Written Evidence Submitted by Hybrid Air Vehicles Ltd

(HNZ0052)

Hybrid Air Vehicles is a British company that has developed Airlander, a new type of green aircraft. Designed to maximise efficiency, Airlander can deliver a 90% reduction in CO2 emissions in many scenarios compared to traditional fixed and rotary wing aircraft. Independent market assessments have identified a $50bn global market for this type of aircraft, and Airlander has the potential to be the first mover in its field.

Utilising hydrogen fuel cells, a combination of hydrogen-electric motors and efficient combustion engines, and with a pathway to an all-electric zero emissions configuration, Airlander can deliver significant environmental benefits compared with other forms of mobility transportation while offering direct city-centre to city-centre connections. We have also engaged with prospective customers in other sectors, such as logistics, experiential travel and telecommunications, where the same emissions reductions can also be realised through hydrogen fuel-cell technologies.

Use of sustainable aviation fuel for the combustion engines would reduce CO2 emissions even further that the stated 90% reduction. The aircraft safety case, low noise levels and ability to land away from airfields, including on water, enable the direct connections envisaged here.

To deliver the 90% emissions reduction and establish a pathway to fully net zero operations, Hybrid Air Vehicles is working to integrate hydrogen fuel-cell technologies into its production models to power its electric motors from 2025. This will create early demand for hydrogen, establishing the fundamental infrastructure required and supporting the pull-through of the technology to other industries.

Our development of Airlander demonstrates how hydrogen will begin to reduce emissions in our aviation sector, which is an increasingly urgent demand identified by the Climate Change Committee in its recent 6th Carbon Budget. While Airlander is not a replacement for existing fixed-wing aircraft, it provides a new aviation technology that supports the UK's net-zero objectives through the use of hydrogen as a fuel in settings such as mobility, logistics, telecommunications and experiential travel. It also provides a development platform to bring hydrogen technology into aviation.

The role of hydrogen in achieving Net Zero

1. The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen", including:

the focus, scale and timescales of the proposed measures;

how the proposed measures—and any other recommended measures—could best be co-ordinated;

the dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated; and

potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel;

The UK Government's investment in new hydrogen generation and storage infrastructure is welcome and will support the utilisation of hydrogen-powered aircraft such as Airlander.

Due to the efficient design of Airlander, a single service will use a relatively low amount of hydrogen to power its hybrid hydrogen-fuel cell model. As a result, while hydrogen could be piped nearby to Airlander's operating sites, it doesn't require this to operate. Instead, hydrogen can be transported by road, including via low or zero-emission road haulage.

The maturation of fuel cell technologies will play a role in driving demand for hydrogen. Because Airlander is highly efficient in operation, it can make use of hydrogen fuel cells sooner than other types of aviation, helping to mature and drive the technology and then make the fundamental business case for increased supply and use of hydrogen as a net-zero fuel. To help make the case for those opportunities, the Government should provide additional funding for broader trials of hydrogen technologies in real-world settings, making the commercial case for their uptake.

2. The progress of recent and ongoing trials of hydrogen in the UK and abroad, and the next steps to most effectively build on this progress;

Hybrid Air Vehicles is ready to bring Airlander forward for manufacture, following over a decade of R&D, and has successfully flown a prototype of its aircraft.

While Hybrid Air Vehicles has not conducted a large-scale hydrogen fuel-cell powered trial, it has identified a number of viable routes that would feasibly put this into action while achieving predictable demand for hydrogen, ticket prices that are in line with current transport modes, and journey times that are competitive with current options. At the same time, each journey would generate approximately 90% less CO2 than current aircraft performing the same journeys.

Route	Sector Distance (km)	Sector Distance (NM)	Time (hrs)	Hours/Month	H2 Use (kg/Sector)	Annual H2 Used (kg)	Estimated Ticket Price (£)*
Liverpool Belfast	245	132	2.7	283.1	75	93,600	105
Cardiff Belfast	384	207	4.3	443.7	118	146,704	158
Glasgow Belfast	175	94	1.9	202.2	54	66,857	78
Liverpool Cardiff	214	116	2.4	247.3	66	81,757	93
Cardiff Exeter	87	47	1.0	50.3	27	16,619	44

While the Government has supported trials for hydrogen in transportation, these are relatively small in number and are restricted to utilising hydrogen in existing forms of transport infrastructure. Hydrogen and other net zero technologies also have the potential to open up entirely new types of low carbon transport – as well as for use in sectors like logistics, telecommunications and research - and this is where broader support would be valuable.

In order to progress the use of hydrogen further, the UK should commit to supporting broader trials of hydrogen end-use cases, which can establish the commercial case for new and emerging technologies. The UK has a strong track record of generating innovation, but support for new transport innovation typically does not continue throughout the entire TRL scale to the point of commercialisation. Support from Government to put this innovation into action can help to demonstrate the safety, net zero, and commercial advantages of hydrogen.

In the case of Hybrid Air Vehicles, for example, a trial route operated between two cities – such as Liverpool to Belfast – can make the case for a new net zero form of mobility that puts hydrogen into action.

In turn, this can then drive future hydrogen demand and begin to realise its potential to decarbonise industries.

3. The engineering and commercial challenges associated with using hydrogen as a fuel, including production, storage, distribution and metrology, and how the Government could best address these;

There are significant complexities involved in the use of hydrogen as a fuel in aviation, including its storage and the efficiency of hydrogen fuel-cell systems in providing propulsion for aircraft.

Due to the efficiency of its design, Airlander can adopt hydrogen technologies before other aircraft can, overcoming those engineering challenges in on-board storage and usage.

Government can best address these challenges by continuing to invest in research and development through initiatives such as the Aerospace Technology Institute, but also by putting technology that is ready to deploy such as Airlander into trial service to demonstrate its robust commercial potential. This will have the effect of 'pulling through' new engineering approaches and proving the viability of technologies such as hydrogen fuel-cells.

In proposing city-to-city UK-based trials, Hybrid Air Vehicles has identified routes that would be price-competitive with existing services, ensuring that the consumer can weigh up the choice of using a hydrogen-powered aircraft based on its merits.

4. The infrastructure that hydrogen as a Net Zero fuel will require in the short- and longer-term, and any associated risks and opportunities;

As previously highlighted, Airlander is an example of a use-case for hydrogen as a Net Zero fuel that can drive demand while interacting flexibly with the fuelling infrastructure.

Operating two aircraft to service a route – for example, Liverpool to Belfast – on the basis of two return flights per day, would use around a single articulated lorry's supply of hydrogen per day. Utilising cryogenic storage, a single lorry could provide four days of supply.

While it could benefit from being co-located with pipelines or adjacent to hydrogen production facilities, this means Hybrid Air Vehicles can also operate remotely within reason. This means that Hybrid Air Vehicles would be well placed to utilise hydrogen produced elsewhere as a result of new investment, a 'hub and spoke' model. So, Government investment in hydrogen can rapidly create impact through Airlander.

5. Cost-benefit analysis of using hydrogen to meet Net Zero as well as the potential environmental impact of technologies required for its widespread use; and

n/a

6. The relative advantages and disadvantages of hydrogen compared to other low-carbon options (such as electrification or heat networks), the applications for which hydrogen should be prioritised and why, and how any uncertainty in the optimal technology should be managed.

As the recent Climate Change Committee's 6th Carbon Budget highlighted, achieving net zero and securing the future of the aviation sector demands that the sector begins to successfully introduce innovation, decarbonise and reduce emissions in line with other sectors. Two of the challenges for hydrogen adoption in aviation are the propulsion technology and delivery infrastructure required.

Hybrid Air Vehicles' Airlander provides a feasible path to deliver reduced-emissions aviation using hydrogen sooner than other aircraft can. The infrastructure required to do this is relatively low impact, as Airlander does not need to operate from existing airports, but can land on water or a sufficiently large flat area. As a result, it can operate in a way that meets the needs of the hydrogen infrastructure available – either near to the site, or 'hub and spoke'.

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