

Unforeseen consequences – the cost to the UK’s aerospace industry of losing EU support



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Direct and indirect European Union involvement in UK aerospace programmes

Introduction

Between 2016 and 2020 the European Union (EU) plans to invest, directly and indirectly, €4.7 billion in aerospace research and operational programmes throughout the EU. As the EU's largest aerospace sector the UK has traditionally received around 15% of total EU investment. The EU currently provides around €140 million of funding directly to UK civil aerospace research¹ but this figure is due to increase rapidly over the coming years. EU support for research and development in areas such as global navigation satellite systems (GNSS) and air traffic management is now being converted into support to deployment - with revenues and benefits from many of these programmes due to materialise significantly in 2018-2020, just as the UK will be leaving the Union.

The UK's industry is part of a globally integrated aerospace sector. But those areas where aerospace companies operate in a highly regulated market, such as defence, space and air traffic management, the UK is institutionally bound into complex funding frameworks of long-term multi-national research programmes. The UK government, via the European Commission (EC), has been helping to fund billions of euros of investment into Clean Sky, SESAR, Galileo and EC framework research programmes (see below). There is now a real threat that, without a successful renegotiation of the UK government's role in these programmes post-Brexit, the benefits of this funding will not become fully accessible to UK industry but will flow instead to EU competitors.

The priority threats, in terms of potential loss of revenue and capability to the UK's aerospace and defence industrial base, are:

- *Leaving the Galileo GNSS programme: The €3.4 billion deployment phase of Galileo is entirely financed by the EU's budget. The market for satellite navigation services has been growing steadily and is expected to be worth €250 billion per year by 2022. UK companies Laird, CSR and Cobham are major players in this market. On leaving the EU, UK industry will no longer have access to the future direction of Galileo programme nor GNSS research funding as part of the EU's Horizon 2020 (see below) and future framework research. The UK has been heavily involved in the development of Galileo system's Public Regulated Service, which provides encrypted signals for military and government customers. The future of access to this system is now uncertain.*
- *Leaving Clean Sky. With 145 participations the UK is the EU's most involved Member State in the Clean Sky research programme. Rolls-Royce's work leading the Sustainable and Green Engine² Clean Sky research programme provides many of the core technologies for the company's open rotor future engine work. GKN Aerospace is a key participant in the Breakthrough Laminar Aircraft Demonstrator in Europe (BLADE) programme to test and measure the benefits of 'natural laminar flow' (NLF) wing designs*
- *Leaving SESAR. SESAR 2020 will work with a budget of €1.5 billion, of which €500 million will be provided by the European Union and the rest by Eurocontrol and industry. The total cost*

¹ <http://www.defense-aerospace.com/articles-view/release/3/174840/uk%E2%80%99s-aerospace-industry-makes-case-against-brexit.html> "Every year, the EU funds almost £100m (\$141m) in UK R&D, supporting UK jobs, innovation and exports. On top of this, the UK stands to gain £2.5 billion (\$3.5 billion) in space R&D funding by 2021 if we stay in the EU,"

² <http://www.rolls-royce.com/about/our-technology/research/research-programmes/sustainable-and-green-engine-sage-itd.aspx#open-rotor-technology>

of developing and deploying SESAR has been estimated at €30 billion³. Of the €20 billion to be spent in the deployment phase, more than half is expected to come from airspace users. It is unclear what rights the UK will have to accessing future safety, capacity and environmental ATM technologies developed by SESAR, especially vital technologies for drone operations and cyber security.

- *Leaving the European Defence Agency. It would be difficult to see how the UK could go it alone in liaising with SESAR programme managers its own policy for military SESAR-compliant avionics re-equipment and new SESAR-compliant procedures, or working with Eurocontrol, EASA and other relevant bodies on a separate series of UK protocols for integrating military drones in controlled airspace. The EDA is managing a €45 million fund for drone research, integration and software development.*
- *Leaving the European Aviation Safety Agency. The UK would likely have to follow the example of members with no voting rights such as Norway and Switzerland– who have to follow the same European safety regulations outlined by EASA, but lose the ability to significantly shape their development. Instead these will be formulated by experts from the largest EU aerospace States – France, Germany, Italy and Spain.*

The EU's aerospace activities span civil and military programmes and the UK government will have to now consider how to either renegotiate its participation in these activities or repatriate research and programme support work.

The European Commission

- *promotes* the sustainable competitiveness of European aerospace industries (see “Focusing on drones”)
- *represents and defends* the EU aerospace industry in dispute settlements at the World Trade Organisation, in particular, developing EU trade policy⁴ support on the issue of US government subsidies to Boeing
- *helps* to fund and coordinates multi-billion euro research and development programmes through the Horizon 2020 research programme under the “Smart, Green and Integrated Transport challenge” and two Joint Technology Initiatives, “Clean Sky” and the “SESAR Joint Undertaking”.
- *helps* mitigate the growing impact of aviation on the environment by setting targets, measuring emissions and noise levels and working with global bodies to reduce aviation's environmental footprint
- *supports*, through its EU aviation policy, the air transport sector by developing common safety standards and procedures through the European Aviation Safety Agency, a common European aviation market, a Single European Sky air traffic management integration programme and an External Aviation policy.
- *develops* with industry partners strategic aerospace programmes such as the Galileo global navigation satellite system

The European Defence Agency (a European Council body)

- *promotes* common EU military airworthiness standards
- *supports* the integration of drones within civil controlled airspace and supports European industry increase its competitiveness in this sector

³ <http://airlines.iata.org/analysis/air-traffic-management-funding-future-atm>

⁴ http://ec.europa.eu/trade/policy/index_en.htm

- *supports* the development of EU wide assets such as air to air refuelling, training, procurement, transport aircraft assets
- *increases* Member States access to space assets, European Commission funds for research into dual-use technologies
- *defends* EU Member State access to spectrum allocation for military communications
- *represents* EU Member States military interests in European Commission programmes such as the Galileo GNSS programme and SESAR

These bodies involve a complex web of inter-governmental and public-private consortia which will have to be unravelled once the UK has triggered its formal intention to leave the EU.

The European Commission also has had a key role to play in the development of a single aviation market for Europe, opening up the EU to increasing airline competition, boosting the market for new aircraft, airport and air traffic management (ATM) technologies. The aviation market was gradually liberalised through three successive packages of measures adopted at EU level which covered air carrier licensing, market access and fares. In December 2015 the European Commission adopted an Aviation Strategy for Europe⁵, based on four pillars: negotiating new external aviation agreements, tackling limits to growth – such as airport and airspace congestion – increasing environmental and safety standards and deploying new safety and capacity enhancing technologies. The European Union’s direct involvement in the EU’s civil aerospace market are outlined in it is “Flightpath 2050” roadmap.⁶ The high level goals are:

- Meeting societal and market needs
- Maintaining and extending industrial leadership HORIZON 2020 Work Programme 2016 - 2017
- Protecting the environment and the energy supply
- Ensuring safety and security
- Prioritising research, testing capabilities and education

Near-term aims include further international cooperation based on in the setting up of public-private partnerships in Japan, China and Canada and ongoing initiatives with United States, Russia, Brazil and Australia.

Focusing on drones

The European Commission has targeted the remotely piloted air system (RPAS) or drone market as an area where European industry needs to rapidly increase its share of the global market. According to the Commission within 20 years, the European drone sector is expected to directly employ more than 100 000 people and have an economic impact exceeding €10 billion per year, mainly in services. To this end it has developed an integrated strategic industrial and regulatory civil drone support programme which it has outlined in its March 2015 Riga Declaration.⁷

⁵ http://ec.europa.eu/transport/modes/air/aviation-strategy/index_en.htm

⁶ <http://ec.europa.eu/transport/modes/air/doc/flightpath2050.pdf>

⁷ <http://ec.europa.eu/transport/modes/air/news/doc/2015-03-06-drones/2015-03-06-riga-declaration-drones.pdf>

The European Aviation Safety Agency

The European Aviation Safety Agency (EASA) is an agency of the European Union established in 2002 to ensure a high and uniform level of safety in civil aviation, by the implementation of common safety rules and measures.⁸ The agency's responsibilities include:

- Expert advice to the EU on the drafting new legislation;
- Developing, implementing and monitoring safety rules, including inspections in the Member States;
- Type-certification of aircraft and components, as well as the approval of organisations involved in the design, manufacture and maintenance of aeronautical products;
- Certification of personnel and organisations involved in the operation of aircraft;
- Certification of organisations providing pan-European ATM/ANS services;
- Certification of organisations located outside the territory subject to the EC law and responsible for providing ATM/ANS services or ATCO training in the Member States where EC law applies;
- Authorisation of third-country (non EU) operators;
- Safety analysis and research, including publication of an Annual Safety Review.

The Agency may adopt various types of act. It may:

- Take binding individual decisions by granting aircraft type certificates and by conducting inspections and investigations;
- Issue non-binding documents containing certification specifications, acceptable means of compliance and guidance material (for use in the certification process) and present opinions to the European Commission on the essential requirements and implementing rules to be adopted.

These tasks are performed by EASA on behalf of all Member States. On leaving the EU the UK will either have to reach a new agreement with EASA for the agency to continue safety oversight of the UK or to redirect some of these responsibilities to the UK's Civil Aviation Authority (CAA). EASA does have working arrangements in place with non-EU States such as Armenia, Albania, Bosnia-Herzegovina, Georgia, Macedonia, Moldova, Montenegro, Norway, Serbia, Switzerland, Turkey and Ukraine.

Analysis: According to the UK's Aerospace, Defence, Security and Space trade association ADS⁹: "At a time when EASA is likely to undergo a significant change in its regulatory oversight, a potential 'Brexit' could mean the UK and UK industry, has less of a say in the development of these new regulations. As an EU member, the UK is able to have a say as the new Commission proposals pass through the legislative process, and once implemented, has voting rights on EASA's main decision making body, the EASA Management Board. By leaving the EU, the UK would likely have to follow the example of members with no voting rights such as Norway and Switzerland– who have to follow the same European safety regulations outlined by EASA, but lose the ability to significantly shape their development."

⁸ [http://www.skybrary.aero/index.php/European_Aviation_Safety_Agency_\(EASA\)](http://www.skybrary.aero/index.php/European_Aviation_Safety_Agency_(EASA))

⁹ <https://www.adsgroup.org.uk/author/richard-gale/>

The European Defence Agency (EDA)

The EDA was created in 2004 “to support the Council and the Member States in their effort to improve the European Union’s defence capabilities for the Common Security and Defence Policy.” It has a growing presence in the military aviation/aerospace sector as EU Member States have sought to find synergies in equipment development and procurement, including creating a single defence market for military goods within the EU and creating common procurement methods for a range of services. It is also creating common standards and agreements for a range of vital aerospace related services, including integrated drones within EU airspace, a common approach to defending spectrum allocation, military satellite communication protocols, providing a common EU military approach to integrating military aircraft within the EU’s Single European Sky programme, and air to air refuelling services. It is a key player in helping generate €1 billion needed to develop the next generation of European drones, for a global market of €10 billion/year by 2020. Since 2004 the EDA has managed over 160 projects worth €1 billion.

Military airworthiness

The EDA’s Military Airworthiness Authorities (MAWA) Forum oversees the development of the European Military Airworthiness Requirements and promotes ways of achieving the harmonisation of military airworthiness regulation and certification processes across Europe. Expected time savings of 50% in the development of new aircraft » Cost savings of more than 10% on government and industry side Pooled Procurement

Remotely piloted aircraft systems

Integration of military drones in European skies through research & technology programmes. The MIDCAS project contributes to RPAS integration in civilian airspace by proposing a baseline of solutions for the "Unmanned Aircraft System Mid-air Collision Avoidance Function". It was launched in 2009 by five contributing Member States (France, Germany, Italy and Spain under the lead of Sweden) under the framework of the EDA with a total budget of €50 million.

Governmental Satellite Communications

The objective is to develop the next generation of government satcom systems by 2025

Air-to-Air Refuelling

Supporting and facilitating the pooled acquisition of new tanker/transport aircraft for European air forces. It is helping to find synergies with French and UK initiatives in terms of support and working towards common AAR systems and procedures.

Analysis: On leaving the EU the UK will have to decide which EDA activities it would like to continue - and thereby negotiate a new working relationship – and which will require repatriation. It would be difficult to see how the UK could go it alone in liaising with SESAR programme managers its own policy for military SESAR-compliant avionics re-equipment and new SESAR-compliant procedures, or working with Eurocontrol, EASA and other relevant bodies on a separate series of UK protocols for integrating drones in controlled airspace.

European Advanced Biofuels¹⁰

Uptake of sustainable alternative fuels in the aviation sector is very slow, but assumed to play a large role in reducing aviation greenhouse gas emissions in the coming decades. The European Advanced Biofuels Flightpath provides a roadmap to achieve an annual production rate of 2 million tonnes of

¹⁰ <https://ec.europa.eu/energy/en/topics/biofuels/biofuels-aviation>

sustainably produced biofuel for civil aviation by 2020. Potential emissions savings from using biofuels may be as large as 80%, but depend highly on the feedstock type and the production processes.¹¹

European commercial flights have trialled sustainable alternative fuels. However regular production of sustainable aviation alternative fuels is projected to be very limited in the next few years, and thus it is unlikely that the roadmap 2020 target will be achieved.

Editor's note: Progress on an EU alternative fuel programme appears to have stalled recently and the impact of the UK disengaging from this programme would appear to be minimal.

The European Investment Bank (EIB)

The EIB helps fund four aviation/aerospace sectors -airport development, air traffic management, aircraft manufacturing¹² and aircraft acquisition. The EIB has been a major supporter of trans-national EU aerospace research and development; since 2011 it has directly funded Airbus Group research and innovation and related projects by €1.3 billion.

Analysis: The UK has a 16.11% shareholding in the EIB, is one of the four main shareholders of the Bank and nominates a member of the EIB Management Committee. On leaving the EU it will give up its shareholding and management position in the bank. It is yet unclear how or whether this will effect EIB support to Airbus UK and UK ATM business seeking funds to implement SESAR safety/capacity/efficiency enhancing technology acquisition.

The European Space Agency¹³

In May 2007, the 29 European countries expressed their support for the European Space Policy in a resolution of the Space Council, unifying the approach of ESA with those of the EU. The main objective of this policy is to guarantee European access to space. With the entry into force of the Lisbon Treaty in 2009, EU countries conferred a stronger role in space matters onto the EU. In a key policy document published in 2011 (Towards a space strategy for the European Union that benefits its citizens), the European Commission identified four key objectives for the EU's space strategy:

- promote technological and scientific progress;
- foster innovation and industrial competitiveness;
- ensure that European citizens fully benefit from European space applications;
- strengthen Europe's role in space at an international level.

The EU directly manages three space programmes and between 2014 and 2020, over €12 billion will be spent on their implementation:

- **Satellite navigation:** The *Galileo* and *EGNOS* programmes which provide positioning, navigation, and timing information worldwide.
- **Earth observation:** The €4.3 billion *Copernicus* programme which provides Earth observation data and information.

¹¹ <http://ec.europa.eu/transport/modes/air/aviation-strategy/documents/european-aviation-environmental-report-2016-72dpi.pdf>

¹² Research, development and innovation (RDI) projects as well as projects involving the construction of aircraft manufacturing plants. RDI projects are primarily aimed at reducing greenhouse gas emissions through new materials and improved airframe engine design, helping to develop sustainable fuels and improving operating efficiency.

¹³ <http://www.esa.int/ESA>

- **Space research:** Part of the *Horizon 2020* programme focuses specifically on space technologies, applications (e.g. GNSS and Earth observation), weather, sciences, exploration, and other space related topics.

EU GNSS costs and revenues¹⁴

Total costs of the development phase which was launched in 2003 under the auspices of the ESA is currently around €2400 million, with the EU providing roughly up to two-thirds of the funding. The **deployment phase** (so-called FOC phase) is entirely financed by the EU's budget. Of the total €3405 million made available, €560 million were re-attributed to the development and validation phase and around €2400 million are earmarked for the deployment phase of Galileo. €417 million have been set aside for EGNOS. The total cost of implementing EGNOS to date has been around €1100 million. Of this, more than €400 million were financed by ESA, €200 million came from previous EU financing programmes and €417 million have been made available under the current budget framework. The annual operating costs of Galileo are in the order of €800 million per year. The revenue is estimated to be in the order of €80 million per year on average, in constant prices in 2011 (source: the Impact Assessment accompanying the new Regulation proposal). EGNOS is now operational and does not need additional budget for completion, over and above what is earmarked in the current budget. With the entry into operations of the Safety-of-Life service, EGNOS will enter the next phase of its life-cycle.

As regards Galileo, costs for the completion of the ground and space infrastructure and for the exploitation of Galileo and EGNOS are estimated at €1 billion per year on average over the next two decades - without escalation.

The cumulative direct benefits emanating from the GNSS downstream market are estimated to amount to €14 billion over the next 20 years.

Analysis: The European Space Agency is an intergovernmental organisation, separate from the EU and there are two ESA members, Switzerland and Norway, which are not EU states. So the UK could remain part of ESA, which accounts for three-quarters of UK space expenditure. But the impact of the UK leaving the EU is likely to have a significant impact on the EU space programmes Galileo, Copernicus and Horizon 2020. ESA contracts funded by the EU can only be granted to companies from an EU country. Surrey Satellite Technology Limited (SSTL a UK company within the Airbus Defence and Space group) is responsible for the development, assembly, integration and test of 22 navigation payloads and ESA has set a deadline of July 19, 2016, for industry to bid on the next Galileo satellite series and the OHB-SSTL team that won the previous order is in the bidding for the next Galileo project. It will be an early test of the long-term consequences to the UK's space industry of Brexit. The UK has also been heavily involved in the development of Galileo system's Public Regulated Service, which provides encrypted signals for military and government customers. The UK government will need to negotiate urgently with the EU its future participation in the programme.

But the implications for the UK's GNSS industry could be even more severe in the long term. The market for satellite navigation services has been growing steadily and is expected to be worth €250 billion per year by 2022.

Independent studies show that Galileo will deliver around €90 billion to the EU economy over the first 20 years of operations. This includes direct revenues for the space, receivers, and applications

¹⁴ http://europa.eu/rapid/press-release_MEMO-13-718_en.htm

industries, and indirect revenues for society such as more effective transport systems, more effective rescue operations, etc. UK companies Laird, CSR and Cobham are major players in this market; UK industry and government will have to seek to increase the country's share of this market from outside the programme management board. Further, on leaving the EU, UK industry will no longer have access to GNSS research funding as part of the EU's Horizon 2020 (see below) and future framework research; two EGNSS calls within Horizon 2020 have already been outlined were opened so far, with a budget of €38 million and €25 million respectively. The projects are expected to develop applications in the key GNSS segments of road, aviation, location based services, maritime, rail, agriculture and surveying/mapping.

There is also now considerable uncertainty in regard to the UK's position within the €4.3 billion Copernicus programme, comprising several Earth observation missions, with applications ranging from climate change to oil drilling opportunities. Once in space, the satellites are owned by the EU. ESA Director-General Johann-Dietrich Woerner has said the impact of Brexit on Copernicus is for the moment unknown.¹⁵ A financial review of the programme is scheduled for later this year.

European Structural and Investment Funds programme

The European Structural and Investment Funds programme supports investment in innovation, businesses, skills and employment and create jobs. Running from 2014 to 2020, there are four types of funds involved in the programme.

- European Regional Development Fund (ERDF) supports research and innovation, small to medium sized enterprises and creation of a low carbon economy
- European Social Fund (ESF) focuses on improving the employment opportunities, promoting social inclusion and investing in skills by providing help people need to fulfil their potential
- European Agricultural Fund for Rural Development (EAFRD)
- European Maritime and Fisheries Fund (EMFF)

For aerospace, the ERDF is a major source of funding for research into advanced aerospace manufacturing and provides support to many small and medium sized (SME) UK companies. In March 2015 the government announced the UK would receive €3.6 billion (approximately £2.9 billion)¹⁶ in ERDF funds for England. The ERDF Operational Programme¹⁷ is made up of the following funding priorities:

- strengthening research, technological development and innovation
- improving access to, and use and quality of, information and communications technology
- increasing the competitiveness of small and medium sized enterprises
- supporting the shift towards a low carbon economy in all sectors
- supporting climate change adaptation, risk prevention and management
- preserving and protecting the environment and promoting resource efficiency
- encouraging sustainable transport and removing bottlenecks in key network infrastructures in Cornwall and the Isles of Scilly
- technical assistance

¹⁵ <https://euobserver.com/science/133375>

¹⁶ <https://www.gov.uk/government/speeches/european-regional-development-fund>

¹⁷

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/441622/ERDF_OP_Executive_Summary_FINAL_030715.pdf

EU regional and investment funds have included a new strategic approach to economic development through smart specialisation. The University of Sheffield Advanced Manufacturing Research Centre (AMRC) has been established as a €18 million collaboration between the University of Sheffield, Boeing, the ERDF and the UK government to establish a cluster of industry- focused manufacturing R&D centres and supporting facilities. Encsite¹⁸ is a programme to help East Midlands SMEs grow through access to resources, workshops, technology and funding; the £14 million programme is part funded by ERDF and is a collaboration between Derby Council and three university partners – Aston, Cranfield and Derby Universities. The Aerospace Supply Chain Excellence (ASCE) 2 Programme¹⁹ is a £11.4 million programme created by the Northwest Aerospace Alliance (NWAA) to improve the performance of the Northwest Aerospace sector. It receives £6.4 million public sector funding from the ERDF and BIS - formerly the Northwest Regional Development Agency (NWDA). It also receives close to £5 million in contribution in kind from the Northwest aerospace companies.

The Cornwall and Isles of Scilly Growth Programme is a £30 million EU-supported investment fund focusing on space and aerospace along with four other sectors. The iNets South West network of innovative SMEs has been supported by £13 million of funding from the ERDF and in Bristol the National Composites Centre²⁰ was developed with ERDF funding of £9 million to put the UK at the forefront of composites technology. In Coventry²¹ the ERDF has provided funding for sustainability consultancy and solutions for aerospace SMEs within the West Midlands Region. Meanwhile the Advanced Manufacturing Supply Chain Initiative²² (2012 to 2020) (£157.5 million) advanced manufacturing supply chain fund for supply companies (SMEs), focused on near term R&D, innovation and capital assets, has been developed by the EU to support aerospace and automotive SME suppliers in the Midlands and Liverpool areas of the UK.

Analysis: Direct support to UK regional aerospace advanced manufacturing initiatives as part of the ERDF is running at around €12 million a year. New sources of government revenue will be required to replace this.

Clean Sky²³

The Clean Sky research programme was set up in 2008 to develop pre-competitive research programmes across the EU's aviation industry to meet the Advisory Council for Aeronautics Research in Europe (ACARE) research targets by 2020 of:

- 50% reduction of CO2 emissions through drastic reduction of fuel consumption
- 80% reduction of NOx (nitrogen oxide) emissions
- 50% reduction of external noise
- A green product life cycle: design, manufacturing, maintenance and disposal / recycling

The Clean Sky JTI was born in 2008 with a budget of €1.6 billion, contributed to on a 50/50 basis by the Commission (in cash) and the aeronautical industry (in-kind contribution). The 12 industry technology demonstrator (ITD) Leaders (including Rolls-Royce) commit up to 50%, the 65 Associate members up to 25% and 273 Partners (through Call for Proposals) a minimum of 25%.

¹⁸ <http://www.enscite.co.uk/>

¹⁹ <http://www.aerospace.co.uk/projects/asce2>

²⁰ <http://www.swgreenerin.org.uk/wp-content/uploads/2016/04/Briefing-EU-Funding-to-the-South-West-of-England.pdf>

²¹ <http://www.cwaf.co.uk/news/erdf-fund-smes/>

²² <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/support-measure/advanced-manufacturing-supply-chain-initiative>

²³ <http://www.cleansky.eu/>

Clean Sky 2 will enable a natural continuation to the progress achieved in the first Clean Sky Programme launched under the EU's 7th Framework Programme for Research and Technological Development (FP7), which will end in 2017. The First Clean Sky programme was mostly concerned with major components and large systems; Clean Sky 2 will move towards their combination into complete aircraft demonstrators comprising innovative configurations, introducing further major demonstrations of several aircraft systems at the aircraft platform level. Research is concentrated in nine areas:

- Large passenger aircraft
- Regional aircraft
- Fast rotorcraft
- Airframe
- Engines
- Systems
- Small Air Transport
- Eco Design
- Technology Evaluator

As part of the European Commission's Horizon 2020 Research and Innovation Framework Programme, Clean Sky 2 will be larger in scope than the initial Clean Sky Programme with a total budget of nearly €4 billion.

Analysis: With 145 participations the UK is the EU's most involved Member State, in terms of research activities, in Clean Sky initiatives. Rolls-Royce and GKN are programme leaders, with Clean Sky providing key pre-competitive research into open-rotor engineering and advanced composite manufacturing, and the UK government will have to negotiate with the Commission either a new working relationship or to remove and replace UK involvement in the programme with EU-based companies.

Horizon 2020²⁴

Clean Sky and SESAR are part of the strategic Horizon 2020 European Commission/industry funded framework research programme, but there are other Horizon 2020 aerospace research areas not covered in Clean Sky and SESAR. Aviation falls within the "Transport Challenge" areas of Horizon 2020 and has been allocated a budget of €6.3 billion between 2014 and 2020. The research will focus on four key objectives, each supported by specific activities. Horizon 2020 will provide funding for a **resource efficient transport that respects the environment** by making aircraft, vehicles and vessels cleaner and quieter to minimise transport's system's impact on climate and the environment, by developing smart equipment, infrastructures and services and by improving transport and mobility in urban areas. Horizon 2020 also aims at a **better mobility, less congestion, more safety and security** with a substantial reduction of traffic congestion; with a substantial improvement in the mobility of people and freight; by developing new concepts of freight transport and logistics and by reducing accident rates, fatalities and casualties and improving security.

Horizon 2020 also supports a **global leadership for the European transport industry** by reinforcing the competitiveness and performance of European transport manufacturing industries and related services including logistic processes and retain areas of European leadership (e.g. such as aeronautics). Horizon 2020 targets a **socio-economic and behavioural research and forward looking**

²⁴ http://ec.europa.eu/transport/themes/research/horizon2020_en.htm

activities for policy making. The aim is to support improved policy making which is necessary to promote innovation and meet the challenges raised by transport and the societal needs related to it.

The aerospace research programmes not included in Clean Sky and SESAR fall within the “Smart, Green and Integrated Transport” domain of Horizon 2020. The aim of the research is “to contribute towards maintaining the leadership of the European aeronautics industry through increased availability of new innovative design tools, materials, manufacturing and service processes.” These are the specific research areas which will be funded by the Commission, with between €5 million and €9 million set aside for each area:

- **Condition-based health management.** The research will quantitatively demonstrate potential improvements towards weight benefits, systems complexity and reduced maintenance costs and demonstrate that European primes and suppliers have an agreed common roadmap towards potential exploitation of the results. It will examine new ways to replace scheduled inspections and decrease maintenance costs, increasing safety and aircraft availability through accelerating the integration of innovative and existing sensor technologies, advancing data analysis methods and promoting standards for health sensing across dissimilar systems and structures, developing and validating multiple sensor technologies on systems and structures, and addressing relevant regulatory barriers.
- **Advancements in composite aero-structures** that have the potential to offer alternative competitive technologies and methodologies and are presently at low Technology Readiness Levels. The research will demonstrate capability to drive costs down and production rates up using new generation composites as well as nonconventional manufacturing methods. It will examine new generation materials and composite structures, validation of new simulation and design methodologies, advanced manufacturing methods, including out-of-autoclave, joining between composites similar or dissimilar media fatigue and damage tolerance behaviour and the related structural health monitoring and repair methodologies, long term behaviour and degradation of eco-efficient surface protection.
- **Internal and external Electromagnetic Environment technologies** addressing at large electromagnetic immunity problems stemming from the increasing complexity of on-board systems in a composite aero-structures and smart materials environment. The research will demonstrate that an increase up to 60% of the confidence in the electromagnetic assessment process is feasible. The proposals will also demonstrate that the proposed concepts and development of tools will contribute to substantial reduction of cost (including qualification and certification) and time-to-market. For the development and validation of multi-disciplinary design tools, the actions will develop computing solutions for key industrial problems to facilitate the introduction of innovative products and services.
- **Development and validation of multi-disciplinary design tools that address key isolated or clustered industrial problems with low degree of confidence that need presently extensive experimental verification.** Activities may contribute to advancing further physical understanding of multi-physics phenomena, simulation of manufacturing processes and design of experiments, uncertainty quantification, cross-cutting computational procedures as well as preparatory work for transition to high-performance computing. Given the strong involvement of SMEs in the supply chain, this topic is particularly relevant for SME participation.

New disruptive technology research

The aim of this cluster of research programmes is to develop exploitable breakthrough technologies and concepts for the medium term that are not currently used or that have not yet been put in combination for civil aviation. The actions should target technologies and concepts that are at low Technology Readiness Level today (up to TRL 3) and can potentially achieve Technology Readiness Level 6 by 2030-2035. The research addresses the following areas:

- Innovative aircraft configurations and airframes (e.g. short take-off and landing, long wing span; personal vehicles).
- Propulsion systems (e.g. partially or fully embedded within the airframe; distributed propulsion technologies and revolutionary engine cycles; high-speed propulsion).
- Novel and integrated multifunctional systems.
- Autonomous, intelligent and evolving systems (e.g. Remotely Piloted Aircraft Systems).

For each area the Commission is proposing a contribution of between €2 million and €4 million each.

Further Commission contributions of between €1 million and €2 million are being set aside in 2016 and 2017 for identification of barriers for increased collaboration in aviation research involving countries and regions with lower participation in the EU Framework Programmes and recently associated countries - such as Ukraine – and identify and assess the needs, gaps and overlaps for strategic aviation research infrastructures in Europe.

RepAIR: Reducing MRO costs²⁵

The main goal of the RepAIR EU-funded research project is to remake and rework spare parts instead of buying new ones, reducing costs and saving time in aircraft maintenance and repair. The team is analysing existing maintenance, repair, and overhaul (MRO) procedures for spare parts to streamline the overall process. One key weapon in making MRO more efficient could be additive manufacturing technologies where components are constructed layer-by-layer under computer control rather than through the traditional "subtractive" machining of metal blocks. According to project coordinator Rainer Koch of Paderborn University in Germany RepAIR could reduce MRO costs for complex spare parts by 30%, and turnaround time by 20%, by using innovative technologies such as additive manufacturing.

Analysis: Jo Johnson MP, Minister of State for Universities & Science: "The referendum result has no immediate effect on those applying to or participating in Horizon 2020. UK researchers and businesses can continue to apply to the programme in the usual way. The future of UK access to European research and innovation funding will be a matter for future discussions. Government is determined to ensure that the UK continues to play a leading role in European and international research and innovation."

Single European Sky

The SESAR Joint Undertaking²⁶ was set up in 2008 to research technologies and procedures which will allow for a 27% increase in Europe's airspace capacity, a 40% reduction in the accident rate, a 2.8% reduction in environment impact per flight and 6% reduction in cost per flight.

²⁵ <http://ec.europa.eu/programmes/horizon2020/en/news/cutting-costs-aircraft-repair-and-maintenance>

²⁶ <http://www.sesarju.eu/>

There are two phases: the SESAR R&I Programme (2008-2016) is now complete. SESAR 2020, starting this year, will prioritise research and innovation in a number of areas, namely integrated aircraft operations, high capacity airport operations, advanced airspace management and services, optimised network service performance and a shared ATM infrastructure of operations systems and services. SESAR 2020 will retain its founding members, the European Union and Eurocontrol. SESAR 2020 will work with a budget of €1.5 billion, of which €500 million will be provided by the European Union and the rest by Eurocontrol and industry. A further €85 million is earmarked for research activities particularly designed to attract universities, public institutions, SMEs and industry. SESAR technologies and procedures are being deployed by the SESAR Deployment Manager²⁷. Some €515 million is being made available for the ATM priority under the general Connecting Europe Facility (CEF) budget, and €300 million are made available for projects in Member States eligible for the Cohesion Funds. The ATM budget related to the period 2014-2020 should amount \$2.5 billion in total.

The total cost of developing and deploying SESAR has been estimated at €30 billion²⁸. Of the €20 billion to be spent in the deployment phase, more than half is expected to come from airspace users.

Analysis: The UK's air navigation service provider NATS was one of the first beneficiaries of the deployment of SESAR technologies with the introduction of a time-based separation method at Heathrow which will help maintain the landing rate and save 80,000 minutes of delay every year.²⁹ Because the ATM world is becoming increasingly interconnected, with the development of transnational technologies such as space-based surveillance, system wide information management and performance-based navigation procedures it is difficult to see the benefits of the UK extracting itself from SESAR, especially given the financial benefits that NATS could accrue from industrialising SESAR research results with industry partners. It is more likely, therefore, the UK will seek to continue a working relationship with the EU beyond the current SESAR 2020 and Deployment Manager's installation programme.

²⁷ <http://www.sesardeploymentmanager.eu>

²⁸ <http://airlines.iata.org/analysis/air-traffic-management-funding-future-atm>

²⁹ <http://www.nats.aero/newsbrief/time-based-separation-heathrow-world-first/>

How will Brexit affect your business?

A new 280-page PMI-Media report “Brexit: Threats and opportunities to the UK’s aerospace industry” will provide the first authoritative guide on the impact of Brexit to UK companies across all tiers of the supply chain. The implications of the EU referendum vote have yet to be fully understood and will have many different impacts – positive and negative - to UK aerospace companies, depending on their product and programme portfolios. This study will take in the views of all key players – from EU-based programme managers to UK and EU government experts, trade association representatives, financial and industry consultants, social partners and manufacturing companies themselves – to build a comprehensive picture of the threats and opportunities awaiting the UK’s aerospace industry as a result of the referendum decision.

Contents

Part one: A strategic overview of the UK’s aerospace business and the potential impact of Brexit.

- Negotiating an exit – how general trading conditions are likely to change (including regulation, market access, freedom of labour movement) post Brexit
- The cost of raw materials, labour
- EU support for research, development and support – a review of current levels of support, the key programmes and alternative funding options
- Supply chain issues: relationship with primes, niche supply chain areas, non-EU competitors and customers.
- The impact of Brexit on mergers and acquisitions of and by UK aerospace companies
- Potential investment opportunities in UK aerospace by non-UK companies post Brexit
- The impact of Brexit on aerospace relationships with customers and suppliers in north America, China, the Middle East, Latin America, the Far East and Russia.

Part two: Winning and losing programme work pre and post Brexit

The section highlights the key supply chain programmes which could be most impacted by Brexit. It will review UK company involvement - companies, contracts, expertise and regional clusters - in the following integrator supply chains networks:

- Airbus, Airbus Defence and Space, Airbus Helicopters
- ATR
- Dassault
- European Space Agency
- Leonardo Helicopters
- MBDA
- Safran

This analysis will be broken down into the following markets: airliners, business aircraft, engines, general aviation aircraft, drones and missiles, military aircraft (manned), rotorcraft, spacecraft, MRO and support companies. It will provide a future programme guide of the announced and potential launch dates for future platforms, aircraft and engines, and the key considerations for EU company involvement. It will also examine, tier by tier, the competitive landscape to the UK supply chain, highlighting where competitors will seek to take advantage of UK companies no longer trading within the EU. It will provide a broad competitor analysis, highlighting where EU-based companies could gain a competitive advantage, including competitors in north America, the Far East, the Middle East and elsewhere.

Part three: the view from EU-based companies of how their relationship with UK aerospace companies will change

We will conduct a series of interviews with key decision makers throughout the supply chain, from major integrators to tier three and four companies, to understand their views on how relationships and business with UK aerospace companies will change as a result of Brexit. We will also examine how aerospace companies in Norway and Switzerland have both benefited and faced obstacles as a result of being outside the EU.

Appendix one:

*The UK's aerospace industry – turnover, areas of expertise, regional clusters (from the Midlands, Northern Ireland, Scotland, the South East, the South West, the North West, Wales), relationship with government, key programmes.

* The global aerospace industry – how the UK sits within the global aerospace industry ; the key relationships, trends in supply chain awards.

What makes this report unique, authoritative

- Timing. The report will be published at a time when key industry decision makers will have had time to gauge the impact of Brexit on their organisations and formulate plans to exploit new opportunities and manage potential problems.
- Access. We will be conducting a wide range of interviews with companies and organisations throughout the supply chain both in the UK and on continental Europe. Our analysis will be based on real-world experiences and views rather than high level trend identification. We have long standing relationships with major integrators and institutions based within the EU. As events and markets evolve we will report on how the relationships, business opportunities and programme decision-making will continue to change the marketplace in our November 2016 and March 2017 updates.
- Experience. Since 2004, PMI Media has built up a comprehensive picture of the global aerospace supply chain through its reports, services and customised consultancy work for a wide range of customers.

View or download a sample of the report here

For more information please contact PMI Media Editorial Director Philip Butterworth-Hayes at philip.butterworth-hayes@pmi-media.com or call +44 1273 724 238.

Available as an electronic publication of 280 pages from August 15th 2016, the report will be priced at £650.00 and is available from 26th September 2016 with two updates – November 2016 and March 2017.



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