AMSL Aero Pty Ltd Submission in response to the

National Aviation Policy Issues Paper on Emerging Aviation Technologies

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1 Introduction

This document details the AMSL Aero Pty Ltd response to the Department of Infrastructure, Transport, Regional Development and Communications Emerging Aviation Technologies National Aviation Policy Issues Paper.

AMSL Aero is involved in the design, certification and manufacture of a range of piloted and remote piloted passenger carrying electric Vertical Take-off and Landing (eVTOL) aircraft. The piloted eVTOL aircraft will address a range of existing markets such as air ambulance and regional passenger air transport and potential new markets such as Urban Air Mobility (UAM). The remote piloted eVTOL variant will have applications in Defence for cargo, medical evacuation and passenger carrying and for civil emergency services such as firefighting support, aeromedical support, cargo and eventually passenger carrying applications.

The issue paper represents a great opportunity to generate a policy framework that encourages innovation for the benefit of the Australian population. Through this process we need to ensure that we do not encourage the adoption of new technologies, but at the same time inadvertently erect artificial barriers that prevent us being successful in creating them. The core principles should be mindful and focused on the goal of developing a policy environment that enables Australian Industry to **create** and adopt new technology and innovation.

There are several regulations in place today that restrict Australian companies from development of new classes of eVTOL Remote Piloted Aircraft, and encourage adoption of technologies developed overseas. This is already a serious constraint on our business that has forced us to complete key development activities overseas in order to progress.

The majority of passenger capable eVTOL aircraft in development globally have conducted their early test flights as a Remotely Piloted Aircraft, despite their intention to certify as a Piloted aircraft.

2 Discussion Paper Key Questions

2.1 Do you agree with the proposed core principles for the National Emerging Aviation Technologies policy?

Noting our desire for the policy focus to encourage development and manufacture of this technology in Australia as well as adoption, we agree with the core principles.

It is also worth acknowledging upfront that the policy priorities for eVTOL aircraft manufacturers will be different to stakeholders importing and wanting to operate Drones. Passenger carrying eVTOL aircraft are already required to be certified to globally accepted certification standards. The first generation will be piloted and will operate under the existing regulations for Airplanes and Helicopters of a similar weight and performance. Drones are

not certified, nor are they currently allowed to operate in the same airspace as passenger carrying aircraft.

It is also worth highlighting that the majority of passenger capable eVTOL aircraft in development globally have conducted their early test flights as a Remotely Piloted Aircraft, despite their intention to be certified initially as a Piloted aircraft.

In general terms we agree with the core principles, however we would highlight that the interpretation of these require nuance. Best practice for example is an admirable goal, the challenge lies in defining what is best practice. EASA and the FAA are in general agreement most of the time, but they do also often disagree. It is important not only that we try to achieve best practice, but that we define what best practice is.

We have concerns about the approach to airspace access being “competitive.” Again, without a clear definition of what competitive is it is difficult to ascertain whether this is something that will enhance or restrict industry. If competitive implies a free market approach then this may provide advantages to one group over another, it may even stifle innovation for those that are not well funded. Care needs to be taken to ensure that there is no ambiguity in the core values, lest one sector interpret the principles differently to another. We strongly suggest that many of the terms used in the principles, such as competitive and best practice be clearly defined.

AMSL observes that the principals have an operational focus that reflects the current situation regarding the ‘risk management’ based approach of drone operation. AMSL believes that the technologies being addressed greatly reduce existing barriers to entry into aerospace markets for system and vehicle manufactures and as such the opportunity exists for the development of an Australian design certification and manufacturing industry in the drone and eVTOL space. Australia already has core competitive advantage in enabling technologies such as composite manufacture, robotics and power electronics. The policy, if it was to include a focus on design, certification and manufacture could facilitate the exploitation of these existing Australian industry strengths into the drone and eVTOL sector. It is noted that both EASA (Europe) and FAA (USA) have a strong focus on vehicle and system design and certification in addition to operational issues. This same duality of purpose and ‘across the board’ industry support is not as well developed or championed within Australia and within CASA.

2.2 Will the proposed approach to policy development adequately allow for the future direction, operations and investments of your business/organization?

The discussion document appears to have a bias toward drones, rather than eVTOL and when eVTOL is mentioned it is done in a manner that suggests a link between eVTOL and drones. We have already had problems arise that have resulted in the business incurring costs and having to take on additional risk because the regulations in place for drone operations are not suitable for the development and testing of eVTOL as a remote aircraft.

Our concern is that policies will be developed that target small and medium drone operations and that eVTOL and autonomous eVTOL will be trapped by the unintended consequences of that approach, as has happened to us already. As we discuss later in our submission, we believe that there should be a clear delineation between eVTOL and drones as policy is developed to ensure that neither sector of the industry is disadvantaged by well-meaning regulations that have unintended consequences.

As noted in our comments on ‘Core Policy ‘ (see 2.1) AMSL’s primary business (and that of our largely Australian sub-contractor base) is not well served by the policy which is presently highly operationally centric and does not look at to how to support and encourage design, certification and manufacture.

2.3 Are there any other approaches that could benefit the sector?

As the designer and manufacturer of eVTOL aircraft we note that this sector of the industry is changing rapidly and is reliant upon advances in a number of fields including battery technology, hydrogen fuel cells, electric motors, digital flight control systems, sensors and autonomous systems. We are reliant upon the breakthroughs that will occur to continually improve our product and thus remain competitive. We believe that the Government has a role in not only regulating the industry but also supporting the fundamental and applied research that will allow Australia to grow a strong and internationally competitive drone and eVTOL industry. We believe that the scope of the discussion paper core principle - “support industry growth and investment” - should be explicitly expanded to include those research activities and industries that are key enablers for this sector.

For an eVTOL design, certification and manufacturing industry to develop in Australia a significant increase in the Government’s ability to support certification (which is an existing poorly served international treaty obligation) would be required. The approach suggested would involve Commonwealth investment in a more in depth and capable regulatory workforce and much greater and more collaborative efforts with EASA and CASA specifically in the certification areas. The existing ‘user pays’ approach to certification support represents a substantial commercial disadvantage to Australian industry relative to our European, US, Asian and South American competitors where these services are provided by Government as industry support. The lack of acceptance by bodies such as EASA of Australian design and certification, represents an existing, significant ‘non-tariff barrier” to trade and can only be addressed by Government to Government trade negotiation and treaty development. Both of these issues are areas that could be improved in order to generate a level playing field with our international competitors.

2.4 hat level of service and regulation do you expect from the Government?

Our expectation is that the Government will provide a timely and consistent service that is supportive of industry. That the regulations are consistent and more importantly rational. As

a business we face the challenge of being required to operate at a commercial pace, where decisions need to be made quickly and decisively to ensure that we maintain a competitive advantage.

The slow pace of Government, from regulatory reform through to simple applications to undertake an activity are inconsistent with our need to maintain a commercial tempo and represent a significant commercial risk. Additionally, CASA operates on a cost recovery basis, which represents an additional financial impost on any innovative start-up that is trying to develop a product.

Finally, our expectation is that the regulator in particular be technically sophisticated. It is not sufficient for the regulator to be knowledgeable about the current regulations and the technologies that are in service today. As the regulator it needs to be at the forefront, have a deep understanding of the changes that are occurring in the industry, and continually develop the skills and knowledge of its workforce. As the discussion paper suggests aviation is changing at a pace not seen since the introduction of the jet age. The regulator needs to be correctly staffed with people that have the skills and knowledge required to deal with this change.

2.5 What are your expectations of the Government's role and responsibilities in the management of drones and eVTOL vehicles?

Our expectation is that the Government will regulate the industry in a consistent manner that supports local industry. That it does not impose regulatory hurdles that unnecessarily hinder the growth of Australian business. Critically it must have the ability to quickly and effectively respond to situations that were not foreseen when regulations were drafted. The industry is changing rapidly, and regulations will quickly become outdated if they are overly prescriptive. There needs to be a mechanism that allows for exemptions to be issued in a timely manner where there has been a failure of the regulations to foresee a particular event. The current minimum three months for an exemption is unnecessarily slow for exemptions that are not the result of a failure on the part of the applicant.

Our business plans on exporting eVTOL aircraft to a global market. Our expectation is that the Australian Government is able to support its International Civil Aviation Organisation (ICAO) treaty obligations as a 'State of Design' and 'State of Manufacture'.

2.6 What are the key opportunities that these new technologies could deliver for Australia?

Electric Vertical Take-off and Landing (eVTOL) aircraft provide significant economic, social and environmental benefits with key opportunities are as follows:

- Growing a world leading aerospace design and manufacturing industry for entire aircraft, sub systems, equipment and components.
- Delivery of low cost air ambulance services, with an opportunity to provide air ambulance services at a cost lower than equivalent road ambulances, but with much

faster response times. This will enable high speed emergency medical care to more Australians in rural and remote communities.
- Ability to provide regional air mobility, high speed, low cost passenger carrying services to regional and remote communities, expanding access of high speed transport to a much wider area.
- Provision of an Urban transport service that bypasses traffic congestion with very low infrastructure investments.
- Significant reduction in transport CO2 emissions due to the electric energy storage and propulsion.

2.7 What are the most significant barriers to realizing these opportunities?

In the near term there is no current way to gain approval to flight test large experimental Remote Piloted Aircraft in Australia. To date this work must be conducted offshore, in countries like the US and New Zealand. This is primarily due to the current regulations for large Remote Piloted Aircraft requiring an operator's licence for that category. The logic gap exists if it is the first aircraft of type and category. Today we can only fly an aircraft with a take-off weight of under 7kg with the design features of our aircraft. This is problematic given our target take-off weight is 1700kg. This creates a barrier if you are developing the first aircraft in that category or weight class.

An ideal situation would be for CASA to adopt a similar process to that currently applied to Piloted aircraft being flown under Research and Development Experimental Certificates Aircraft, or alternatively accelerate the process to issue exemptions.

Another barrier is the capability and capacity of the Civil Aviation Safety Authority (CASA) to support the certification of eVTOL aircraft, and the policy of full cost recovery. Full cost recovery is an additional cost burden not imposed in jurisdictions such as the US. An ideal situation is that CASA appropriately resource the certification activity, and that the cost is not passed on directly to the applicant.

In the longer term significant barriers include access to landing sites and pilot licensing. Heliports and airports are limited and the current process is administered by Local Governments. In many locations the lead time to approval a new Heliport will become a constraint. An ideal arrangement is a national approach with a single approval authority.

eVTOL Aircraft will all be piloted for early civil applications. The current regulations require a new category of license for Powered Lift. An eVTOL commercial pilot for will require a minimum of 140 hours experience on a Powered Lift aircraft, prior to issuance of a Commercial Pilots License. An experienced helicopter or airplane pilot will need to complete the minimum 140 hours regardless of prior experience. Our aircraft has been designed to be easily flown by a conventional Airplane Pilot. The ideal situation would enable Airplane or Helicopter Pilots to complete a short 5-10 hours conversion similar to an endorsement or type rating. This would allow a rapid conversion process for the 30,000 Australian pilots that currently have Airplane and Helicopter pilot Licenses.

2.8 What issues or actions should the government prioritise to facilitate the growth of emerging aviation technologies?

The immediate priority should be to remove barriers to development and testing of new eVTOL technologies. This includes setting a Government policy that encourages the creation of new technology and fast tracking of exemptions and approvals.

A priority should be to work with other Governments and regulators, in particular the FAA and EASA, to gain a clear understanding of how those Governments intend to deal with the challenges of drones and eVTOL. An alignment with international regulations will improve AMSL Aero's competitiveness in global markets.

We support the establishment of appropriately constituted working groups to work on the details of policy development and regulatory reform. The Government needs to ensure that this process is well coordinated so that any one working group does not proceed down a path that would adversely impact the progress of any other working group.

The Government should prioritise trade negotiations with Europe and the USA to ensure products certified and manufactured in Australian can be exported to and operated in International markets.

2.9 To what extent should Australia's approach be harmonised with approaches taken in other countries?

Harmonisation with other countries, particularly as it relates to the certification of eVTOL, is critical for local eVTOL manufacturers. The design of any aircraft, including eVTOL, is strongly influenced by certification requirements. Harmonisation is important as it ensures that a product made in Australia can then be marketed and sold globally because there is a common and accepted certification standard. Beyond certification, harmonisation will make sure that the aircraft meets the needs of larger overseas markets. Care should be taken in harmonising to global best practice, and not add unnecessary regulatory burden. performance based

2.9.1 Separation of Drone and eVTOL Discussions

We believe that it is important to clearly differentiate between eVTOL and drones (RPAS) when developing policies, rules and regulations. The rationale for this is that eVTOL will carry fare paying passengers and must therefore be designed, certified and operated in a manner that is consistent with what we as a community consider to be an acceptable level of risk for carrying passengers. Unlike current general aviation operations, eVTOL in a mature state will carry large numbers of passengers every day and thus while there will be only a few passengers per aircraft the total number of passengers will be significant. The large number of passenger movements per day means that eVTOL will more closely resemble regular public transport

The carriage of passengers informs the risk profile which in turn should guide the development of rules and regulations. This focus on the risk to passengers can be seen for example in the EASA special condition for small category VTOL aircraft where EASA have

specified probabilities of failure that are similar to those used when certifying large regular public transport aircraft. Unlike drones, eVTOL are subject to a certification process that requires that the manufacturer demonstrate to a regulator that the aircraft meets all of the requirements for the issue of a type certificate. eVTOL are not in our view different from other aircraft, they are an extension of existing aircraft technology that introduce new and novel design features. They should therefore be treated as an aircraft, not a drone.

We do acknowledge that the long-term goal of eVTOL is the provision of autonomous passenger flight, but again this does not make them drones. They remain a passenger carrying aircraft and as such it will be necessary to demonstrate that the autonomy systems provide the same level of safety as provided by the manned aircraft. The economic use of drones requires a different and more cost-effective approach, particularly for small drones. The certification burden currently placed on manned aircraft would not be practical for small and medium sized drones, and this is appropriate given the different risk profiles. We believe that it is important to clearly separate eVTOL and drone policy making to the greatest extent possible to ensure that neither is disadvantaged by rules and regulations that while appropriate to one are not appropriate for the other.

2.9.2 Autonomy

The discussion paper notes that there will “need to be consideration of the implications regarding autonomous operations in advance of the introduction of this technology in the future”.
For this to occur we believe that the current paradigm regarding what is and is not autonomy needs to be clarified. Autonomy currently is by definition operation without a pilot and under the current CASA RPAS regulations it is operating in a manner where the remote pilot is unable to intervene and take control at any time during the flight. Rather than an all or nothing definition, we believe that we need to look at autonomy as a sliding scale, not a binary operation. Taking this approach, we can see that autonomy has been in operation in the aviation community for decades through the provision of increasingly sophisticated autopilots. From simple heading and height hold through to modern Autoland systems including the recent Garmin Emergency Autoland System.

The aviation industry has been slowly, incrementally and safely introducing increasing levels of autonomy into aircraft for many years. As an industry they have been addressing issues associated with certification, safe operation, training and in the case of the Garmin Autoland incapacitation of the pilot. Removing the pilot completely from the cockpit will add another complication to the equation, but not one that we believe is revolutionary, because we have been slowly moving toward this goal over many years. The implementation of full autonomy will present many challenges, particularly in low level airspace, but it can be addressed incrementally starting with piloted aircraft then moving toward full autonomy if we accept that autonomy is a sliding scale of capability.

2.9.3 Licencing and Training

One of the clear benefits that comes with drones and eVTOL is their simplicity. Electric motors and power cells, be they hydrogen fuel cells or batteries, are simple technologies that involve very few or no moving parts. By comparison a modern high bypass turbofan is orders of magnitude more complex to design, manufacture, operate and maintain. Added to this is a

flight control system that is designed to make the task of flying an eVTOL as simple as possible, ideally far easier than driving a car. This presents a challenge for Governments and in particular regulators that have a well-established and effective training and licencing system for pilots and aircraft maintenance staff.

The aviation licencing system relies on a combination of experience and competency requirements that are linked to clearly defined aircraft types. For pilots this results in separate licences for helicopters, aeroplanes, powered lift aircraft, balloons and gliders. For maintenance staff they qualify on engines, airframes and avionics. In an analogue world this is completely rational, but it becomes problematic when we look at drones and eVTOL.

Digital flight control systems can provide novel control strategies, can prevent the pilot endangering the aircraft and as autonomy levels increase change the role of the pilot from someone who controls the aircraft to someone who simply enters the flight path into the system. There is a similar impact on the maintenance of aircraft. As currently happens with drones, eVTOL maintenance will be greatly simplified when compared to traditional aircraft. The designs will be inherently modular with maintenance involving simply replacing modules as required by the maintenance schedule.

To realize of the full potential of eVTOL aircraft there needs to be a fundamental review of what it means to be a pilot and aircraft maintainer. What are the skills sets that are needed to operate and maintain a highly automated and modular aircraft? While eVTOL are aircraft, they will not be flown or maintained in the same manner as happens currently with aircraft. An overly burdensome licencing regime that does not add to the safe operation of eVTOL will stifle growth in the sector. The changes envisaged by industry are significant, technology currently under development will for example make redundant the need for pilots to know how to navigate, any review of the licencing system needs to consider the wider implications of the advances that are occurring and prepare for them.

2.9.4 Skills and Jobs

The discussion paper notes that jobs in the drone sector are “concentrated in the platform and software areas”. It states that “There is a large demand for software engineers in both areas.” As a designer and manufacturer of eVTOL AMSL Aero cautions using generalisations and points out that there is not a direct correlation between the drone industry and the larger advanced aerospace industry as a whole. Our experience designing, building and testing eVTOL is contrary to the statement made in the discussion paper. While we have used software engineers to code our flight control systems, the development of those systems has been undertaken by aerospace engineers who have a fundamental understanding of aerodynamics and aircraft flight dynamics. Aerospace is a multidisciplinary field, our engineering team is predominantly made up of aerospace, electrical, electronics, structural and systems safety engineers. We will continue to need many more aerospace and electrical engineers than software engineers.

2.9.5 As a manufacturer we are focused on attracting engineers with the right qualifications, skills and experience to help us grow our business and provide job opportunities for more Australians. As an employer of Australian engineering talent, it is important for us that Government policies and messaging correctly reflect the totality of the industry's demand for skills. A focus on one engineering discipline, in this case software, will make that task more difficult.

eVTOL *as* Infrastructure

Normally discussion surrounding aerospace infrastructure has a focus on airports and airspace management. With low cost eVTOL there is a new opportunity, from a policy perspective, to consider eVTOL capacity *as* rural infrastructure.

Rural transport infrastructure policy in Australia is dominated by the provision of expensive road infrastructure together with limited rail. The provision of road infrastructure in Rural Australia is expensive, represents a substantial economic cross subsidy to rural communities but is ultimately essential for the functioning of the Australian economy. The use of eVTOL technologies for general transport, at cost that is equivalent to or less than road transport, opens up the notion of eVTOL as a valuable element of rural communications infrastructure.

If I can substitute a two- hour return road trip for a farmer to buy groceries in the closest town with two 10-minute semi-autonomous eVTOL flights I have dramatically improved farm productivity together with facilitating a substantial increase in safety. The same applies to transport for education and health. Cheap easily accessible eVTOL transport has the potential to dramatically change the relationship between remote rural families and their support communities. If I am faced with a 3-hour return car trip to catch up with my community in town I may only make that trip once or twice a week. eVTOL may allow the same trip twice a day. For a farmer who has a stroke at home, where minutes count, eVTOL will be the difference between timely medical intervention that allows that farmer to return to work compared with the potential of lifelong disability.

The potentially transformative nature of eVTOL for rural communities suggests that it needs to be considered in policy terms as akin to productivity and health enhancing infrastructure rather than just another transport option.

In many countries eVTOL is seen as "Urban Airborne Mobility; exclusive taxi transport for the wealthy" in Australia it is the potential for eVTOL technologies to transform rural life, productivity and health, that is the technologies greatest offering. eVTOL as rural infrastructure is a suggested policy paradigm worthy of further consideration.