis of the Specific Operations Risk Assessment framework (SORA) developed by the Joint Authorities for Rulemaking on Unmanned

Systems (JARUS). In the United States, Wing is the first FAA-certified Part 135 Air Carrier for commercial unmanned operations. The first Wing aircraft to complete a commercial delivery in the US is held by the National Air and Space Museum in Washington DC.

Length ~ 1.3m
Wingspan ~ 1.0m
Weight ~ 5.2kg

Carries ~ 1.2kg
Cruises ~ 104 km/h
Delivers ~ 10km away

In addition, Wing is committed to promoting the safe, responsible, and open use of airspace by all. To that end, Wing has developed a USS, OpenSky, that provides freely-available geo-awareness and automated airspace authorisation services in Australia and the United States to help recreational and commercial UAS operators plan safe and compliant flights. Wing is working with authorities in Australia, the United States, the United Kingdom, France, and Switzerland to demonstrate a safe, open, and scalable approach to UTM that supports diverse airspace users.