Results of competition:
Delivering Aerospace Industrial Strategy through advancing technology capability - Collaborative R&D

Total available funding for this competition was £25m from the Department for Business, Innovation and Skills, as part of the Aerospace Industrial Strategy.

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
CAV Advanced Technologies Limited (lead) TEN Solutions Limited Thompson Friction Welding Limited TWI Limited	Innovative Linear Friction Welding technology for Near Net Shape manufacture of advanced Ti aerospace components	£2,461,381	£1,621,611

Project description (provided by applicants)

The use and cost of Titanium (Ti) alloys in aerospace continues to grow and escalate, putting ever more pressure on cost-effective manufacturing of parts in Ti. Near net shape forming technologies for Ti alloys are currently under development with the aim of building Ti parts rather than machining them out of solids. Most current approaches however are somewhat limited in terms of productivity, with material deposition rates of around 5kg/hr being common.

Linear Friction Welding (LFW) is an innovative solid phase welding technology that is emerging as a new enabling technology for Ti near net shape manufacture. Capable of effective material deposition rates of 50kg/hr, together with excellent weld quality and process repeatability, LFW has the potential to be a game-changing technology in this field.

The TiFab project will develop and demonstrate Linear Friction Welding (LFW) technology for the cost effective manufacture of near-net shape Ti alloy components and will support the ambitions of CAV, a UK tier 1 aerospace supplier, to grow their product offering.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Helitune Limited (lead) Queen Mary University of London Foundation University of Bristol XMOS Limited	IVHM-EVOLVE - Ecosystem of Intelligent Self-Organising Sensor Nodes for Helicopter Health Monitoring	£2,580,711	£1,766,429
Project description (provided by applicants)			
The EVOLVE project will result in continued evolution of existing IVHM by creating an environment in which monitoring systems can learn and adapt to the health of the components being monitored, and will also contribute to reduced cost and installation impact, whilst extending the reach of IVHM to previously-inaccessible components. The aim is to move IVHM into a new era, where on-board monitoring systems begin to think and respond more like humans – to take the right action, at the right time, and in the right area. This project will advance the core technologies required to create competitive advantage for the UK IVHM Supply Chain and provide a clear differentiator for future UK helicopter sales. Use of intelligent, self-organising, sensor nodes which can adapt and prioritise the system around the current health of the aircraft – focussing acquisition and processing where anomalies exist, as well as tuning data rates and feature extraction algorithms – will significantly enhance the effectiveness and reliability of health monitoring techniques. The resulting diagnostics will permit enhanced decision-making, enabling meaningful and timely maintenance actions.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Hybrid Air Vehicles (lead) Blue Bear Systems Research Limited Cranfield University Forward Composites Limited University of Liverpool University of Sheffield	LOCATE - Collaborative industrial research into technology and manufacturing capability for a novel LOw CArbon aircraft using lighter than air TEchnology	£3,822,712	£2,564,756
Project description (provided by applicants)			
Hybrid Air Vehicles Ltd has formed a collaborative industrial research team with Blue Bear Systems Research, Forward Composites, Liverpool University, Sheffield University and Cranfield University. This project team will advance the fundamental and interrelated enabling technologies required to maintain the UK's lead in the field of hybrid air vehicles – a novel aircraft form with substantial worldwide sales potential (against competitors such as Lockheed Martin and EADS). The project will focus on lowering the developmental risks in key technology areas such as novel aircraft aerodynamics, carbon composite structures, avionics monitoring systems and improving rate production to enable launch of production design and manufacture. The project results will be exploited by HAV and the UK aerospace supply chain generating UK jobs and maintaining HAV's lead in the field of hybrid air vehicles and LTA technology.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Ilika Technologies Limited (lead) Diamond Light Source Limited University of Cambridge	High Throughput Development of Superalloys	£1,909,344	£1,325,870
Project description (provided by applicants)			
The project aims to identify new alloy compositions for use in gas turbine engines which have better thermo efficiency than current alloys leading to increase in performance, reduction in CO_2 emissions and reduction in noise levels at take off. In undertaking this project, we will introduce a robust methodology for future alloy development which will ensure the UK supply chain continues to be the largest in Europe and which will increase market share. Ilika uses high-throughput, or combinatorial, techniques which involve the rapid synthesis of a large number of different structurally-related materials in a few automated steps. The novel materials will be characterised and scaled up using state of the art facilities at Ilika, Cambridge University and Diamond Light Source to ensure an improved understanding of the limitations of the current materials in respect of their structure, stability and performance; information critical for the optimal use of existing alloys and the future development new improved alloys. Rolls Royce has given their support for this project and has confirmed their commitment to this particular area of research.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Monitor Coatings Limited; (lead) Ashton & Moore Limited Granta Design Limited Indestructible Paint Limited Loughborough University Rolls-Royce PLC The Manufacturing Technology Centre The University of Birmingham	Accelerated Manufacturing with Chrome Free Sacrificial Cermet Coatings in Aerospace (AMSCA)	£2,393,638	£1,551,810
Project description (provided by applicants)			
European legislation (REACH regulations) requires the elimination of hexavalent Chromium (Cr6+), which is carcinogenic, by September 2017. Existing sacrificial coatings, used for corrosion protection in aerospace, all contain Cr6+ and, therefore, must be replaced. Currently available alternatives do not give acceptable performance, so new replacement materials are needed. A complete supply chain consortium, plus academic and Catapult support, has been brought together to address this issue. This project aims to formulate a new sacrificial coating for corrosion protection of steel aero-engine components that is free from hexavalent chromium and demonstrate the technology to TRL5. In addition, improved, cost-effective application methodology will be developed, incorporating automation where appropriate, to increase manufacturing rate and capacity and reduce waste. Furthermore, in a field traditionally developed on an empirical basis, this project aims to provide an improved science based understanding of the coating behaviour, which will underpin the innovative sacrificial coating technology being developed.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Oxsensis Limited (lead) Parker Hannifin Manufacturing (UK) Limited	Monitoring Pump Health Using Optical Sensors (MORPHEUS)	£2,373,136	£1,223,880
Project description (provided by applicants)			
MORPHEUS will develop novel optical sensors for aircraft fuel system monitoring and control. The consortium will seek to leverage current trends in aircraft system architectures towards optical technologies and the clear advantages they bring in developing replacements for electrical sensors for use in explosive environments. With increasing use of composite materials in aircraft structures, the intrinsically safe nature of optical sensors, as well as their EMI immunity and relatively low-weight when compared to current technology make such approaches highly attractive. It is anticipated that using these benefits, optical sensor technologies can be used to improve reliability of fuel system equipment monitoring, and enable new control methodologies to optimise fuel system and component design, leading to significant weight savings			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Plant Integrity Limited (lead) Brunel University Innovative Technology and Science Limited JackWeld Limited Kingston Computer Consultancy Limited Net Composites Limited	Automated ultrasonic inspection of aerospace composites with enhanced defect detection probabilities aided by gantry deployed, CAD controlled robotics (AutoDISC)	£2,021,885	£1,408,283

Project description (provided by applicants)

Future generation aircraft will consist mostly of carbon composite materials. The modes of failure in composite intensive aircraft are not fully known as they are still near the beginning of their design life, although it is clear that they are susceptible to internal impact damage, not visible at the surface. Yet current NDI of composites in production and service is still largely manual with low area coverage and NDI images are difficult to interpret for any technique because of macroscopic structural anisotropy. To address these problems the project proposes two key NDI innovations:

(1) Up to 100% volume NDI coverage using gantry deployed, CAD controlled robotics so that inspection records at any point can be accurately compared at successive maintenance downtime intervals to allow health diagnostics and prognostics.

(2) A step increase in current detection probability for composite defects implemented through an inference engine performing similarity analysis on spatial and temporal changes in images with coherent noise removal performed by Bayesian separation.

The innovations, validated using ultrasonic NDI, are applicable to any type of NDI sensor.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
QinetiQ Limited; (lead) Axi-tek Ltd Rolls-Royce PLC University College London University of Southampton XTek Limited	Project CAN (Project Composite Aircraft NDE)	£2,734,839	£1,844,165
Project description (provided by applicants)			
Project CAN is a collaboration between the UK aerospace industries, UK X-ray technology companies and academia to develop new testing techniques to ensure modern aircraft are designed using the latest materials and techniques to reduce their environmental impact whilst ensuring their safe operation Two technologies will be developed for the testing of aircraft structures, components and engines; X-ray back scatter and Laminar CT. The new techniques have their origins in both medical equipment and cross border security equipment The project partners see the techniques as crucial to the UK retaining its strong position as a worldwide leader in the aerospace market.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Safran Power (lead) Arnold Magnetic Technologies Limited FGP Precision Engineering Limited MEP Limited Midland Tool & Design Limited Newcastle University Teesside University	Advanced Electrical Machines Technologies for Aircraft (AEMTA)	£5,318,813	£3,083,313

Project description (provided by applicants)

AEMTA is a large R&T project, led by Safran Power UK and working with an extensive supply base of companies and academic researchers addressing high performance and environmentally robust electrical products.

If successful, the results will establish the UK for future supply of advanced high added-value products for the More Electric Aircraft concept.

Manufacturing specialists are: FGP Precision Engineering Ltd of Dorset, MEP Ltd from Kent, Midland Tool Design Ltd from the West Midlands and Arnold Magnetic Technologies Ltd from Sheffield.

Academic researchers University of Newcastle and University of Teesside will contribute in technical areas where they already have solid expertise – novel electrical machine topologies and environmentally robust electrical conductors respectively.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Stirling Dynamics Limited (lead) Argon Design Ltd Hitex (UK) Limited McWade Associates Limited TWI Limited	Highly efficient induction heating process to cure and health monitor the bonding of composite patches on aircraft structures (InHeatPro)	£1,373,370	£988,395

Project description (provided by applicants)

Bonded composite patches are used to repair corrosion, fatigue and impact damage to airframes due to their superior mechanical integrity characteristics compared with mechanically fastened repairs. Such repairs also reduce aircraft down-time, maintenance labour costs and enable useful life extension. Success of a bonded repair is critically dependent on achieving suitable surface preparation and cure under difficult field conditions. Expanding the scope of patch repairs to primary load bearing structures, requires an added level of assurance where voids/disbonds are below a critical size threshold and that cure conditions result in adequate adhesive shear modulus without high residual stress.

We propose to develop a 'smart-patch' system with a reliable, low-cost, integrated sensor network that will act as part of a feedback control system for active cure control to optimise both adhesive mechanical properties and minimise residual stress. The sensors will also be used as active transducer elements to enable non-destructive inspection of the patch to with a high probability of detection for voids and disbonds that are equal to or larger than the critical size.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Triumph Actuation & Motion Control Systems - UK Limited (lead) Magnomatics Limited Romax Technology Limited University of Sheffield	Electro-Mechanical Magnetic Actuator Systems (EMMAS)	£2,621,636	£1,560,349
Project description (provided by applicants)			
The EMMAS project aims to create safer, quieter, more-reliable electro-mechanical actuator designs, containing electronics suitable for extreme environments (wide temperature ranges, and high vibration). These actuators will be vibration resilient, have capacity to thermally regulate, require less maintenance, and be resistant to 'jamming' when permanently or temporarily overloaded. All aspects of the actuator design process will be evaluated throughout the program. The main programme topics include the development of control strategies and drive electronics, investigation of using novel magnetic gearing technology to replace a conventional motor and gear train, and full system analysis of electro-mechanical performance. The objective of the project is to advance technology capability within electro-mechanical actuation, with a key focus on increasing reliability, safety and passenger experience.			