Written evidence from Rolls-Royce

About Rolls-Royce

Rolls-Royce pioneers the power that matters to connect, power and protect society. We have pledged to achieve net zero greenhouse gas emissions in our operations by 2030. We joined the UN Race to Zero campaign in 2020 and in our pathway to net zero by 2050 report, committed to ensuring our new products will be compatible with net zero operation by 2030, and that all products will be compatible with net zero by 2050.

We are a significant contributor to the UK economy, with our activities prior to COVID-19 representing 0.6% of UK GDP, or £12.1bn across our Civil Aerospace, Defence and Power Systems businesses. We support a global network of 28 University Technology Centres, which position Rolls-Royce engineers at the forefront of scientific research. Rolls-Royce is one of only two global companies able to design and manufacture aerospace engines for wide bodied aircraft and so remains a beacon for UK engineering capability.

Background to this response

Aviation is a force for good in modern society, underpinning trade, commerce, connectivity and intercultural understanding. Aviation and aerospace are complex, interconnected global industries and ultimately operate at a systems level. Carbon emissions from aviation represented 2.6% of total global (CO2) emissions prior to COVID-19, although this proportion is expected to rise as other sectors where solutions are more easily scalable decarbonise more rapidly; a challenge which the industry is strongly committed to addressing. The UK has significant competitive advantage through the established R&T and innovation ecosystem in aerospace which it can use to develop the jet zero technologies of the future based on the transformative capacity of science and technology. This represents a significant export opportunity for the UK.

Rolls-Royce is the UK's largest Civil Aerospace company, whether measured by employment, output, or R&D investment. We are at the forefront of cutting-edge technological innovations which have been driving sustainability and efficiency improvements across the aviation sector for many decades. We have over 13,000 in-service engines currently powering aircraft across the globe. More than 100,000 jobs across the UK, focused in the Midlands and North of England, are directly supported by Rolls-Royce, bolstered by an annual spend of £2.6bn with UK suppliers. Rolls-Royce sits at the centre of the UK's aviation and aerospace ecosystem and is at the centre of the Jet Zero and innovation landscape.

Key themes

Rolls-Royce welcomes the opportunity to respond to this call for evidence. Enclosed below are thoughts grouped by key themes.

Domestic aviation

- Domestic aviation presents a readily addressable near-term market for new disruptive aerospace technologies including electrification and hybrid-electric propulsion. These net zero technologies carry the benefit of being deployable without significant infrastructure development and therefore without additional embedded carbon impacts.
- Domestic aviation additionally represents an opportunity to bring new technologies to market and are a springboard to propel low-emissions technologies into the longer-haul segment.
- We are involved in concept development in the short-haul market with partners such as Vertical Aerospace, based in Bristol, with critical funding support from UK Government via the ATI. ATI-funded projects such as the Rolls-Royce ACCEL 'Spirit of Innovation' aircraft will also play an important role in developing future technologies for this market.
- We support the Government's 2040 objective for domestic aviation as set out in their Jet Zero Consultation but would urge consideration of the following factors alongside its implementation in policy:-
    - Government should ensure that the competitive position of UK aviation is not undermined by implementation of this policy through potential for non-UK routes to take market share into UK-bound destinations should domestic flights be curtailed.
    - Government should continue to support the development of technologies suitable for the short/medium-market domestic market through a continued focus on R&D investment and the articulation of a credible roadmap, specific to this sub-sector. Investment should be balanced to maximise the impact on domestic and non-domestic flights to generate the greatest possible CO2 reduction for every £1 of investment.

Efficiency within the aviation system

- Rolls-Royce has long supported modernisation of UK airspace through membership of the UK Sustainable Aviation (SA) alliance. Modernisation of airspace is one of the core pillars of SA's roadmap to a net zero carbon UK aviation sector by 2050. Delivering the modernisation of UK airspace and integrating this into neighbouring airspace systems must be a priority.

- At a systems level within the context of aviation and its ambitions to reach net zero, it should also be considered that ground infrastructure costs and roll-out plans should be actively addressed alongside aviation technology development, to ensure that both work to complementary timescales.

Sustainable Aviation Fuels (SAF)

- SAFs have the potential to significantly reduce net aviation carbon emissions. They replace current fossil-based fuels and require no significant changes to aircraft or at airports. SAFs will play an important role in the delivery of Government's ambitions for the sector. This impact will be increased when combined with the efficiency improvements brought about by the latest aerospace engine technologies such as those delivered through Rolls-Royce UltraFan.
- Government should continue its focus on pursuing mandates and could additionally benefit from focused policy such as access to finance such as green bank investment and price stability mechanisms such as contract for difference.
- We welcome the Government's focus and existing investment in SAF. There is currently a gap between the sector's ambition and desire to transition to SAFs at scale and the affordability of the fuels for operation, which is preventing the development of this sector. The UK has a significant opportunity to capitalise on this opportunity and focus on the development of high-value jobs in hubs outside of London and the South East.
- Generation of SAFs at scale will require a constant supply of reliable, highly secure, low-carbon power. Small Modular Reactors are ideally positioned to deliver this and are appropriately flexible and scalable to tailor to the needs of a developing industry; a concrete step forward here would be to classify SAF generated from nuclear sources as acceptable under the Renewable Transport Fuel Obligation (RTFO). The use of clean power in the generation of the fuel has the potential to increase the lifecycle CO2 savings associated with SAF above the ~70% available through today's production methods (compared to conventional fossil fuels), to 100%.
- In addition, SAFs will play a critical role in the transition of the Defence sector to net zero within the ambitious timeframes set out by the Ministry of Defence and individual services, such as the Royal Air Force. Defence can play a critical role in 'pump-priming' and proving out key concepts in readiness for wider adoption in civil aviation; DfT should work closely with MoD to capitalise on this opportunity.

Development of zero-emissions flight in the UK

- There is no single silver bullet solution to the decarbonisation of aviation. Rolls-Royce supports a focus on technological solutions to address the challenge.
- In their roadmap to 2050, UK Sustainable Aviation supports a broad and balanced approach to aviation decarbonisation in the UK by 2050, supporting a combination of increased investment and uptake of SAF alongside increased investment in aerospace technologies through the ATI, complemented by increasing airspace efficiency in operations.
- From a Rolls-Royce perspective a sustained and increased funding settlement for the ATI will be the single most important measure in achieving these ambitions. Rolls-Royce is already engaged in a range of innovative programmes in this area and will shortly attempt to break the world speed record for an all-electric aircraft using our ATI-supported 'Spirit of Innovation' aircraft on the ACCEL project.
- Rolls-Royce supports the need for continued investment in programmes like FlyZero which will be necessary to bring multiple technologies to fruition and to understand and develop the potential for zero-emissions flight in the UK.
- An additional challenge which should be considered in this context is that safety and certification standards must keep pace with evolving technologies.
- Electrical Vertical Take-off and Landing (eVTOL) aircraft represents another aviation pathway to connect city pairs but with different requirements for infrastructure and air traffic management. Therefore, we recommend that from a planning perspective this transport mode be considered alongside other solutions

Carbon Markets & Greenhouse Gas Removal

- Carbon markets and greenhouse gas removal methods have important roles to play in helping aerospace, and other hard to decarbonise sectors get to net zero. It is important to stress that our focus remains on in-sector CO2 reductions through new and innovative technology and operations, but also welcome the role of carbon markets in supporting customer choice.
- Government should engage in the development of the UK green taxonomy to ensure that the net zero solutions being developed and deployed in the aviation sector are favourably represented within the taxonomy to ensure continued investment and support from both the public and private sector.
- Greenhouse gas removal technologies such as Direct Air Capture (DAC) offer a medium to long term route to decoupling economic growth from increasing emissions and represent significant environmental and economic opportunities for the UK in their own right.

- We welcome the Government's initial investment in technologies such as Direct Air Capture. Increased funding support to support scale-up of Greenhouse gas removal technologies such as Direct Air Capture (DAC), and the development of enabling policy to incentivise its adoption, would help accelerate its development and deployment with material economic and societal benefits. Accelerated DAC deployment has the potential to make a significant impact on overall level of emissions in the atmosphere. There is also potential for this technology to support of Net Zero SAF production.
- DAC could also be deployed at airport sites to remove CO2 to further reduce the carbon footprint of aviation.

Non-CO2 impacts of aviation

- Non-CO2 impacts of aviation are not a well understood aspect of the overall environmental footprint of aviation and are an on-going focus of climate scientist investigation. It is important the international community reach agreements on mechanisms to address the non-CO2 impacts of aviation and the UK should support further climate science and research work into this topic.
- Combustion emissions such as NOx and non-volatile particulate matter have been the subject of engine emissions regulations at the international level such as ICAO. This is the forum where any further regulations should be developed.
- The UK already addresses NOx through engine emissions landing charges at the major airports and this remains a suitable economic instrument to push airlines and engine manufacturers to reduce NOx emissions. We are developing a lean burn combustion system for our UltraFan engine which will reduce the NOx footprint of that engine.
- Government should continue to invest in scientific research which underpins understanding of issues such as contrail development, and in doing so should ensure that there is clear and consistent separation of CO2 and non-CO2 instruments to address the different topics. We continue to support work in addressing contrail understanding at altitude and potential benefits of sustainable aviation fuels in terms of contrail radiative forcing in the recent ECLIF3 experiments on an Airbus aircraft with our engines.
- Government should ensure that there is clear and consistent separation of CO2 and non-CO2 instruments to address different policy objectives.
- Novel propulsion and fuel technologies (e.g. electrification, hydrogen, and SAF) all could have a bearing on non-CO2 impacts which will need to be understood and quantified when considering the adoption of those new technologies.

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