



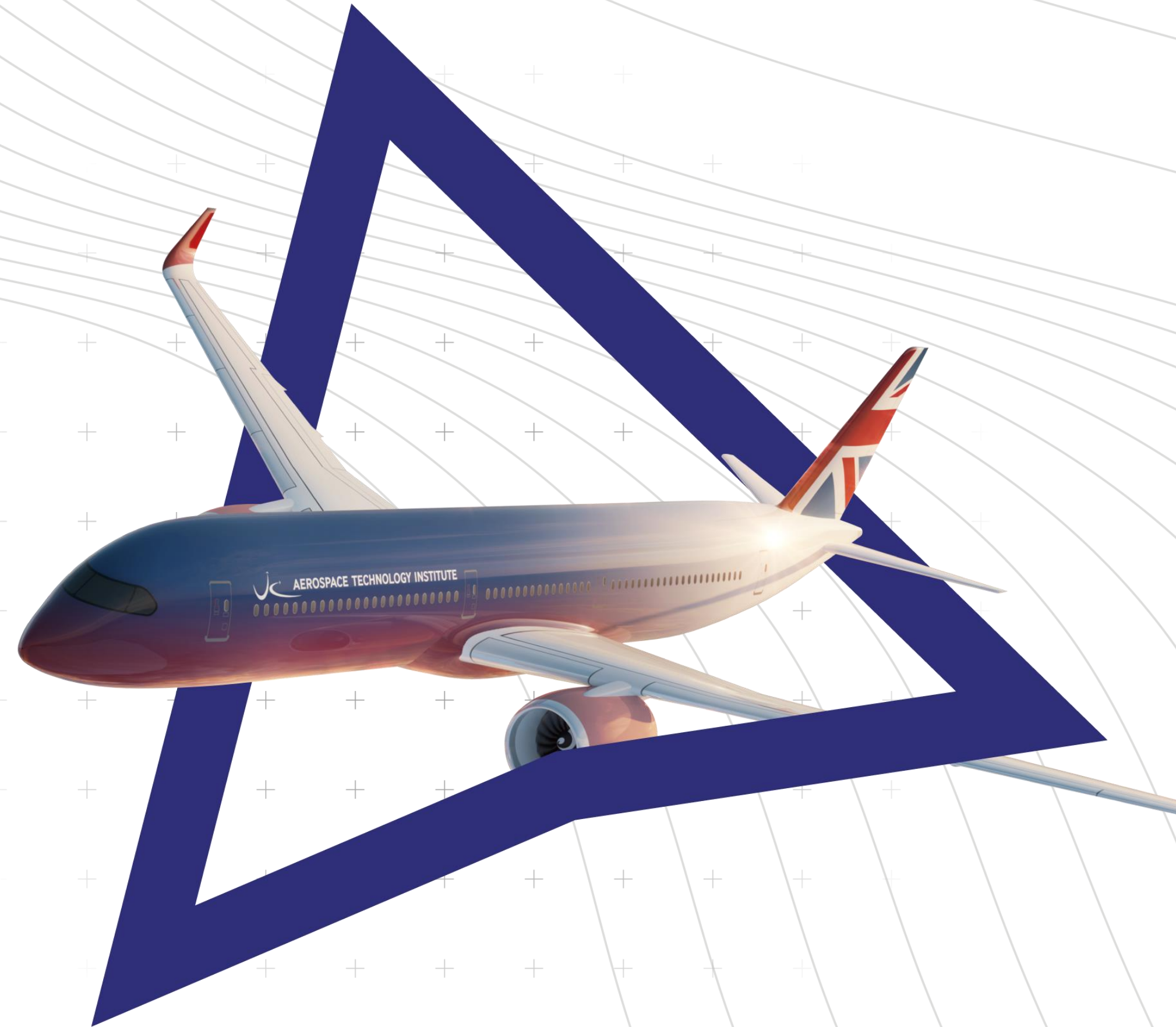
HENRY  
ROYCE  
INSTITUTE

# Manufacturing Net Zero aviation

## Event Programme

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18<sup>th</sup> September 2024



# Event Introduction



University of  
Sheffield

HENRY  
ROYCE  
INSTITUTE



The Aerospace Technology Institute (ATI), The University of Sheffield and The Henry Royce Institute invite you to join a one-day event to explore the opportunities and challenges of sustainable manufacturing in aerospace.

Aerospace manufacturing faces many hurdles on the journey to Net Zero. Decisions made now, in terms of materials and manufacturing process selections, will be locked-in for a generation of aircraft production, therefore it is critical that we select future materials and processes with their sustainability as a primary consideration. The ATI, through their Cross-Cutting Technology Advisory Group (CC-TAG), has been exploring the trade-offs between competing future materials and manufacturing technologies and their implications for both the sustainability and competitiveness of the UK aerospace manufacturing sector.

This event will bring together industry, academia and RTOs to share these ATI trade studies and showcase examples from across the sector. Exchanges on best practice and sharing of methodologies and tools will help foster collaboration and integrate sustainability paradigms into the design and manufacturing process.



The poster features a dark blue background with a dynamic, wavy pattern of light blue and red lines. At the top, the logos for the Aerospace Technology Institute, University of Sheffield, and Henry Royce Institute are displayed. The date '18TH SEPTEMBER 2024' is centered above the main title. The title 'Manufacturing Net Zero aviation' is prominently displayed in white and teal. Below the title, the subtitle 'Enhancing UK competitiveness in sustainable aerospace' is written in white.

AEROSPACE  
TECHNOLOGY  
INSTITUTE

University of  
Sheffield

HENRY  
ROYCE  
INSTITUTE

18TH SEPTEMBER 2024

# Manufacturing Net Zero aviation

Enhancing UK competitiveness  
in sustainable aerospace

# Location

University of Sheffield  
Sir Frederick Mappin Building  
Mappin Street  
Sheffield  
S1 3JD

*The elaborately decorated Mappin Hall is situated within a grade II-listed building named after Sir Frederick Mappin (1821–1910) who was a Sheffield factory owner and politician who supported the formation of the University of Sheffield. The building was recently refurbished in early 2020 with Mappin Hall retaining its historical significance.*



0900 Doors Open

0930 Welcome & Introductions



## Prof. Conchúr Ó Brádaigh

*Vice-President and Head of the Faculty of Engineering*  
University of Sheffield



## Matthew Bailey

*Lead Technologist – Structures, Manufacturing & Materials*  
Aerospace Technology Institute

0940 ATI Cross-Cutting Technology Advisory Group (CC-TAG) Case Studies

Members of the ATI's CC-TAG will present manufacturing process trades spanning aerostructure and propulsion components.



## Alison Gamble

*Chief of Industrialisation and Cost - Civil Operations*  
Rolls-Royce

### Life Cycle Assessment of LASER Powder Bed Fusion

An overview of the methodology applied to create a Life Cycle Assessment for a combustor tile in a preproduction low volume development using LASER Powder Bed Fusion method of manufacture. Providing an insight into scoping and analysis employed to create the life cycle assessment and providing insights into data collection, assumptions, additional processing considerations and the challenges presented to produce an assessment.



## Phil Scott

*Head of Design Engineering & Technology*  
Hamble Aerostructures

### LCA Case Study – Near Net Shape vs Subtractive Manufacturing of a Typical Aerospace Part

The case study contrasts the typical outputs associated with the manufacture of a typical aerospace wing metallic component using a NNS and subtractive method. The evaluation utilises a commercially available software package to derive the material and energy consumptions and emissions associated with each manufacturing method. Comparing the values embedded within software database with measured data, for the same processes, enables specific observations about the quality of the data and the influence of the data within the analysis, whilst highlighting the priorities for future direction.

## 0940 ATI Cross-Cutting Technology Advisory Group (CC-TAG) Case Studies *continued*



### **Emelia Fabris**

*Environmental Life Cycle  
Assessment Expert*  
Airbus

#### **Setting the standard for modern, fuel-efficient aviation - Life cycle assessment and ecodesign in Airbus**

How life cycle assessment can be used as a tool to support eco design and answer external pressures coming from regulations, customers and stakeholders on environmental impacts in commercial aviation.



### **Simon Jenkins**

*Principal Engineer*  
GKN Aerospace

#### **Sustainability in machining processes**

Machining of aluminium wing rib components was chosen as a case study and has been approached from a number of different angles with a view to improving sustainability. This work, funded under the ATI MASTER programme, explores viability of swarf circularity, scheduling for the use of low carbon energy and impact of machining strategy on energy usage. This presentation discusses the potential sustainability benefits of addressing these different aspects of the machining process.

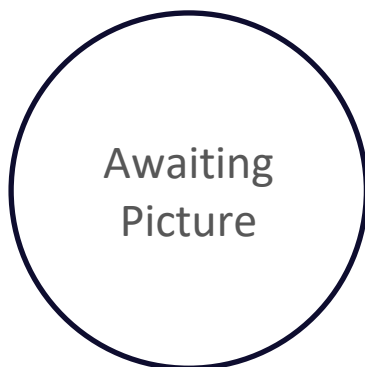


### **Denzil Lawrence**

*Boeing Research & Technology  
(Europe)*  
Boeing

#### **Life Cycle Assessment for AM Parts In Aerospace**

A case study showing how Boeing has included sustainability drivers when considering alternative manufacturing techniques.



### **Alan Moore**

*Chief Engineer – R&T (Europe)*  
*Technical Fellow – Structures  
Design and Analysis*  
Spirit AeroSystems

#### **Awaiting presentation title**

Awaiting presentation description

# Programme *continued*

1130 Break

1200 Panel Discussion: Opportunities and challenges for sustainable aerospace manufacturing

A discussion around both the challenges of realising sustainable manufacturing through the supply chain and the opportunities for the UK aerospace sector  
Chaired by **Prof. Kathy Christofidou**



**Prof. Kathy Christofidou**

*Chair in Digital and Sustainable Metallurgy*  
University of Sheffield



**Neil Glover**

*Materials Fellow*  
Rolls-Royce



**Prof. Conchúr Ó Brádaigh**

*Vice-President and Head of the Faculty of Engineering*  
University of Sheffield



**Chris Weir**

*Technology Manager*  
Midlands Aerospace Alliance



**Phill Godfrey**

*Chief Sustainability Officer*  
Collins Aerospace



**Eddie Andrews**

*Group Commercial Director*  
3T Additive Manufacturing

1300 Lunch

1345 Methods and processes for sustainability evaluation

A focus on the methods and processes for monitoring and evaluating the sustainability of materials and manufacturing processes.



## **Prof. Konstantinos Salonitis**

*Acting Director of Manufacturing and  
Materials*

Cranfield University

### **Assessing sustainability in manufacturing processes and operations**

The presentation will focus on tools and metrics developed for assessing sustainability in manufacturing processes, operations, and supply chains. It will also discuss the role of data quality and simulation, which can lead to more informed decision-making.



## **Tace Morgan**

*Technical Lead for Sustainable  
Manufacturing Processes*

AMRC

### **Measuring sustainability in manufacturing**

There are many well known challenges around how sustainability should be assessed in manufacturing. The AMRC has been working to look for solutions to a variety of these challenges, including prioritising processes for decarbonisation, streamlining the LCA process and evaluating how data can be stored more sustainably.



## **Ben Orson**

*CEO*

Orson Associates

### **Zero Carbon Cabins**

At 10% of an airliner's empty weight and replaced four to five times during its life, the cabin presents a formidable environmental challenge. Cabins are also uniquely resistant to circular manufacturing and so most end their lives as landfill.

Strategic change demands knowledge and understanding. Without data-rich models of product life cycles, manufacturers and operators are unable to make informed investments in greener cabins.

Our presentation highlights Orson Associates' innovative capabilities in rapidly and efficiently collecting essential data, empowering customers like Air Canada to make cost-effective, impactful changes that result in quantifiable sustainability benefits.

## 1345 Methods and processes for sustainability evaluation *continued*



### **Angelo Emmi**

*Senior Technologist – Structures,  
Manufacturing & Materials*  
Aerospace Technology Institute

#### **The ATI CC-TAG Comparative Case Studies Framework**

The ATI CC-TAG comparative case studies framework is a methodological approach developed collaboratively by the members of the ATI Cross-Cutting Technology Advisory Group as a result of sharing of internal best practices established in individual industrial, academic and research organisations.

The framework provides a method for comparing two or more competing materials or process choices, taking sustainability and competitiveness metrics into consideration, to enable decision making about materials and manufacturing processes for future and heritage products.

## 1500 Break

## 1515 Industry Case Studies

Sustainability trade case studies from industry



### **Stella Job**

*Sustainable Innovation Consultant*  
Grazebrook Innovation

#### **A case study in LCA for future technologies: The Swift light aircraft in Project MONET**

Project MONET aims to support the RAF's path to a sustainable future by delivering the MOD light aircraft flight training capability with zero carbon emissions in flight. The project has evaluated different powertrain solutions for a fleet of Swift aircraft, assessing technical, economic, environmental, logistics and training implications.

This presentation will discuss the methodologies used for assessing environmental impact. Managing uncertainty in LCA data is always a challenge, but MONET raises further issues around assessing emerging technologies, in the context of a rapidly changing energy mix over a 25 year contract.



### **Carrie Lambert**

*Head of Sustainability*  
Reaction Engines

#### **Reaction Engines first product footprinting model - sharing key results and learnings**

An overview of Reaction Engines first product footprinting model is presented. First, the modelling scope and approach will be discussed before results across the full product lifecycle are shared. Following this, some lessons learned and potential opportunities for the wider aerospace community to work together will be highlighted.



## 1515 Industry Case Studies *continued*



**Dr Amy Fitzgerald**

*Research Engineer*

National Composites Centre

### **Low-carbon carbon fibre manufacture: a balancing act**

The urgent need for the aviation industry to reduce carbon emissions and achieve Net Zero targets has highlighted the importance of precise and reliable environmental data along the product life cycle. However, existing software and tools provide varying environmental data for CFRP composites, leading to uncertainty within results which affect decisions during design. This research has identified the key processing parameters that influence the environmental impact of CF production through the development of a process model using actual industrial data, demonstrating that a deeper classification of CF types is required to understand the effective choices needed for sustainable manufacture.



**Dr Filomeno Martina**

*CEO*

WAAM3D

### **Environmental benefits of large scale metal 3D printing**

The talk will cover the application of wire-based, multi-metre 3D printing to use cases in aerospace and heavy industry, with focus on alloys of titanium, aluminium, and steel. Reduction in both embodied energy and CO2 emissions will be demonstrated, vs incumbent manufacturing processes.



**Robert Scudamore**

*Associate Director AMT - Welding*

*Joining and Additive*

TWI

### **Using joining technologies to save cost and improve on environmental impact**

Awaiting presentation description

## 1655 Closing Remarks

## 1700 Presentation Close, Networking and Tours (optional)



## Eddie Andrews

Eddie is the Commercial Director at 3TAM and has worked within Aerospace for over 20 years. His early career began in engineering at Senior Aerospace before transitioning to a commercial role. He moved to GKN Aerospace in 2013 as European Proposal Manager which led to the first commercial Aerospace contract in Additive Manufacturing (AM) with Saab on the Grippen fighter jet. Today he oversees 3T's growth, understanding the commercial viability of additive manufacturing as well as where the real value is. He leads 3T's sustainability roadmap, which aligns with their mission to achieve net-zero component manufacturing by 2030.



## Matthew Bailey

Matthew is a Lead Technologist at the ATI in the Structures, Materials & Manufacturing team. Matthew is primarily focussed on supporting metallic technologies in the ATI portfolio. Matthew co-ordinates the ATI's Advisory Network and formerly chaired the CC-TAG. Before joining the ATI, Matthew worked at Airbus for nearly 10 years in various roles including Lead Engineer in R&T and latterly in cost engineering as Composite Manufacturing Cost Architect. Matthew has MEng in Aeronautical Engineering from Loughborough University and is a Chartered Engineer and member of the IMechE.



## Prof. Kathy Christofidou

Katerina (Kathy) Christofidou joined the department in 2019 and was appointed Chair in Digital and Sustainable Metallurgy in April 2024. She is currently the Director of Recruitment for the department and leads the Advanced Metals Processing research area for the Henry Royce Institute. Prior to this, she held roles at the University of Cambridge, as part of the Rolls-Royce University Technology Centre, and the University of Manchester, where she also worked in close collaboration with the Henry Royce Institute. College London.



## Angelo Emmi

Angelo Emmi is Senior Technologist for Structures, Manufacturing and Materials at the Aerospace Technology Institute. In his role, Angelo leads on composite material technologies for the institute and engages with stakeholders across the aerospace sector and beyond to support the delivery of the UK civil aerospace technology strategy. Angelo holds a B.Sc. in Industrial Engineering and a M.Sc. in Mechanical engineering from the University of Catania and prior joining the ATI he has had several years experience in the automotive industry, contributing to the engineering and development of cars such as the McLaren Speedtail, Elva and Artura among others.



## Emelia Fabris

I first met LCA at university, where I beta tested the first LCA software available for the construction industry in Australia, to support design decisions on the architecture of a new university building. Once I graduated I joined the commercial construction industry where I worked as a site engineer to build the building I helped design at University. The building was the first certified living building in Australia. Eventually the business moved me into a consultancy role, where I operationalised LCA, and applied my knowledge of sustainable design through digital integration into our design, construction and delivery processes. My experience broadened to include not only sustainable design for the environment but also for human wellbeing and regeneration, where I helped contribute to the adaptation of Well Building standards for Asia Pacific. In 2019 I moved to the UK and joined Airbus where I am now the engineering expert on env. impact assessment, leading topics on LCA and driving the development of new state of the art methods, data and tools to enable sustainable design.



## Dr Amy Fitzgerald

Amy Fitzgerald is a Research Engineer at the National Composites Centre (NCC) in Bristol, England. She holds an engineering doctorate from the University of Surrey, where her research focussed on understanding the environmental impact of carbon fibre manufacture under different production scenarios. Now she is applying this research more widely to the composites industry in order to realise the substantial sustainability benefits they can bring. Specifically this includes, but is not limited to, the use of bio-based materials, understanding sustainable manufacturing scenarios, applications for recycled composites, and the implementation of Life Cycle Assessments.



## Alison Gamble

Since leaving Bristol University with a degree in Aerospace engineering, Alison has nearly 20 years' experience in the Aerospace industry, working in Rolls-Royce. Her career has enabled her to experience all parts of the Turbine component supply chain and more recently to lead significant technology development programmes across the Civil Aerospace sector. Through her exposure to technology she has been able to understand the critical role manufacturing plays in our sustainability journey and the link to business improvement and driving cost out.



## Neil Glover

Neil is Materials Technology Fellow at Rolls-Royce plc. He is a Fellow and past-President of IOM3 and a Fellow of the Royal Academy of Engineering. Neil has over 25 years of experience of materials engineering for aerospace and other high integrity applications. His current role is focused on materials technology to support new product opportunities including electrical and hydrogen powered flight. Previous roles have spanned multiple business sectors and materials engineering across the product life cycle. For many years Neil was responsible for Rolls-Royce's aerospace materials research portfolio, including the company's extensive external network for materials research.

# Speaker Profiles *continued*



## **Phill Godfrey**

After three decades in aerospace and a wide variety of roles leading change, I am honoured to have the opportunity to contribute to the next aerospace transition to a more sustainable future.



## **Dr Simon Jenkins**

Simon is a Principal Engineer and Workstream Lead at the GKN Aerospace Global Technology Centre and has been leading technology development projects in metallic manufacturing since 2017 most recently with a sustainability focus. Simon spent his early career at the BAE Systems Advanced Technology Centre as a material testing specialist and worked as a metrology applications engineer for SME Imetrum Limited. He is a Charter Engineer and holds a PhD in Mechanical Engineering from Bristol University.



## **Stella Job**

Stella is an advanced materials and sustainability specialist with an engineering background. She is passionate about supporting people to design and innovate with a sustainability mindset, which she does through her consultancy business, Grazebrook Innovation. Stella was Sustainability Specialist on the ATI FlyZero project about hydrogen-powered aviation and previously led sustainability activity and supply chain engagement at Composites UK and worked in composites and smart materials at the Knowledge Transfer Network.



## **Carrie Lambert**

After studying physics and mechanical engineering at The University of Melbourne, Carrie joined Rolls-Royce where she worked for 11 years in a variety of roles with a focus on ground-based sustainable technology development and aerospace demonstrator programmes. Joining Reaction Engines in 2017 as Chief Project Engineer, Carrie helped progress the SABRE air breathing core demonstrator programme through its preliminary design phase and in developing the next generation technologies for space access. In 2022, she transitioned to the role of Head of Sustainability, responsible for accelerating Reaction Engine's products and operations towards net zero.



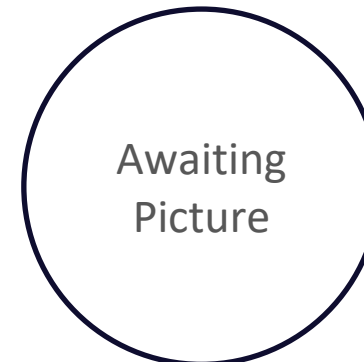
## **Denzil Lawrence**

Denzil has a broad engineering background, with over 30 years' experience in large and small organisations in aerospace, defence, marine, petrochemical and energy sectors. Over the last 18 years, Denzil has been active in supply chain collaborations between industry, academia and government helping companies access, develop and make sense of emerging manufacturing technologies. Denzil works with a team of research and technology specialists working throughout high value manufacturing sectors across the globe, seeking out current and emerging manufacturing technologies, tools and techniques that will improve the performance of The Boeing Company's manufacturing operations and global supply chain.



## **Dr Filomeno Martina**

Dr Filomeno Martina is the CEO of WAAM3D Ltd, a spin-out company of Cranfield University commercialising the Wire+Arc Additive Manufacturing (WAAM) process. Prior to this, he was Senior Lecturer in Additive Manufacturing at the Welding Engineering and Laser Processing Centre, Cranfield University, where he was the course director of the first MSc on Metal Additive Manufacturing in Europe. He is the winner of the 2022 FAME Jr award, and has received further awards from BAE Systems (2010, 2018), Royal Aeronautical Society (2013), European Space Agency (2015), and The Welding Institute (2018). He counts >50 publications to his name since 2013.



## **Alan Moore**

Awaiting biography



## **Tace Morgan**

Tace Morgan obtained a BEng in Mechanical Engineering from Newcastle University. She then went on to achieve an MSc(Res) in Additive Manufacturing and Advanced Manufacturing Technologies from the University of Sheffield. As a Senior Engineer at the AMRC, Tace has worked on projects across many sectors including Aerospace, Energy Storage, with a strong focus on Sustainability. She has technically led and managed AMRC projects looking to improve sustainability of the manufacturing processes of the AMRC partners and customers. Tace has worked on a number of customer funded projects and Innovate UK funded grant projects.

# Speaker Profiles *continued*



## **Prof. Conchúr Ó Brádaigh**

Conchúr is an elected Fellow of the Royal Academy of Engineering, a Chartered Engineer and a Fellow of the Institute of Material, Minerals and Mining and of the Institution of Mechanical Engineers. He joined the University as the Vice-President and Head of the Faculty of Engineering in 2023.



## **Ben Orson**

Designer of some of the most influential aircraft interiors over the past 20 years for airlines such as Cathay Pacific, Japan Airlines, and Singapore Airlines, Ben Orson has led creative teams in the UK and USA. In 2020, he launched Orson Associates, a design studio focused on future travel experiences, specializing in strategy, brand, sustainability, industrial design, and engineering. In 2021, Orson Associates led the cabin development for FlyZero, a £15m UK government-funded project for zero-carbon aircraft by 2030. In 2024, the company conducted a ground-breaking cabin sustainability audit for Air Canada, aiding the airline in achieving greener interiors.



## **Prof. Konstantinos Salonitis**

Prof Salonitis is the acting director of Manufacturing and Materials at Cranfield University and the head of the Sustainable Manufacturing Systems Centre. He has more than 20 years of experience in research on manufacturing systems and their sustainability. He leads two ATI projects at Cranfield University and has co-invested in many EPSRC, Innovate UK, and EC-funded projects. He has published more than 250 papers on related topics. He is the chair of the Manufacturing Industries Division at the Institute of Mechanical Engineering.



## **Phil Scott**

Career spanning nearly 30 years in the Aerospace and Defence for companies including Thales, GE Aviation and more recently Hamble Aerostructures, following an Aernnova Group acquisition in 2020. Conducted a number of product development and certification roles so far in my career. BEng in Mechanical Engineering from Leeds University and a MSc In Airworthiness from Cranfield University, Chartered Engineer and Fellow of the IMechE.



## **Robert Scudamore**

Rob is the Manager of the Advanced Manufacturing Technologies group at TWI that covers materials processing including welding/joining, coatings, repair and additive in metallics. He holds a PhD in Materials Science and Engineering and is a Fellow of The Welding Institute. His main technical background is laser Direct Energy Deposition (DED), laser powder bed fusion, and general metal DED. He is a past Chair and member of the Additive Manufacturing National Strategy and has been a committee member of the EFFRA Partnership Board and the Joining and Additive Sub-Platforms at European level.



## **Chris Weir**

Chris has 34 years' experience in aerospace engineering and senior management, spanning the full product lifecycle including technology acquisition, new product introduction, production and in-service support. He has worked on equipment systems including satellite cryogenic coolers, airframe flight controls, electrical power generation and aero-engine controls. His roles have included Chief Engineer - Technology for TRW, Vice President - Strategy & Business Development for AEC and Engineering & Technology Executive for Control Systems at Rolls-Royce. He is currently with the Midlands Aerospace Alliance, delivering the IUK/DESNZ "Decarbonising the Midlands Aerospace Cluster".

