CONSULTATION RESPONSE

July 2019

Aviation 2050: The Future of UK Aviation

This document sets out a response to the policy proposals for the Aviation Strategy – Aviation 2050.
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1 | Summary

This document provides collective responses to Chapters 3 – Ensure Aviation Can Grow Sustainably and Chapters 8 – Encourage Innovation and New Technology of the *Aviation 2050* document, based on internal reviews within EGB Engineering. In addition, review comments specific to paragraphs have been provided where necessary to complement or provide an alternative viewpoint for consideration as part of this consultation response. The responses take into account the zero net carbon targets for 2050 announced in June 2019.

2 | Chapter 3 - Ensure Aviation Can Grow Sustainably

1. How could the policy proposals be improved to maximise their impact and effectiveness in addressing the issues that have been identified?

   The policy can be improved by providing ‘sub’ policy objectives that all require technological advancements for each sub objective, with the focus being on the various flight phases, specifically the flight phases with the greatest impact on the UK’s emissions. Given the recent Government target of achieving a net-zero carbon economy, which will include aviation, the Government will need to look at the emissions from the critical flight phases that significantly contribute to the UK’s total emissions. The take-off and climb phases constitute the largest engine power requirement and fuel demand, correlating to the biggest emissions per square mile for an aircraft taking off from the UK. As such, it is important for policy to focus on driving clean power technologies (current and potential) for the critical flight phases that apply to UK airspace in a ‘combined hybrid cycle configuration’ setting. Flying less to meet the zero emissions target according to the CCC report will not be realistic if the UK is expected to be an active player in the Global Aviation market, in addition to the forecasted increase in air travel. Furthermore, although the Aviation strategy is not concerned with increase in the generation of electricity, the impact of clean, renewable and sustainable electricity generation has to be considered alongside the supply and recharge infrastructure.

2. How should the proposals described be prioritised, based on their importance and urgency?

   A. Collaborative research and development to look at hybrid (conventional and electric) aircraft. Specifically:

   - Aerodynamically improved and integrated fuselage and distributed propulsion;
   - On-board battery usage for propulsion and Direct Current (DC) recharge demonstration using current aircraft technology;
   - Development of hybrid cycles for short to medium term that will utilise electric motors powered by rechargeable batteries and combustion jet engines for different flight phases;

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3. Are you aware of any relevant additional evidence that should be taken into account?

EGB Engineering’s research shows that the aviation sector will have a global market value of approximately £5 trillion in the next 20 years due to significant growth that is expected. The UK’s ability to compete for investment and sales of goods requires our manufacturing sector to be competitive in the form of productivity. As at 2017, the UK lagged behind Germany and France in productivity by 44% and 41% respectively. To improve on productivity, the UK Government needs robust policies that stimulate investment in SME businesses and digital and automated manufacturing.

4. What implementation issues need to be considered and how should these be approached?

A. Policies that cannot be supported by supply chain, which will impact the responsiveness of the manufacturing industry to the R&D activities being undertaken by R&D centres in institutions, businesses and academia – This can be rectified by creating synergies with local R&D centres and in other countries to improve the responsiveness of the local supply chain to changes. Sustainability should have the supply chain at the heart of the supporting policies to increase competition, create new skills, increase innovation in a responsive manner, which will increase the maturity of products and accelerate learning required to manufacture the products, leading to early reduction in cost.

B. Policies are not linked to the technological goals meaning the expected actions to drive progress in the technological development from early stage to realisation are poorly implemented due to misaligned polices - Policies that drive R&D funding and resources should be directly linked to the technological development. The policies design should focus on strategic technological goals for a specific technology theme to encourage gated innovative milestones to be met that are in line with funding requirements, which that are directly linked to the policy mixes. This will stimulate rapid innovation and disruption. See below link for an insight on energy mixes researched by EGB Engineering, which could be adopted for aviation. [https://egb-eng.com/how-can-we-determine-the-right-energy-mix-for-a-country/](https://egb-eng.com/how-can-we-determine-the-right-energy-mix-for-a-country/)

C. Gaps in policy design to specifically tackle safety of innovative technology, which means safety guidelines are slow to be defined, which will result in technology being realised and introduced without robust safety guidelines in place. Current negotiations with the EU will further propagate this as the role of the CAA post leaving the EU is not fully understood. – The approach that is recommended to be adopted is for the CAA to be integral in policies based on a post Brexit relationship that should see all regulations transferred from EASA to CAA to be re-enacted. Furthermore, the CAA’s role post leaving the EU should be one of strategic pre-emption rather that reactive. This will require close engagement with the R&D activities. This will also minimise the regulatory burden effects that will accompany new developments in hybrid and electrical systems.

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and accompanying radical new air vehicle designs. Furthermore, batteries in the form being developed, is an area with least knowledge from a regulatory stand point so it would be important to define early-on what the requirements are.

5. What burdens, both financial and regulatory, are likely to need to be managed and how might those be addressed?

A. Without the EU funding programme, the responsibility to stimulate R&D rests with the Government and aviation would perhaps need prioritising but the level of prioritisation should be similar to what was experienced under our membership with the European Union where initiatives such as CleanSky and Horizon 2020 accelerated a lot of investment in the sector. A commitment to allocating a percentage of GDP or of total revenue received from aviation should be part of the policy to guarantee the investment.

B. Current negotiations with the EU hampers the CAA regulatory position with no regulations directly being managed by the CAA. This can be addressed by giving more powers to the CAA to be integral in policies based on a post-Brexit relationship that should see all regulations transferred from EASA to CAA to be re-enacted. Furthermore, the CAA’s role post leaving the EU should be one of strategic pre-emption rather that reactive. This will require close engagement with the R&D activities.

6. Are there any options or policy approaches that have not been included in this chapter that should be considered for inclusion in the Aviation Strategy?

The development of autonomous flying taxis known as Urban Air Mobility (UAM) projects. There are opportunities for synergies of technologies, which will encourage learning from experience but also will encourage robust policies, which can be utilised for future aviation projects.

7. Looking ahead to 2050, are there any other long-term challenges, which need to be addressed?

A. Replacing the nuclear power plants that represent 20% of current UK’s energy mix to support a hybrid to fully electric propulsion strategy.

B. Improving productivity of the UK workforce.

C. Streamlining the flight path as more flights become available. This will place heavy reliance on safety systems. Current issues with the Boeing 737 Max and the anti-stall technology is evidence of how lack of knowledge on the flaws of the system meant that regulatory bodies were not able to ensure a safe aircraft.

8. To what extent does the proposed partnership for sustainable growth balance realising the benefits of aviation with addressing environmental and community impacts?

The areas of focus as highlighted in Figure 8 of the consultation document provide a reasonable balance between growth and environmental and community impacts but it is unclear how the balance accommodates
technological development to support the framework. A ‘Smart’ interlinked system is recommended to support this framework which will enable better ‘informed’ communication to ensure social-economic and environmental aspects are given the equal attention needed.

Without this joined up relationship supported by smart technology, the potential merits of the framework will not be realised and the trust of the communities in the Government with the reputation in Government to deliver, will be lost.

9. How regularly should reviews of progress in implementing the partnership for sustainable growth take place and are there any specific triggers (for example, new information or technological development) that should be taken into account?

Annual reviews are recommended. Triggers should be based on milestones for overall policy objectives associated with technology, safety and aviation passenger trends being achieved, or late in delivery. Further triggers could include CCC reviews and Climate Change Act ‘carbon budget’ periods.

3 | Chapter 8 – Encourage Innovation and New Technology

1. How could the policy proposals be improved to maximise their impact and effectiveness in addressing the issues that have been identified?

Policies on automation to improve security are better suited to chapter 6. EGB Engineering wishes to recommend that the Government prioritise increasing productivity through automation and R&D.

2. How should the proposals described be prioritised, based on their importance and urgency?

In view that the suggestion in Q1 will be implemented, the priority should be

1. Investment in R&D to further hybrid and next generation propulsion and aircraft systems
2. Investment in SME and drive automation to increase productivity and maintain competitiveness.

3. Are you aware of any relevant additional evidence that should be taken into account?

The Government should consider the approach in driving the technological revolution in renewables and the disruption of the energy market particularly coal-fired plants.

4. What implementation issues need to be considered and how should these be approached?

Technology and Safety should be intertwined in the R&D. The problem is the CAA in terms of regulation will not be able to enforce the regulations because of the impending exit from the EU. EASA’s framework is currently adopted across the EU and through such regulations, the UK benefits from bilateral trade with the
US, Canada and Brazil. In the event that the default position is to re-enact the EASA regulations into UK law to be enforced by the CAA, the R&D activities will have to consider different regulations in different countries.

5. What burdens, both financial and regulatory, are likely to need to be managed and how might those be addressed?

With regard to finance, the UK Aerospace industry benefits from allocated R&D subsidies from the EU, which may not be matched by the UK Government. Access to EU funding through the funding R&D schemes such as CleanSky and Horizon 2020 have benefitted the UK immensely. The UK Government will have to deal with the financial burden of balancing the budget and matching funding in the Aerospace and Aviation sectors at the expense of other sectors. With regard to regulation, see response to Q4.

6. Are there any options or policy approaches that have not been included in this chapter that should be considered for inclusion in the Aviation Strategy?

Materials used in the manufacturing of airplanes are some of the most rare and sophisticated in the world and with finite resources, sustainable manufacturing and recycling of components need to also be at the heart of the technological revolution and this 2050 Aviation strategy as a whole.

7. Looking ahead to 2050, are there any other long-term challenges, which need to be addressed?

Congestion, not just at airports but as air travel increases and routes become optimised for efficiency. Congestion in the skies should be a factor to consider and technology will be required to minimise the impact on aircraft in-flight stability from other aircraft being in close proximity. Furthermore, technology will need to be enhanced to cope with traffic in the skies and avoid collisions.

8. To what extent are the Government’s proposals for supporting innovation in the aviation sector the right approach for capturing the potential benefits for the industry and consumers?

By engaging industry, agencies and academia, the Government is adopting a conservative approach in an industry that has seen heavy consolidation in the last 30 years. This means that only well established organisations that have the financial reach and resources at their disposal can come up with the innovative solutions of tomorrow. The Government should go above and beyond and set up specific funding schemes for individuals and SMEs with aviation and aerospace backgrounds and expertise, who wish to set up their own businesses and/or grow their businesses, respectively. This can stimulate technological growth and innovation, increase productivity and maintain the UK’s competitiveness post Brexit. For consumers, the challenge is always engagement. The Government needs to communicate its policy ideas to engage the user. This level of information will give the user confidence that the Government is at the heart of these changes and will back the changes. The advancements in technology must have the consumer at the heart of the solutions, thus improvement of our air, reduction in greenhouse gases, creating jobs and improving the economy are all benefits to the consumers and will result to positive consumer engagement.

9. Do the proposals in this chapter sufficiently address the barriers to innovation?

The proposals provide a good framework in an attempt to engage with the sector and address some of the barriers to innovation. However, EGB Engineering feels that the Government needs to align its policies with the
technological aims of each solution rather broad definitions. For instance, specific policy sets should focus on next generation aircraft to bring about a significant reduction in CO$_2$ emissions. Within such a policy set, there should be specific strategies for the engines/propulsion systems and aircraft design as well as safety. Negotiating with industry as to what can be achieved rather than driving a policy that sets targets for achievements in line with the ambitions of the Government will not expedite the solutions. This is even more crucial with the UK leaving the EU. Furthermore, the barriers to innovation are rooted in access to funding. Whereby this was heavily supported by the EU, the UK Government will need to match the influx of investment and support more SMEs and individuals who what to start their own businesses. There are a lot of capabilities that the UK doesn’t have with regard to parts and components precision machining, and specialist component and assembly manufacture. The skills required to make such components and assemblies are in short supply in the UK. The big aerospace UK firms have expertise in the R&D, design, innovation and assembly, and the processes regarding certification. However, manufacturing of low level components and the testing of these are usually done outside of the UK. A drive to bring such capabilities back to the UK needs to be pursued to maintain our competitiveness including supporting the manufacturing capabilities with digital automation to improve productivity.

3.77 – Aviation makes up 3% of the EU’s current greenhouse gas emissions. Apart from potential increases due to decarbonisation of industries, expansion of UK airport capacities means that the UK will increase its foothold in the European connectivity hub. This may mean that aviation could significantly represent more than 25% of the UK’s greenhouse gas emissions by 2050. This potential increase provides an opportunity to start to trial some promising technologies and hybrid cycles to make sure that there is a steady decrease leading up to 2050.

3.79 – A greater demand for short haul flights does not have a significant benefit because time at cruise conditions where fuel burn is less, is reduced in comparison to long haul flights. Furthermore, there are more increased frequencies per existing route and new routes that have been created in that period. Higher load factors have also not offered significant savings because there are other airlines with lower load factors. Rather, airlines have become better at optimising the fuel load with the passenger load to ensure excess fuel is not being carried. Furthermore, increased restrictions on carry-on baggage on airlines such as Ryan Air means that this has changed the behaviours of passengers meaning that passengers now travel lighter than before.

3.81 – EGB Engineering would provide an alternative view to the last bullet point. This is because there are noise and emissions requirements that are covered in the regulations. Operational and technical improvements are less likely to bring about increases in noise and air quality because of the restrictions already in place to adhere to them for maintain compliance to the requirements.

3.83 – This may not be necessary. In light of the Paris Agreement being ratified, it is expected that ICAO would default to the Paris Agreement in terms of defining goals that are consistent with the minimum temperature requirements. Rather, the UK should attempt to take the lead (which it has done) by using quantitative research to determine feasible emissions target in the short to medium term with the current technology of engines, fuels and batteries. In doing so, the UK Government with the help of industry experts and academia, can assess what future technologies aim to deliver and their timeframe for maturity.

3.86 – See comment on 3.83

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3.96 – Engines are expected to become fully integrated as part of future aircraft technologies so the current approach of propulsion design and development is likely to change.

Note: Reduction in GHG requires chapter 8 to effect significant change.

8.2 Additional benefits include improving fuel efficiency, reducing fuel burn and bringing about a revolution in the design of next generation propulsion systems to meet the 2050 emissions target.

8.3 How does this amount compare with investment received from the EU? The UK Government will need to match/exceed R&D funding received by UK, from the EU in light of our exit from the EU. This is necessary to maintain the UK’s competitive edge and to rapidly advance the R&D of next Gen aircraft.

8.5 Automation in EGB’s view is an opportunity that is associated with increasing our manufacturing capabilities and productivity in the UK in comparison to other countries such as Germany and France. Automation with regard to flight has its challenges in terms of achieving a higher degree of automation at the expense of safety, user acceptance e.t.c and these are not really a pressing matter for aviation and technological innovation in aerospace. This is best aligned with the objectives of chapter 6.

8.6 This paragraph is a perhaps best served if raised in chapter 6.

8.7 The need for automation in manufacturing as a priority will be to enhance the UK’s productivity levels in order to maintain manufacturing relevance and competitiveness. The safety aspect and benefits of automation to move towards single crew operation, is best served in chapter 6.

8.8 Technology could help with tracking and co-ordinating the unmanned portion of the air traffic. However, technological innovation is implicitly part of aviation and aerospace. The challenge will be determining the safety protocols and process that would underpin the technology.

8.9 same as 8.8

8.13 The drones market is an example of recent commercialisation. One of the lessons to be learnt is to integrate the use of drones into a regulatory framework early to avoid some of the recent problems experienced such as proximity of drones to commercial flight path and the regulation and enforcement of it. One of the ways in which Government can support is to enforce the development of novel aircraft under the CAA regulatory framework to ensure compliance in design and operation.

8.15 The UK has a thriving aerospace sector due to the competitive advantage afforded by the EU (level playing field). With our impending exit from the EU, the UK will not have access to tariff free manufacturing capabilities at the lower-tier of manufacturing. Countries such as Germany, France and Poland have such manufacturing capabilities. This strategy perhaps requires the UK to invest in SMEs, encourage companies to invest in new machinery to improve productivity and invest in the right types of crafts and apprenticeships.

8.21 The data quality needs to be heavily linked to the user’s journey from door, to airport, and within the airport (check-in, security, boarding) and arrival at final destination. However, the key challenge is standardisation because different airports provide different user experiences. There is also the security aspect of the data and deciding on what needs to be open and what doesn’t need to be open. It is important in today’s world to know who your doctor is on the day prior to visiting him/her and their performance/track record. This level of openness is what society has come to expect. This has security implications when it is applied to pilots.
8.22 Government policies need to be developed around the detailed and preferred/Government-priority objectives of next generation aviation technology in order to accelerate the investment and drive the focus of industry and academia in the right direction. This will have the benefit of causing disruption to the current technologies. Regulation is a necessity for the industry and as such the innovation to be underpinned by the regulatory framework or at least consideration of it. Communication can be improved and this can be through a co-ordinated channel, which will deliver periodic updates on policy, technology and the players involved. This is also applicable to 8.27 & 8.28.

5 | About EGB Engineering LTD U.K.

EGB Engineering is a U.K. registered company with expertise in the field of power and propulsion. We provide quality engineering products and services to OEM and End User clients such as Rolls-Royce (U.K & Germany), Safran (France) and United Technologies (US). The company operates in various sectors including such as Aerospace, Defence, Energy (low carbon and renewables) and Nuclear.

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