

Taking flight: an aviation system for the automated age

Ministerial forward

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Our vision is to enable a thriving, innovative and safe unmanned aircraft sector

New Zealand is a world leader in the unmanned aircraft (UA) sector due to our good reputation as a safety regulator, our 'open for business' mentality and our risk-based UA regulatory regime. We want to retain these advantages and remain at the forefront of UA development by ensuring our approach to UA operations harnesses the many opportunities they bring while addressing the challenges.

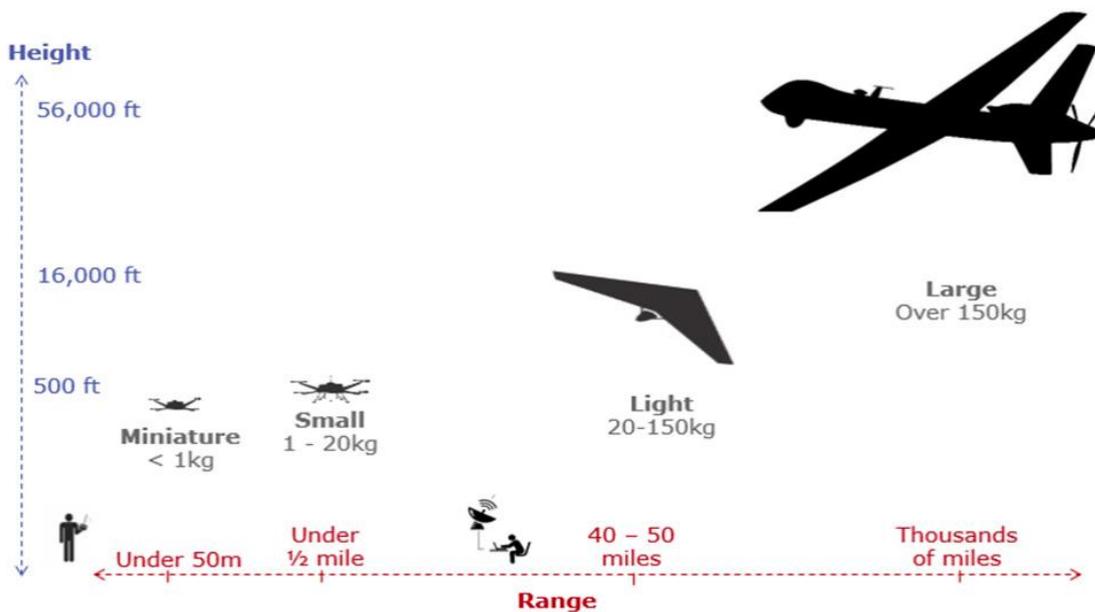
This document aims to provide the sector with a clear understanding of the Government's role, and its strategic direction and priority areas, to achieve the safe integration of UA into the aviation system and broader transport system. This will inform a cross-government UA strategy and work programme to incorporate UA into a safe and integrated transport system.

Outlining a pathway to integration will provide clarity to the sector about steps the Government will take to ensure the benefits are realised for New Zealand and the sector as quickly as possible.

What is a UA?

UA are aircraft of all sizes that operate without a pilot on board. UA can be operated recreationally (a person flying a small UA in the local park or through a model aircraft club) or they can be operated commercially (Appendix 1 provides further detail). UA can be operated at all height levels from just above ground level to very high altitudes (above where commercial jet aircraft operate).

[Diagram is a PLACEHOLDER and isn't the best representation of UA operations in New Zealand].



Increasingly, more and more people are using UA. Approximately 281,000 New Zealanders own or fly UA (the majority made up of recreational users)—dwarfing the 5000 piloted aircraft operating in New Zealand. There are approximately 130 commercial UA operators certified by the Civil Aviation Authority (CAA). In addition, approximately 200,000 UA were used by foreign tourists in New Zealand in the past year. Reports project that UA numbers will continue to increase.

New technologies are transforming aviation and can deliver significant economic benefits to New Zealand

UA are part of a broader air transport sector, which already makes a significant contribution to the New Zealand economy—creating jobs and generating wealth. In 2014, the air transport industry was estimated to have contributed \$6.9 billion gross value to New Zealand's GDP. These contributions come from large airlines like Air New Zealand right through to the smaller general aviation sector that support our tourist operations in the regions.

Transitioning to new aviation technologies will deliver even greater economic benefit to the country

The UA sector is moving to take advantage of new and emerging technologies. The sector stands to gain economic benefits from other projects, such as New Southern Sky (NSS). NSS will transform New Zealand's air traffic control system and will deliver New Zealand around \$128m of economic benefits through new performance based navigation, surveillance and air traffic management technologies.

UA will also deliver economic benefits by undertaking tasks that are time intensive (e.g. monitoring stock and crops), expensive (e.g. power line inspection), and risky (e.g. assisting with search and rescue or emergency services). Numerous reports agree that UA will grow into a multi-trillion dollar market globally in the next five to ten years.

In New Zealand, a number of industries will benefit from greater use of UA. For example, there is significant scope for UA in agricultural operations. New Zealand's challenging topography lends itself to UA use. UA will allow more efficient and safe management of stock, pasture and crops, and at a lower cost.

UA is already being used as an inspection and surveying tool in a wide range of sectors in New Zealand. UA are fast, efficient and capable of capturing large amounts of detailed information remotely. This means that tasks, such as routine maintenance, can be better targeted, further reducing costs.

Taking advantage of these transformative activities will place New Zealand in a good position to realise the economic benefits such technologies have the ability to deliver, allowing our aviation sector to continue to grow.

UA have the potential to transform the transport system as well

UA have the potential to change the way we move goods and people, as capabilities and operations expand to include freight delivery and passenger transport. Acknowledging that other types of operations will continue to develop to provide services that we cannot imagine yet, the following examples outline services that could make a positive contribution to New Zealand's transport system.

Example 1: Rural freight and goods delivery

As technology continues to develop, the range and weight limits of UA are expected to increase. This will open up new opportunities for UA to transport goods around the country. In particular, UA could play an important role transporting high-value, time-sensitive goods, particularly in rural areas. UA offer a number of potential advantages in rural settings. Costs could be lower than land transport due to reduced labour and fuel costs. They could also provide greater flexibility in delivery schedules. Over time, the volume of goods transported by air could increase significantly, helping to connect regional businesses to their suppliers in areas where land transport infrastructure is less developed.

Example 2: Passenger carrying UA

Passenger carrying UA are developing quickly, and are close to becoming a reality. There are a large number of companies developing and testing technology to transport passengers in small, electric powered aircraft, which operate autonomously and can land and take off vertically. New Zealand is already at the forefront of this development, with one company already testing its aircraft here.

It is too early to know what role these 'air taxis' might play in the future transport system. The combination of electric and autonomous technologies mean that the cost of travelling in these aircraft could be considerably lower than the cost of travelling in a helicopter or small aircraft today. There is speculation that these aircraft could revolutionise our urban transport systems, providing a new transport option that will be attractive for time-sensitive passengers. However, these aircraft could also play an important role connecting communities that are not large enough to sustain regular air services using existing aircraft, and reducing transport infrastructure costs.

Safe integration of UA into an integrated transport system

Our objective is to safely integrate UA into the New Zealand aviation system and ultimately into an integrated transport system. By integration, we mean all aircraft (manned and unmanned) operating safely and seamlessly together, and seamlessly with other transport options.

Successful integration would see our aviation system provide opportunities for UA to operate beyond the visual line of sight (BVLOS) of their pilot or operator. Before widespread BVLOS operations can occur, UA and other aviation technologies need to demonstrate to the CAA that they can operate alongside other aircraft while ensuring the continued safety of all aviation users and people and property on the ground.

The challenges and opportunities presented by UA integration are not unique to New Zealand. Integration is an iterative and phased process as we work to address the challenges presented by safety, security, privacy and enforcement. Of particular importance is national security as UA can be used to conduct illegal activity. The risk of these types of operations needs to be appropriately managed by having practices in place to limit instances of illegal activity and stopping them quickly if they occur.

Phase 1 – Integration into the aviation system

UA integration has the potential to increase the use of airspace in New Zealand, both in terms of the numbers of aircraft and the number of movements they make. This increase may deliver significant economic and social benefits to New Zealand¹. However, it could also negatively impact on existing commercial and non-commercial users (and the value gained from that use).

Greater use of UA could also affect people on the ground (e.g. through a reduced sense of privacy, and noise and visual impacts), particularly in urban areas and at popular locations. We must be transparent in how we balance the positives and negatives UA present as we consider the appropriate regulatory approach to achieve integration.

We will work with the sector and the public to build our understanding of what and where UA operations are acceptable, their flight frequency, acceptable noise levels, and how privacy concerns should be addressed.

Like piloted aircraft, there may be constraints on where UA can operate, for example, having segregated flight paths or designated no fly zones.

With the majority of our airspace being uncontrolled, prevention of collisions between piloted aircraft is predominately achieved through 'see and avoid' and the application of internationally aligned right of way rules, often supported by radio communications between aircraft. UA cannot use visual flight rules because there is no on-board pilot on board to 'see and avoid'. The regulatory regime will initially need to rely on rigidly enforcing spatial separation between aircraft before we can consider dynamic airspace configurations.²

¹ For example, UA are typically electric (low carbon) and could provide emission reductions in the freight sector.

² Currently, airspace is reconfigured to accommodate traffic demand. In the future, it is likely to reconfigure more quickly (near instantaneously) and dynamically.

As technology develops³, we will move to a system that can incorporate more sophisticated Detect and Avoid (DAA) technology. One example could involve on-board electronic devices that detect other aircraft coupled with a method to avoid them. This is known as electronic conspicuity (EC).⁴ This will require appropriate and scalable levels of air traffic control - manned and unmanned - as complexity and density increase. At present, we use spatial separation, but the proliferation of commercial applications of UA in the medium-term using BVLOS operations is challenging this approach.⁵

Integration into the aviation sector also means bringing UA and their operators fully inside the aviation regulatory system. This will require UA operators to pay their share of the costs of ensuring an integrated, safe, sustainable and responsive aviation and transport system.

Impacts on other air users

Recreational aircraft users and the general aviation (GA) community are important participants in our aviation system. UA integration is likely to impact how these air users operate. We will work with the aviation sector to limit any negative impacts associated with integration.

Phase 2 – Operation of UA in an integrated transport system

Ultimately, UA stand to play a unique role in urban transport systems. This will involve considering issues, such as infrastructure requirements, and the appropriate licensing system for operators. In the land transport system, we are increasingly seeing a focus on integrating ticketing and payment systems between different transport modes through Mobility as a Service platforms.⁶ We would expect any UA used for transporting people or goods to integrate with those systems as well. We must first consider how UA will be deployed and what their role in various environments (including in urban areas and for regional connectivity) to inform any long-term decisions. The work programme that underpins our vision for UA integration will consider the best way to test the feasibility of these operations.

A range of new or modified infrastructure is likely to be required to enable the use of UA in urban settings, including physical UA landing zones, radio towers and spectrums, mobile phone and LTE networks and technical UA traffic management systems (UTM), or an upgraded air traffic management system (ATM).

³ Technological developments will be required before integration can occur, many of which are outside of New Zealand's control. Until future technological developments occur to enable safe airspace integration, UA will continue to be segregated from traditional aviation.

⁴ EC devices turn the traditional 'detect and avoid' concept into 'see, BE SEEN, and avoid'.

⁵ Other considerations include UA registration; identification systems (on-board); flight planning; communications; surveillance; procedure design; geo-awareness and obstacle identification.

⁶ Mobility as a Service is the integration of various forms of transport services into a single mobility service accessible on demand.

What does success look like?

[to be presented in graphic form]

Successful integration of UA and achievement of our vision of 'a thriving, innovative and safe UA sector' will be when:

Thriving

- Our airspace is more dynamic so GA and UA can integrate effectively and can successfully contribute to our economy.
- There is practical and economic use of UA in everyday life.
- New Zealand UA's sector is growing and globally connected.
- UA are integrated into the wider transport system, utilising the same or new infrastructure to the extent that they are applicable and appropriate.
- New Zealand businesses, government and the general public increasingly take advantage of UA technology in their products and services.
- New Zealand has the necessary skills required to utilise the full potential of UA technology.
- New Zealand is an attractive place for UA international investors and innovators.
- Public perception of the operation of UA is positive and any concerns about lack of safety and breached privacy are reduced.
- We continue to comply with key international standards which enable New Zealand to export and connect to the world.

Innovative

- New Zealand is a destination of choice for UA business and R&D. UA businesses bring their R&D initiatives to New Zealand.
- We are globally recognised as having strong R&D and testing capabilities in the UA area with the necessary talent to support it.
- New Zealand is seen as a leader in stimulating start-up activity in the UA sector (including incubators, investment and providing pathways to commercialisation).
- We have expanding applications of more advanced and valuable UA operations.
- We have an appropriately resourced regulator to support greater UA operations.

Safe

- New Zealand's aviation regulatory regime continues to be recognised as safe, secure, and enabling.
- Our regulatory regime is at the forefront and can rapidly respond and scale to evolving technologies, applications and international practices (while not compromising our existing international obligations). If the environment and type of UA operations allow for it, our risk tolerance for certain UA operations may increase.
- UA operators pay their share of the costs of ensuring an integrated, safe, sustainable and responsive aviation system.
- We have established an integrated national system of data, infrastructure and operating models which initially supports safe UA integration into controlled and uncontrolled airspace and then eventually into the wider transport system.
- The New Zealand aviation regulatory regime continues to effectively protect New Zealand national security interests.

A pathway to integration

Time is a critical factor if we are to be at the forefront of UA development. To enable this the Government has initiated a cross government programme of work to achieve our vision for UA integration.

Creating the environment for integration requires a number of complementary building blocks. We have identified four building blocks where we will propose actions and necessary timeframes to achieve UA integration.

<p>Regulation:</p>	<p>For New Zealand to fully realise the benefits of UA operations, our regulatory system needs to be flexible, proportionate, equitable, consistent with relevant international standards and practices and importantly have scope to evolve to respond to changing circumstances or new information on the regulatory system's performance. Regulation should not unnecessarily restrict integration and should be regularly reviewed and amended to ensure this. Some restrictions in activity will be necessary to ensure safety and security is maintained.</p> <p>There is a need to continue raising awareness of the rules, regulations and safety requirements for UA operations (through education and improving the way in which we communicate with the public). There is also a need to better understand what UA operations (commercial and recreational) the public is comfortable with.</p>
<p>Funding and investment:</p>	<p>Through integration, the requirements of our aviation and transport system will change. We will consider what investment may be needed to support our vision and who should fund this investment (local and central government, UA operators, third party or public private partnership).</p>
<p>Infrastructure and technology:</p>	<p>In the short term, it is likely that investment in new technology (e.g. transponders) and infrastructure (e.g. ground stations, transport connections and UA ports) will be required. Any decisions on the type of technology or infrastructure will require robust analysis and stakeholder engagement. We must be aware that the decisions we undertake may change the way we fund our transport revenue system and the design and management of transport corridors across New Zealand.</p>
<p>Research and development:</p>	<p>The UA sector is R&D intensive, with a focus on technology areas (e.g. automation, energy management, noise and configuration, positioning, detect and avoid systems, and air traffic management) that are also applicable to a range of other sectors. To fully realise the benefits of the regulatory interventions and investments in infrastructure and technology, governments also have a key role to play in supporting the development of domestic R&D capabilities and talent.</p>

Leadership and collaboration

Integration requires a coordinated cross-government (both local and central) and industry approach to fully consider and address all the potential benefits and risks associated with UA integration. The UA Integration Leadership Group⁷ will provide strategic guidance and oversight of the work to achieve the safe integration of UA into New Zealand's aviation and transport systems (Appendix 2 provides further detail).

Supporting this will be a cross-government officials group to provide a forum for agencies collaborate and coordinate on UA integration issues, and an industry group to provide operational and technical advice on UA integration matters.

We also have the opportunity to influence the global direction on UA operations and should be deliberate about which international standards we want to influence to help us achieve our vision.

Being a responsive and responsible global citizen

We must be a responsive and responsible global citizen in aviation. Globally, New Zealand is often recognised for its progressive and risk-based approach to aviation regulation. We are well regarded for our pragmatic solutions, and the integrity of our regulatory system due to our commitment to safety and security.

Our aim is to maintain this position but we must be mindful not to deviate too significantly from other global standards and practices. We must continue to work with and influence the domestic and international UA stakeholders (including the Joint Authorities for Rule Making on Unmanned Systems (JARUS) and the International Civil Aviation Organization (ICAO)) to carefully consider other international standards and ensure their appropriateness and applicability to the New Zealand context, while also ensuring harmonisation and global interoperability.

For all UA regulatory work, care must also be taken to ensure we do not interfere or infringe upon existing international treaties to which New Zealand is a party.

This vision is living and evolving

This vision for UA integration is intended to be an evolving framework. As technology continues to rapidly develop this in turn will influence our knowledge and view of what "integration" could be and what it could look like in practice. As work progresses, this document and any associated strategy and work programmed will be reviewed and updated accordingly. The strategy should also consider how we monitor and evaluate interventions we have undertaken (particularly in the regulatory space), to ensure we are achieving our intended outcomes.

⁷ Made up of senior officials from the Ministry of Transport (Chair), CAA, Airways and MBIE.

Appendix 1 – How we are currently enabling safe UA operations in our aviation system

[possibly have a diagram]

In New Zealand, the principal regulatory control for the aviation system is the Civil Aviation Act 1990 and associated Civil Aviation Rules. New Zealand's current regulatory framework for UA operations is risk-based and flexible; it permits innovative uses of this technology, while supporting a high standard of safety.

At present, most small UA operations occur under Rule Part 101 and its set of prescriptive rules to manage risk and help protect existing aviation and the public. Those wanting to operate larger UA or undertake operations outside of Part 101 can apply for operator certification to the CAA based on a safety case under Rule Part 102.

Part 102 has attracted a range of international and domestic companies to develop, test, trial and manufacture UA technology in New Zealand, which has increased economic development here. Operators can conduct R&D under Part 102 in a manner whereby restrictive limitations are initially placed on them, such as conducting activities in Restricted Airspace. As they demonstrate the safety of their aircraft and operation, these limitations are incrementally reduced.

With the likely growth in the use of medium and large UA (e.g. for passenger transport), there will be a need to ensure the entire suite of Civil Aviation Rules are reviewed and updated appropriately to accommodate such operations. For example, in the long-term Part 102 is not currently well-suited to certify a large, passenger carrying operation similar to traditional aircraft certified under Part 121. Similarly, there is likely to be a need to review airspace classifications, particularly in the very low levels, should goods delivery by smaller UA become commonplace.

Appendix 2 – Government Department and Agency Roles and Responsibilities

To provide clarity and for coordination purposes, the section below shows what the UA working arrangements are and describes the role and responsibilities of each of the departments in the UA Integration Leadership Group.

UA Integration Leadership Group

Ministry of Transport

The Ministry is the Government's principal transport advisor. The Ministry has a system leadership and regulatory stewardship role. In relation to unmanned aircraft, the Ministry's key role is to provide strategic direction to other participants in the sector. This includes working with other agencies to understand the impact of UA on the aviation system and the role that unmanned aircraft can play in our broader transport system, and ensuring that our regulatory system strikes the right balance between enabling innovation and addressing risks to the public and other aviation participants.

Civil Aviation Authority (CAA)

The CAA is responsible for the safety and security regulatory oversight of the civil aviation system, and the enforcement of the relevant regulations for that system. The objective of the CAA is to undertake its safety, security and other functions in a way that contributes to the aim of achieving an integrated, safe, responsive and sustainable transport system. This purpose and objectives will continue to apply in an integrated system as outlined in this Vision paper.

Airways New Zealand

A state-owned enterprise, Airways is New Zealand's sole air navigation service provider (ANSP) and is certificated and regulated by the CAA. Airways role is to operate the required airspace management and supporting infrastructure to enable safe and efficient integrated UA flight into the New Zealand aviation and transport system. Airways also actively supports international efforts to bring innovation and R&D to support safe and efficient UA into New Zealand.

Ministry of Business, Employment and Innovation

MBIE is the Government's principal economic development advisor. Its goal is to create a resilient and high-performing economy. Through its Innovative Partnerships programme it seeks to build New Zealand's competitive advantage as a location to develop and deploy innovative and new technologies. In relation to UA its objective is to position New Zealand as a location of choice for the emerging global UA sector.