Aviation 2050 – The future of UK aviation

Response from the Aerospace Technology Institute

About the ATI

1. The Aerospace Technology Institute (ATI) was created in 2013 by the UK government and commercial aerospace sector working together as the Aerospace Growth Partnership (AGP). Both sides committed £150m each per year to fund research and development, creating a total investment of £3.9bn up to 2026. The programme is now in its fifth year and over 200 projects are on contract worth a total value of £2.1bn. These projects – advancing the development of new aircraft that are more efficient, quieter and better for the environment – will go a long way to maintain the UK's global leadership in aerospace.

Introduction

2. The Institute welcomes this green paper. It comes at a time when innovations within engineering and technology are set to significantly change civil air transport. Much of this technological change will be enabled by electric propulsion and autonomous capabilities, meaning that existing aircraft will become more efficient and new markets will be created such as low-cost regional routes and urban/city air routes.

3. We welcome the broad outline of the paper and in particular the chapter focussing on innovation and new technology, the area most relevant to the ATI's expertise. Our initial comments focus on the Future Flight Challenge, providing additional information to DfT to strengthen the view expressed throughout the green paper that technological advances and new business models will reduce the environmental impact of aviation and boost economic growth. We also provide commentary on areas that are currently missing from the draft strategy, specifically the infrastructure required to enable future air transport concepts and intermodality which will underpin the operation and commercial feasibility of new forms of air transport. In addition, we comment on the policy proposals where the ATI is able to provide a considered view, including automation, digitalisation and the need for cross-departmental and industry coordination.

Electrification, automation and the Future Flight Challenge

4. Aviation is at an inflection point and poised to go through the biggest change in 50 years as a result of aircraft designs and operating concepts enabled by new technologies including electric propulsion and the increased use of autonomation. We welcome the green paper's recognition that new aerospace technology will play an integral part in reducing the environmental impact of aviation. We also welcome the Committee on Climate Change 'Net Zero' report which urges the government to ensure the Aviation 2050 Strategy supports innovation and research and to ensure new technologies are brought to market in a timely fashion.

5. Technology will have a transformative impact. The electrification of new aircraft not only offers the capability to reduce emissions and aircraft noise but also unlock the potential for new business models. Electrification also provides new opportunities for the supply chain in the aerospace industry by posing technological challenges to be overcome by existing suppliers and facilitating access for new entrants with innovative ideas. The ATI portfolio is currently funding a large number

of projects advancing electrical power systems in current and future commercial aircraft and we are working with established organisations in the sector, as well as more disruptive companies from outside the sector, to identify new projects which will position the UK as a world leader in the development of electric and autonomous aircraft.

6. The Future Flight Challenge complements the ATI programme. It commits up to £125m (matched by industry) to develop new technology and to consider the infrastructure, policy and regulation required to incorporate new forms of electric, autonomous and unmanned aviation into the air transport system. The ATI was the driving force behind the Industrial Strategy Challenge Fund bid that led to the Future Flight Challenge, working with a wide spectrum of stakeholders to bring the Challenge to fruition. The role of the ATI is crucial in ensuring that the Future Flight Challenge is relevant to the UK aerospace technology strategy, remains at the forefront of aviation technology and secures industry buy-in.

7. The Future Flight Challenge was formed on the basis of a wide spectrum of partners recognising that a systems level approach is needed to better understand the implications of disruptive technologies for aircraft. The target of the system of systems aspect of the challenge is to knit all the work undertaken by manufacturers, regulators, policy-makers, air traffic management and infrastructure providers together to deliver a roadmap for future development and, in turn, maximum economic and societal impact for the UK.

8. The green paper outlines a proposal to support industry with the early safe demonstration and piloting of new technologies and support to enable business models. The challenge represents an opportunity for the UK to forge a lead in this exciting area by ensuring coordination between different market strands that are required simultaneously in order to ensure market success. This principle applies to both the sub-regional and Urban Air Mobility markets. Public perception forms a key part of this potential market and the challenge is likely to undertake a number of activities in this area to gauge and evolve public perception of new vehicles, systems of operation and travel options. We therefore welcome and recommend that government use public awareness campaigns (developed through the Future Flight Challenge) to articulate the benefits of new technologies, as it has done on the Go Ultra Low electric vehicles campaign.

Infrastructure

9. Connectivity is crucial to promoting regional growth and increased productivity. More efficient transport options such as urban and sub-regional air routes enabled by new aircraft will complement existing road and rail infrastructure in increasing the capacity, flexibility and resilience of the network An important component that will enable the successful introduction of new aerial vehicles - either electric vertical take-off and landing (eVTOL) or electric conventional take-off and landing (eCTOL) will be the physical infrastructure required to allow new vehicles to take-off, land, charge, undergo maintenance, park and wait for passengers. With the pace of electric aircraft development increasing, the Aviation 2050 Strategy should ensure that infrastructure development is in step with technology development as failure to do so could stifle the development of new air transport operations in the UK. For urban air mobility eVTOL aircraft, a distributed network of ‘vertiports’ or ‘skyports’ (VTOL hubs with multiple take-off and landing pads, as well as charging infrastructure) or single-aircraft vertistops (a single VTOL pad with minimal infrastructure) is essential. For eCTOL regional/sub-regional aircraft, existing airfields and airports will need to consider the provision of suitable charging infrastructure and maintenance

facilities. At a minimum, skyports and airports will need high voltage rapid chargers, as well as lower voltage chargers for each vehicle vertiport parking slot to recharge at a slower rate.

10. The provision of essential infrastructure could be developed and maintained by both public agencies and businesses and operated much like a conventional airport; services could be provided by the airport/skyport either by the operator of that facility or sub-contractors specialising in handling/ground-based maintenance services. For both eVTOL and eCTOL aircraft, the provision of landing sites (whether these are new vertiports on conventional airfields/airports) will need to be dispersed strategically, ensuring that they are well connected to existing transport connectivity or onward travel providers.

11. The ATI believes that investment in infrastructure – either privately or with government support – will accelerate the creation of the overall ecosystem, generating growth in both cities and regions. A key and immediate aim of the Aviation 2050 Strategy should be to identify potential/suitable locations to begin development of supporting infrastructure. This will require a cross-government approach, led by DfT but with significant input from the CAA, NATS, the Department for Communities and Local Government, local/municipal authorities and Local Enterprise Partnerships. All of these organisations will be able to provide advice and input so that both the operational needs and user needs are considered, ensuring that vertiports and dispersed strategically and existing airfields/airports are developed correctly.

12. A further infrastructure consideration is the provision of 5G communication networks which will allow the precise navigation that is needed for new aerial vehicles, many of which will be operated autonomously. For many services, unmanned air traffic management (a digital system that can monitor and manage increased aerial activity) will be key to ensure smooth and efficient operation of an increasing volume of new aircraft.

Intermodality

13. New aircraft will only become a useful component of tomorrow's future mobility if they are integrated into the overall transport network of cities and regions and new urban and regional aircraft should be thought of within the context of multi-modal transport solutions. It is encouraging that the Green Paper recognises that existing airports are unique multi-modal transport hubs and should be recognised and treated as such. The Aviation 2050 Strategy should recognise that new skyports and smaller airports and airfields should also be treated as connectivity hubs as longer distance trips involving new aircraft will not always be point-to-point but rather these trips will be multimodal to some degree. For example, a sub-regional eCTOL flight may involve a car, bus or rail journey at either end. In a city environment, a user might be able to walk to/from each vertiport but will more likely connect to/from the vertiport using buses, rail or cars.

14. The ATI sees Mobility as a Service (MaaS) and the shift away from personally-owned modes of transportation towards mobility solutions that are consumed as a service as a key enabler for the future of flight. This includes embracing end to end solutions across all modes, not just MaaS within modal silos. Open data being used will be key to making this happen as the ability to exchange data between all types of transport systems will be key in finding the optimal route, understand the fare structures and provide tickets that work across different transport modes. In addition, interoperable systems, supported by open architecture and standardised features, such as booking, payment, ticketing, authentication and security, are important elements that will enhance the development of MaaS. There may be a role for DfT to play in brokering agreements between public and private transport operators and data providers for the sale and resale of

transport services and it is possible that regulation/legislation might be needed to ensure that data can be accessed and used effectively.

UTM technology

15. The government proposes to "work with the CAA and industry to determine the next steps for UTM technology and regulation in the UK, and more widely consider the impact that UTM will have on the aviation sector as a whole". The ATI is supportive of this approach. There are many models of UTM in development and such a system could potentially enable universal awareness for drones or drone users of permanent (and temporary) airspace restrictions; awareness of other airspace users; conflict detection and resolution between drones and other aircraft; and handle requests for permission to enter or transit through controlled airspace. UTM is a vital step in realising the full potential of drones and coordination between the regulator, NATS (and other UK ASNPs) and industry will be key to unlocking the potential of UTM technology. The CAA's new 'Innovation in Aviation' capability, offering innovators the chance to discuss, explore, trial and test emerging concepts and technologies in aviation where there are no current precedents or clear frameworks is a welcome move. Initiatives in the UK should take into account developments in the EU, where the European Commission's U-space project is considering a range of technologies that will enable a common UTM approach.

Identification of aircraft

16. The Green Paper proposes the mandatory identification of all aircraft in UK airspace. Technological advancements in electronic conspicuity have resulted in the rapid uptake of identification technology by all airspace users (commercial, governmental and recreational) and it is anticipated that uptake will continue to grow to a level where all aircraft will be able to be positively identified. This will be vital to the future integration of new technologies within existing airspace.

17. There are wide variety of providers offering electronic conspicuity solutions. To enable the continued strong uptake of this technology, interoperability of these systems is important. The government should regulate for an intention - mandatory identification - rather than specifically mandate how it should be achieved.

Digitalisation

18. As mentioned above, open data is essential to Mobility as a Service and the Green Paper's proposal to work with industry to improve the quality and openness of data is a welcome one. The data action plan for rail serves a useful starting point and lessons can be learned from the taskforces set up as part of the plan. An aviation data action plan could either be set-up as a stand-alone initiative or – ideally - integrated with aspects of the rail (and other) modal data plans as the possibility to deliver an efficient multi-modal transport service vehicle is highly reliant on access to data.

Overcoming barriers to innovation

19. The government proposes to "consider the current arrangement of working across government in response to specific challenges and whether this is sufficient to deliver on specific areas of innovation, such as driving forward the electrification agenda for the aviation sector". Close working across government will be vital in accelerating the pace of progress for the UK. Future

approaches to the air traffic management will need a combined approach across DfT, incorporating the CAA, NATS and BEIS with the ATI and UKRI marshalling industry and academia respectively. The formation of a dedicated cross-departmental programme team, including DfT and BEIS would be an important step forward. The electrification of flight is a critical part of addressing sustainable aviation and the ATI has been encouraging BEIS and UKRI to coordinate different initiatives such as the Future Flight Challenge, Faraday Battery Challenge and Driving the Electric Revolution to accelerate progress by exploring synergies. Furthermore, given the impact urban air vehicles/sub regional new aircraft will have on communities, increased collaboration will be needed with regional ANSPs and local/regional authorities to form a collective view of the solutions required to implement new air vehicles and routes appropriately.

Human Factors, new technology and automation

20. In chapter six, the paper describes how 'Increasingly automated, and potentially fully automated, systems could enable safer operations through diminishing or eliminating human error'. A proposal is then put forward to: 'incentivise take up of existing technology and new innovation by working with industry to set out common specifications to facilitate greater interoperability, reduce cost, and to mitigate safety risks.'

21. The ATI is supportive of common specifications to facilitate greater interoperability. To an extent this already occurs in the civil avionics markets with organisations using common industry standards for sending data between sensors and avionics systems. From a software and hardware development perspective, common standards drive the complete development lifecycle of most avionics platforms and are likely to be used for future development of avionics systems that allow autonomy to develop further.

22. There is also a requirement to increase the level of automation in other parts of the ecosystem such as air traffic management due to the level of expected increases in air traffic density. Automation can be a powerful tool but needs to be introduced with appropriate testing and validation to ensure that other failure modes are not created, and suitable redundancy is built into the system to balance safety and cost. The work expected to be completed as part of the Future Flight Challenge will lay the groundwork for increased automation of the air traffic management system and the wider aviation ecosystem.

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