Innovate UK

Results of Competition: UKART: Fast-Track Collaborative R&D Round 1 Full Stage

Competition Code: 1809_CRD_FT_UKART_R1

Total available funding is £8,000,000

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
Ionix Advanced Technologies Ltd	High Temperature On-Engine Structural Health Monitoring and Sensing	£399,497	£199,748
LUCIDEON LIMITED		£187,594	£93,797
The University of Manchester		£128,533	£128,533

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
This project aims to develop new sensors for inspection and monitoring of operational parameters and defects in aeroengines. In the short term, the project will enable a new range of instruments capable of inspecting the engines on the ground, either whilst powered or shortly after shutdown. In the longer term, the sensors will be fully integrated into the engines to provide continuous data during flight. The sensors will effectively be either highly sensitive microphones to monitor acoustic emission from various components in the engine, or ultrasound imaging sensors. Although such acoustic and ultrasound technology is relatively common, there are no devices that are able to operate aeroengine operating temperatures. In order to develop equipment that will work under such harsh conditions, the consortium will employ a relatively new high temperature piezoelectric material that is proprietary to the lead organization, Ionix Advanced Technologies Ltd. This material can operate at temperatures up to 580C. The project will develop new manufacturing techniques to deposit thick films of the piezoelectric material on high temperature substrates and configure them electrical to produce instruments that can inspect hot engines during post-flight maintenance. In the longer term, up to 5 years beyond the end of the project, the sensors will be integrated onto test engines and finally onto flight engines to monitor performance in flight. The implementation of the new sensors will increase the reliability of engines, reduce their fuel consumption and reduce their noise footprint. The resulting increased performance of engines will result in increased sales for engine manufacturers (primarily Rolls-Royce), with a positive financial impact for the UK.

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INSPHERE LTD	Ubiquitous Monitoring And Control (UMAC)	£389,128	£194,564
University of Sheffield		£152,616	£122,093

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Project description - provided by applicants
The Ubiquitous Monitoring and Control (UMAC) project aims to develop and demonstrate automated manufacturing process monitoring, analysis, prediction and correction within a multi-stage manufacturing system. This will improve system performance and enhance process control ultimately reducing part-to-part variation. The target application will be automation-based manufacturing processes which could be significantly enhanced with adaptive feedback from the UMAC system. In addition to developing innovative, disruptive hardware, this project aims to develop software based analytical algorithms to enhance the process control, using the data generated, for the whole manufacturing eco-system and subsequently utilizing the data to facilitate machine learning.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
NEMA LIMITED	Electro-Magnetic Flux Imaging Scanner (EMFIS)	£294,020	£147,010
DEVA TECHNOLOGIES LIMITED		£298,839	£149,420
PARAGRAF LIMITED		£170,205	£85,102

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Project description - provided by applicants
Development and testing of high-reliability and high-efficiency motors for aerospace applications is becoming a key dependency for the introduction of the More/All Electric Aircraft. The project will develop real-time imaging of motor flux density characteristics, addressing an industry requirement for a scanner that can be modified to arbitrary stator/armature diameters. Research will focus on flux measurement control, scan rate of flux sensors and advanced post-processing techniques. The principal project output will be a marketable electro-magnetic flux scanner (EMFIS) which is unique in offering a linear response across a broad field range (pT-T) due to the use of an innovative graphene sensor. An ability to interrogate the 2D/3D field characteristics of electric motors and other electromagnetic (EM) devices would offer significant tangible benefits throughout the design, manufacturing and qualifying process. There are currently no solutions for mapping the magnetic field produced by an energised stator or armature in 2D or 3D. Imaging the field configuration directly would lead to an inherently marketable scanner and push the aerospace sector towards lighter, more reliable and higher efficiency motors. EMFIS development would generate manifold benefits, visualisation of the flux characteristics of an EM device for the first time (currently only possible with FEA simulations) would offer unprecedented insight into magnetic saturation, facilitating substantially improved motor efficiencies and power densities through enhanced design and allowing un-rivalled reverse-engineering and fault-finding services to be developed. The technology would also lead to real-time health monitoring services through the use of embedded sensors, due to the robust nature of graphene and the small device footprint sensors could be integrated into aerospace motors, adding significant value to existing motor products.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ACEAXIS LIMITED	Delivering Wideband Radio-Frequency (RF) digitising transceiver for aircraft communication	£700,001	£350,000
THALES HOLDINGS UK PLC		£299,999	£150,000

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Project description - provided by applicants
For the UK to remain at the forefront of aeronautical wideband communications, development of advanced communication transceivers is a necessity. This project researches a very wideband Radio-Frequency digitising transceiver for use within high data rate aeronautical communication systems. The work will result in a novel leading-edge wideband transceiver design, incorporating highly innovative RF power amplifier and filter technologies. This unique radio transceiver will use advanced digital signal processing algorithms to optimise analogue RF components, and ensure optimal trade-off between size, weight, power consumption, communications performance and flexibility. It will build upon patented digital pre-distortion algorithms minimising power consumption while maximising data throughput, essential for supporting wider bandwidths. The outcome will constitute significant progress towards a practical and unique solution for future aeronautical broadband wireless communications. It will significantly advance the availability of new, compact, multi-frequency transceiver units supporting substantially higher data rates. This work will further strengthen work already carried out by the project partners and thereby extend UK's leadership in this area.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
M. WRIGHT & SONS LIMITED	Advanced, couplant free non-destructive testing system for next generation composite parts - CFLUX	£155,040	£77,520
ADVANCED HALL SENSORS LIMITED		£161,648	£80,824
ETHER NDE LIMITED		£134,702	£67,351
FAR-UK LTD		£158,760	£79,380
TWI LIMITED		£194,700	£194,700

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Project description - provided by applicants
The use of composite materials in aerospace manufacture is accelerating fast, with the most modern aircraft in the world's fleet now more than 50% composite materials. These new-generation aeroplanes are lighter, more fuel-efficient, and so more profitable, as well as significantly reducing CO2 emissions compared to traditional aluminium planes. However, composite materials are much more expensive to produce, partly because they are not yet as well-understood as metals, so the industry spends millions every year slowly inspecting each part for flaws before it is deemed safe enough to take its place in an aircraft, and inspecting composite components is not easy. Carbon fibre composite is in many ways an ideal material for aerospace construction, being less dense than aluminium, with a greater stiffness-to-weight ratio. It does not corrode and it is less susceptible to fatigue. Carbon fibre components can be moulded directly into their required geometry, reducing the need for vulnerable bonded areas. But there is also the possibility of introducing weakened areas when constructing the material itself - fibres can break or move out of alignment, layers can separate, gaps can open up, and this can all happen invisibly, deep within the internal structure of the material, weakening it and leading to unexpected failure. Manufacturers need techniques to inspect the internal structure of their carbon fibre components and CFLUX is designed to do just that. The inspiration comes from traditional eddy current non-destructive testing techniques that have been used for aluminium aircraft. These are fast and effective for finding hidden flaws but rely on the good conductivity of metals. Carbon fibre is 1000 times less conductive than aluminium, making eddy current testing impossible, until now. The CFLUX consortium have developed innovative sensor technology that can give sensitivities 1000 times greater than before, retrieving high-quality, high-resolution signals that were previously unachievable. Not only that, but this technology is tiny, making it easy to develop into multi-sensor arrays that are resilient, flexible and ideal for use in the production-line robotics necessary to really speed up and reduce the cost of the inspection process. Robotic inspections using CFLUX are expected to be more than 30 times faster than current processes, reducing inspection costs from £1,292 to just £72 for a single 34m2 composite component. This supports the aerospace industry in its drive for safe aircraft that are lighter, more cost-efficient, and have a reduced impact on our environment.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
VALUECHAIN.COM ENTERPRISES LIMITED	Valuechain Intelligence Trading Authorisation Ledger for Additive Manufacturing Ecosystems (VITALam)	£530,000	£265,000
DIGITAL CATAPULT		£181,547	£181,547
FDM DIGITAL SOLUTIONS LTD		£104,932	£52,466

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Project description - provided by applicants
The objective of this project is to streamline the capture of real-time digital factory data from multiple Additive Manufacturing (AM) sources (people, plant, process, powders, products and partners) to create an AM accurate record (digital thread); and utilise artificial intelligence to optimise machine, atmosphere, powder (raw material) and AM build parameters. VITALam will securely share and consolidate data from multiple organisations to create a digital AM ecosystem whereby stakeholders, such as Aerospace Original Equipment Manufacturers (OEMs); AM agencies; AM plant vendors; AM powder / raw material vendors; and post-processing suppliers; can exchange and benefit from real-time intelligence and performance monitoring to optimise product quality and productivity levels. This will accelerate aerospace AM technology advances and ultimately unlock the scalability of this game-changing technology which has the potential to disrupt all advanced manufacturing sectors, such as more environmentally friendly and economical component design and production techniques, supported by agile global supply chains. The main project output is a working prototype solution that will be piloted by Airbus and several SMEs to refine the following: - innovate world's first dedicated Manufacturing Execution System (MES) for AM and Enterprise Resource Planning (ERP) solutions that can support every AM technology from "Fuse Deposition Modelling (FDM)" to "Selective Laser Sintering (SLS)" for all sizes of AM business from OEM to start-up SME - uniquely integrate with disparate real-time data sources to create reliable and granular digital thread; - deploy innovative machine learning, with state-of-art insights from University of Huddersfield to curate big data, predict issues and optimise AM product quality and productivity; - unique deployment of blockchain technology to provide secure AM intelligence exchange platform with unique insights from University of Liverpool; - establish digitalised AM ecosystem with Airbus, FDM Digital Solutions and other existing Valuechain clients / partners. Valuechain will initially focus on the global aerospace AM due to the significant and immediate market opportunities; such as compliance legislation, significance of the product quality, significant financial and operational savings, such as weight saving component design and the potential for spare part production anywhere in the world. Following the completion of this project, Valuechain will innovate VITALam with its automotive, defence, nuclear, industrial gas turbine, marine, rail and medical clients and then scale into these other global advanced manufacturing sectors once traction and substantial aerospace market penetration has been secured.

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TBG SOLUTIONS LIMITED	Enhanced Software Defined Telemetry for Ground and Flight Testing	£583,206	£291,603
SCITEK CONSULTANTS LIMITED		£408,469	£204,234

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Project description - provided by applicants
This project will develop new broad band measurement technology for the use of aircraft engine manufacturers in developing new engines; it will also be useful for other manufacturers and operators of gas turbine engines used in ships and in electricity generation. The project is a collaboration between two small hi-tech engineering companies, TBG Solutions and SCITEK Consultants, located in the East Midlands. The technology will allow faster and more efficient recording of measured data from an engine under test, resulting in considerable cost savings, reduced fuel consumption and reduced emissions. Key aspects of the project include development of a sophisticated miniaturized software defined wireless radio data transmission equipment, new antenna (aerial) designs for use in flight tests, and installation of a second-hand aircraft engine to allow testing and demonstration of the new products.

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