

## Results of Competition: NATEP Spring 2020

Competition Code: 2004\_MMM\_NATEP\_ATI\_SPR

Total available funding is £2,500,000

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
CARBON THREESIXTY LIMITED	GTTC-Wheel. Guided Tow Technology Composite Wheel - Next generation composite wheels for rotary-wing aircraft	£209,909	£104,954
NCC OPERATIONS LIMITED		£44,981	£44,981

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

GTTC-Wheel will see Carbon ThreeSixty, in partnership with the National Composites Centre and in collaboration with Leonardo Helicopters, leverage their combined expertise to design, develop, characterise and manufacture a revolutionary, ultra-low mass proof of concept CFRP wheel for rotorcraft applications. This includes developing the optimum route-to-market and further quantifying the prospective business opportunity arising from the disruptive innovation in a rapidly growing sector of the aerospace market.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ARCHER TECHNICOAT LIMITED	Continuous interface coating for SiC composites (CICSiC)	£171,285	£85,642
CYGNET TEXKIMP LIMITED		£23,096	£11,548
TISICS LIMITED		£29,999	£15,000
University of Sheffield		£37,685	£37,685

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## Project description - provided by applicants

Ceramic matrix composites (CMCs) are a vital material for improvement of efficiency in future aircraft engines, enabling higher turbine temperatures and offering the advantages of significantly lower weight, lower cooling requirements and lower aircraft emissions. The rate of introduction of these new materials can be improved by raising the predictability of material strength, enabling design engineers to have a greater degree of confidence in the life of the material.

Interface coatings on fibre reinforcements are one of the critical components of CMCs and control of these coatings with tight tolerances is vital for ensuring reliable properties. Current batch coating methods only give a relatively low level of uniformity control. Complex components can show coating thickness variations, limiting the predictability of performance.

This 'CICSiC' project aims to develop the coating technology, a novel prototype machine design and a UK based manufacturing partnership for the equipment which will coat the reinforcing silicon carbide (SiC) fibre for SiC based CMCs in a continuous mode. This mode will enable tight coating tolerance by treating the fibre before it is shaped into a thicker and complex shaped component preform where it becomes difficult to process all areas of the component with equal precision.

There is significant global demand for this technology amongst customers of ATL (project lead) including engine manufacturers and component developers, as recent developments in the US have enabled GE Aviation to gain a competitive advantage. This project aims to enable technology to be developed and sold to a world market from a UK base. Customers of the planned product are keen to push the development through and understand the properties of the material produced by this new process.

The project will take the existing batch coating process and apply knowledge from that to design and build prototype equipment which coats a moving SiC fibre on a continuous basis. Fibre handling expertise will be drawn both from SMEs and a research centre to form a knowledge base from which a production scale multi-tow plant is designed ready for manufacturing at the end of the project. End users of the coated fibre, including the German company now setting up the only SiC fibre plant outside Japan and the US, will form part of the consortium's test regime for the coated fibre to ensure it meets industrial requirements.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OVERVIEW LIMITED	Counter UAS (CUAS) and Perimeter Intrusion Detection System (PIDS) Autonomous Air and Ground Surveillance Pod (ASP) Sensor Clusters	£118,561	£59,280
OPERATIONAL SOLUTIONS LTD		£84,910	£42,455
RINICOM INTELLIGENT SOLUTIONS LIMITED		£96,522	£48,261

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Project description - provided by applicants

Overview Ltd. have joined with Operational Solutions Ltd. and Rinicom Intelligent Solutions Ltd. to develop an infrastructure independent sensor and automated perimeter sweep system to protect airports against disruption from air and ground threats.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
PROGRESSIVE TECHNOLOGY LIMITED	Additive Manufacturing of Magnesium Alloys	£168,020	£84,010
DESIGN Q LIMITED		£42,000	£21,000
University of Warwick		£44,983	£44,983

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Project description - provided by applicants

The project will develop the high integrity Additive Manufacture of Magnesium alloys using Powder Bed Fusion for uses in aerospace applications.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
TANGERINE LIMITED	The Slouch Comfort System	£129,756	£64,878
CECENCE LIMITED		£90,002	£45,001
SABETI WAIN AEROSPACE LIMITED		£79,975	£39,988

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Project description - provided by applicants

Slouch is a lightweight retrofit comfort system for use in a long haul economy class seat. It dramatically improves comfort in an extended recline seat position by combining a 3D sculpted membrane with movable seat pan.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OPERATIONAL SOLUTIONS LTD	Interceptor Drone	£169,743	£84,872
RINICOM LIMITED		£129,909	£64,954

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Project description - provided by applicants

OSL and Rinicom are collaborating on a project to develop a new, safe counter-measure system to protect airports against illegal drones that pose a threat to the airport security.

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RINICOM LIMITED	Novel AI for Image Processing in Aviation	£206,468	£103,234
SYSTEM LOCO LTD		£92,750	£46,375

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Project description - provided by applicants

Rinicom and System Loco propose to develop a new artificial intelligence software design to improve the detection range and processing capability of optical drone detection with new, higher-resolution optical cameras.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ALLOYED LIMITED	Optimising the Material Properties of Novel High-Temperature Superalloys for Additive Manufacturing	£252,852	£103,922
University of Sheffield		£45,000	£45,000

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 will develop the highest-performing nickel alloy for additive manufacture of components operating at 1000°C, making 3D-printing a viable option for critical high-temperature aerospace applications for the first time.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
KWIKBOLT LIMITED	Robotic end-effector system for fully flush fasteners	£210,000	£105,000
Kingston University		£44,978	£44,978

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Project description - provided by applicants

Kwikbolt's objective is to design, develop and prototype a bespoke demonstrator end-effector and robotic system to be used to install and remove fully flush temporary fasteners, required in the production line manufacturing process of aerospace components.

The deliverables will include a prototyped end effector that interfaces with an industry standard robot arm to install and remove a range of flush automated fasteners, providing precise high tolerance hole location (X&Y) and high load clamping (Z). Incorporating a vision system that calibrates robot system in 3D space ensuring the correct fastener is installed in the correct hole accurately, for a given assembly.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
R6 ECO-ENGINE LTD	SilkE Hybrid Propulsion System	£126,597	£63,298
EMB POWER LIMITED		£173,388	£86,694

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## Project description - provided by applicants

The Silk\_E\_ Hybrid Propulsion System project offers a 21st century breakthrough in hybrid propulsion efficiency and cost, reducing turboshaft fuel consumption and CO2 emissions by 50%, reducing propulsion system cost by 70-90%, and enabling a new generation of eVTOL air taxis capable of 400mph international inter-city flight.

The urban air mobility (VTOL air taxi) market is still at feasibility stage and eVTOL solutions remain unproven. Uber Elevate is aiming for 400Wh/kg battery capacity and charging in five minutes to be able to offer a range of 100 miles, which it calculates makes Uber flying fleets feasible. Even assuming this is possible by 2025, the resultant aircraft would be limited to low speeds and two passengers. Range figures are further complicated by international aviation regulations, which dictate that aircraft must carry a 30-minute fuel reserve to reach an alternate landing strip in an emergency. Therefore, if the range of the aircraft is 100 miles at 100mph, the maximum trip length is 50 miles.

By contrast, powered by a 1200kW P&W PT6C-67C turboshaft engine, Transcend Air Corporation's Vy-400 aircraft is capable of carrying a payload of 1 tonne, cruising at 300-400mph with a range of 450 miles. But the downside of this approach is that the turboshaft turbine/ gearbox is inefficient (peak 25.7%, cruise 22.3%) and noisy and since the unladen aircraft weighs 2.2 tonnes (1 tonne more than an equivalent helicopter) and flies 3 times faster, even with a more efficient tilt wing architecture, the aircraft uses 50% more fuel than a helicopter per hour (50% less per trip).

The Silk\_E\_ hybrid propulsion system solves these problems because it combines 400kW from the power dense battery system with 800kW from the generator system, for 1200kW peak take-off distributed electrical power and then isolates 800kW from the generator for cruise power, with battery recharging in flight. Even accounting for losses, the R6 eco-engine/ YASA motors can provide cruise powertrain efficiency of 42.6% compared to the turboshaft/gearbox efficiency of 22.3%, thereby reducing fuel costs and CO2 by 50%.

The Silk\_E\_ hybrid propulsion system project is inspired by the manufacturing heritage of the North West and aims to revive the legacy of Rolls-Royce in its deprived inner-city birthplace in Manchester. The project can make a substantial contribution to the Northern Powerhouse initiative, eventually creating thousands of jobs, manufacturing hybrid electric propulsion systems fit for the 21st century in partnership with a global manufacturer.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CECENCE LIMITED	SAINT - Sustainable structural and/or semi-structural Aerospace INTERiors	£157,253	£78,626
ELG CARBON FIBRE LIMITED		£51,911	£25,956
PLYABLE LTD		£15,484	£7,742

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Project description - provided by applicants

Sustainable thermo-compression moulded structural and semi-structural aircraft interior components using FST compliant renewable and recycled materials, as a contributor in balancing out the carbon footprint created by air travel.

At the moment neither natural fibres nor recycled carbon fibres are being considered for such usage in aerospace interiors. This is not because they are not credible, but because manufacturers are typically still working with aluminium and plastics or more traditional composite materials, and are often tied in to one supply of carbon fibre or resin system.

This project will enable sustainable materials, in this case hemp and recycled carbon within a bio-resin matrix, to be a proven viable alternative, with a focus on the demonstrator being a lightweight aerospace tray-table.

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EU ECO TECHNOLOGIES LTD	Prometheus II: Game-changing Hybrid Power Systems for Aerospace using Thermoelectrics	£149,400	£74,700
Blackburn College		£14,971	£14,971
Cranfield University		£14,999	£14,999
INNOVATIONWORKS SYSTEMS LTD		£90,176	£45,088

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## Project description - provided by applicants

The Prometheus project will demonstrate that novel thermoelectric generators can harvest excess heat and convert it to useful electric power for passenger electric aircraft in mass and cost-efficient manner, compared to other competing technologies. Complimentary to current battery power storage solutions, high performance thermoelectric modules developed in a previously funded ATI activity have shown to produce power densities of 1 kW/kg which can be a cheaper alternative to conventional batteries and can be tailored to the demanding power profiles needed by electric aircraft. Using the well known Seebeck effect, thermoelectric generators are solid state semiconductors which can harvest excess heat and convert it to usable electric power. Using novel 3D printing and automated ink printing technology, a novel thermoelectric 'chip' has been developed through a previous ATI activity which can used 3 times more semiconductors per square unit area compared to conventional thermoelectric modules. A 1kW/kg breadboard was successfully tested recently and our proposed project will focus on maturing the breadboard technology demonstrated by focusing on developing mass production manufacturing units, characterising the thermoelectric system performance and adapting the technology for future small passenger electric aircraft, thus creating a unique new set of commercial products for the aerospace market, in the UK.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
INTELLEGENS LIMITED	Machine Learning for Additive Manufacturing Experimental Design Algorithm (MEDAL)	£209,294	£104,647
University of Sheffield		£44,966	£44,966

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Project description - provided by applicants

MEDAL will develop a method of optimising process parameters by suggesting a minimum number of new experiments based on legacy data. This will significantly reduce process optimisation cost and time.

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Texture Jet	STREAM - Surface Texture Re-tooling for Efficient Aerospace Manufacturing	£198,207	£99,104
CODEM COMPOSITES LIMITED		£86,416	£43,208

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## Project description - provided by applicants

With the effect of Covid-19, now more than ever, streamlining production in the UK aerospace industry is critical for survival and regrowth. As such, manufacturing technologies that can reduce production costs are highly sought. This project, STREAM (Surface Texture Re-tooling for Efficient Aerospace Manufacture), aims to provide a machine tool that can redefine surface textures on components in a much more efficient and environmentally friendly manner than typical legacy methodologies commonly applied in aerospace manufacture.

TextureJet has developed an innovative technology called STAT (Surface Texture Adjustment Technology) which is based on 6 years of fundamental research at the University of Nottingham. STAT is utilised for surface texturing of components in applications such as surface preparation before bonding operations, discreet super-polishing or revealing component microstructures for inspection. It can roughen, polish, etch and structure surfaces, without inducing surface damage by impact and without the requirement of masking. STAT also provides a superior alternative to thermal processes. From a technical perspective, it eliminates thermally induced surface degradation and financially lessens the extensive capital expenditure, maintenance and operational costs required for safe utilisation. Compared to current methods, STAT has the benefits of simplicity, precision, flexibility, and environmental sustainability due to eliminating the use of toxic chemicals. Uniquely, it can be carried out on site or in-situ and so the production line attributable footprint is drastically reduced.

This project aims to enhance regional employment and training opportunities, as well as provide a new and innovative technology to the UK aerospace sector as a whole to enable the UK to gain a competitive edge in the global aerospace market and keep manufacture within the UK.

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ADAPTIX LIMITED	Creating a Proof-of-Concept cloud-deployable software system to compare a unique fingerprint for aerospace composite parts as part of preventing ingress of counterfeit parts into the supply chain and protecting revenue streams.	£209,648	£104,824
NCC OPERATIONS LIMITED		£44,986	£44,986

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## Project description - provided by applicants

**\*\*Project Description:\*\*** To demonstrate the "\_fingerprinting\_" of multiple representative aerospace parts made using composites and the ability to discriminate between them as a result of the fingerprinting, ideally for those parts to be actual production parts provided by an aerospace prime.

**\*\*Need:\*\*** Counterfeit parts are: "\_A product produced or altered to resemble a product without authority or right to do so, with the intent to mislead or defraud by passing the imitation as original or genuine\_".

The estimated counterfeit market size for all products exceeds \$460Bn. The aerospace and automotive parts are in 10th place among the most counterfeited products, accounting for 2% of this illegal business (almost \$10Bn).

A 2008 report by the Boeing Company states that anything can be counterfeited including fasteners (bolts, nuts, rivets) and materials.

Fake parts in the aerospace industry are among the most dangerous as they put unsuspecting people at risk of injury or death.

The need is to create a mechanism for operators to have certainty as to device provenance to protect against the risk of catastrophic failure and resulting economic damage to manufacturers and operators resulting from counterfeit parts use.

**\*\*Innovation\*\*:** Our combination of patent-pending innovations will allow composite components to be given a unique 'fingerprint' such that composite products can be traced through the supply chain and validated prior to use.

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IMAGENE LIMITED	AIRaCor	£210,044	£105,022
University of Sheffield		£44,977	£44,977

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Project description - provided by applicants

AlRaCor is about the research into Artificial Intelligence enabled quality defect identification and corrective action. This research if successful will significantly enhance an existing product call RaCor.

AlRaCor will utilise advanced digital technologies to ensure seamless communication throughout the supply chain; connecting proven engineering tools and processes to rapidly identify and resolve non-conformances.

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ELE ADVANCED TECHNOLOGIES LIMITED	Hybrid Capacity for Aerospace Growth (FARGO)	£160,000	£80,000
ALLOYED LIMITED		£49,918	£24,959
University of Sheffield		£44,992	£44,992

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Project description - provided by applicants

FARGO will establish a prototype hybrid, additive and subtractive, production line of a turbine component, to expand the capacity of a high performance SME member of the aerospace supply chain.

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DOMIN FLUID POWER LIMITED	INCEPSION: Integrated Compact Electrically Powered & Signalled Actuation Systems	£254,955	£107,081
Cranfield University		£44,960	£44,960

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 will develop and test an ultra-compact electrically signalled and powered hydraulic flight control actuation system, delivering weight savings of 50%, bandwidth increases of 5x and total cost of ownership reductions of 30% vs conventional solutions, whilst also enabling More Electric aircraft architecture. We will do this by building on Domin's technology which delivers step changes in power density for servo valves and positive displacement pumps, and using Additive Manufacturing to integrate components into a single compact subsystem. Cranfield University bring their world-class simulation and analysis skills to together develop an industry-aligned, optimised solution.

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