ACM6

SC, March 4 - 8 2024

The 6th International Symposium on Automated Composites Manufacturing

Columbia, South Carolina, USA • March 4 - 8, 2024

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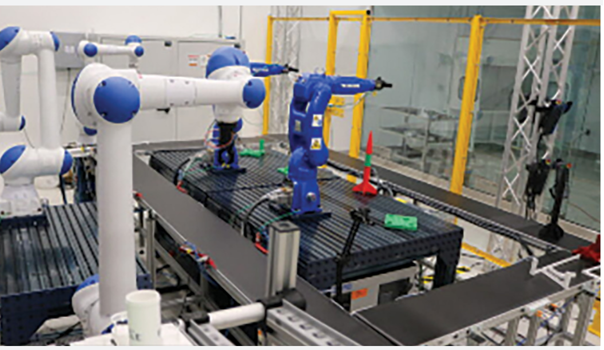

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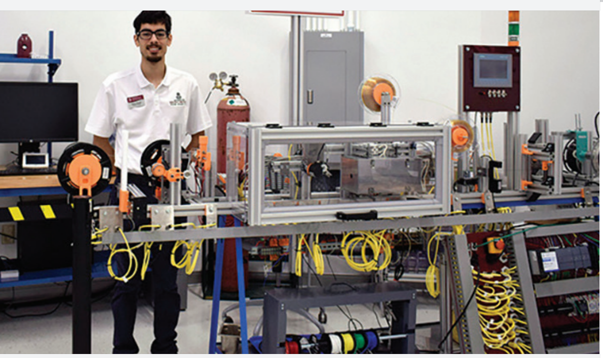
future factories

McNAIR



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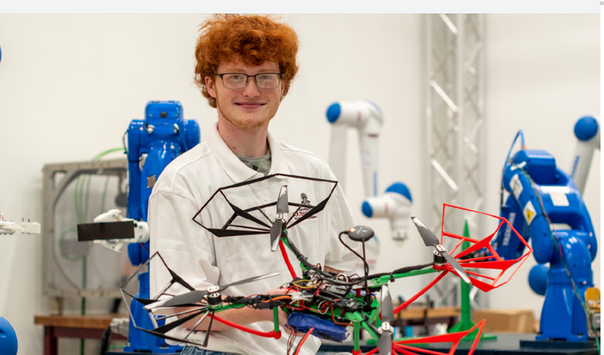

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WELCOME NOTE FROM ACM6 CHAIR

Dr. Ramy Harik

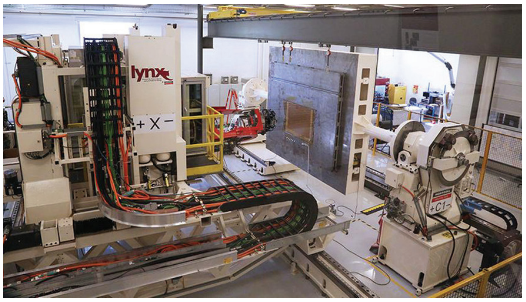
I firmly believe that the key to innovation, in all domains such as aerospace, automotive, energy, and beyond, lies within the realm of composites, where forthcoming structures will enjoy unprecedented advantages as automation in manufacturing reaches new heights. Whether it's my personal favorite, Automated Fiber Placement, or any other process within composites manufacturing, the automation benefits are poised to unfold as expertise and knowledge continue to proliferate, propelling this dynamic field forward on both hardware and software fronts.

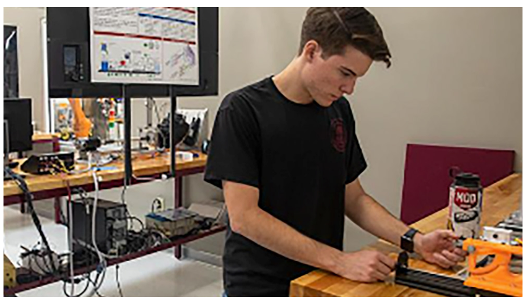
As we gather at the University of South Carolina, I am thrilled to extend a warm welcome to the composites manufacturing community. What an exceptional scientific program we have in store, featuring over 35 talks and numerous engaging activities, including tours. What sets this event apart is the harmonious blend of industry and academia among our attendees, spanning both sides of the Atlantic. I encourage you to seize this opportunity to connect and forge relationships with colleagues from around the globe. From the outset, our aim was to create an intimate gathering for composites manufacturing, and the program reflects that commitment. Please feel free to reach out to me during this week for anything that can make your stay more enjoyable. Enjoy ACM6 to the fullest!

BIOGRAPHY:

Dr. Ramy Harik, the ACM6 General Chair, is a Professor of Mechanical Engineering at the University of South Carolina. He leads the neXt (new and emerging X technologies) research team at the McNAIR Center for Aerospace Innovation and Research. Dr. Harik is a distinguished author, having written the "Introduction to Advanced Manufacturing" textbook, and "Manufacturing vs Corruption: Who Wins?" which won the 2023 Independent Press Award Distinguished Favorite for Social/ Political Change books. With over $18 million in funding from prestigious entities like NASA, Boeing, and the National Science Foundation, he has made significant contributions to his field. Dr. Harik has received numerous accolades, including the 2023 Outstanding Associate Editor Award from the Society of Manufacturing Engineers, and has been recognized as one of the 20 most influential professors in Smart Manufacturing by SME's Smart Manufacturing Magazine.

Dr. Ramy Harik, ACM6 General Chair / Professor of Mechanical Engineering

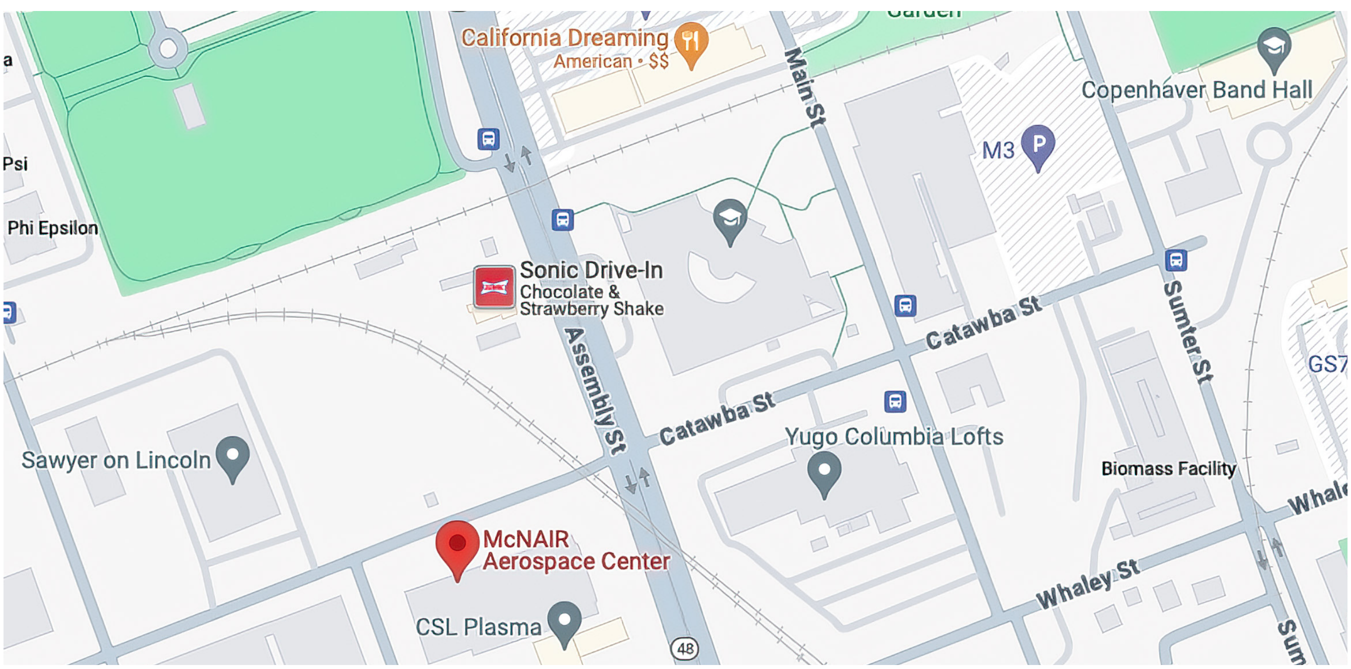




McNAIR

The McNAIR Center is a university center focused on aerospace-related education, research, K-12 STEM support, workforce development, and industry engagement. The McNAIR Center research team includes over 30 faculty from mechanical, chemical, civil and electrical engineering. Named in honor of SC native and Challenger astronaut, the Ronald E. McNair Center for Aerospace Innovation and Research was founded in 1950 with donations from Darla Moore, Anita Zucker and Marva Smalls. The McNAIR Center's mission is to grow South Carolina's knowledge-based economy and support industry through aerospace, research leadership and industry advancement. The main thrust areas of the McNAIR Center's core research include: steered fiber nonconventional laminate design, automated novel structural composite part production, multi-disciplinary design optimization of composite (aircraft) structures, automated, fusion based assembly.

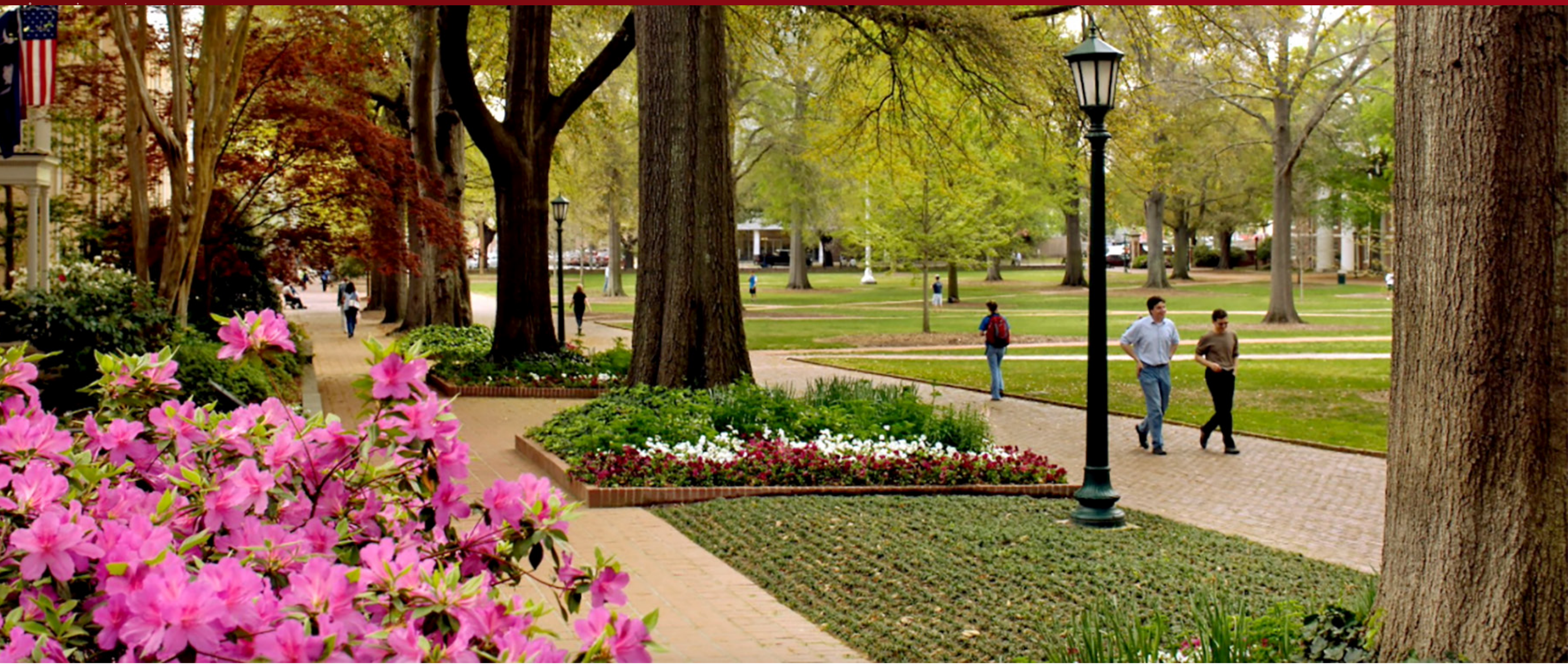
The McNAIR Center is located at 1000 Catawba Street, Columbia, SC 29201.



Ronald Erwin McNair (October 21, 1950 - January 28, 1986) was a physicist and NASA astronaut. McNair died during the launch of the Space Shuttle Challenger on Mission STS-510-L.

Ronald Erwin McNair

ACADEMIC PRE-CONFERENCE TOUR
Monday, March 4, 2024



10:00 am ● **Historical Tour of the Horseshoe/Campus**
- University Archivist Elizabeth West

UofSC Map

ACM6 Website

WIFI Network: uscguest

University of South Carolina Horseshoe Gates

A TOUR of the Historic Horseshoe with USC's Archivist Elizabeth West

Monday, March 4, 2024 at 10 am
Meeting Point: Maxcy Monument

The historic Horseshoe is one of the most iconic places on campus. Established in 1801, only 12 buildings have helped create the well-known U-shaped layout of the Horseshoe. Maxcy Monument, at the center of the Horse-shoe, was added in 1827.

Directions: Approximate street address is 886 Sumter Street, Columbia, SC 29201, enter through the main gate, and meet us by the Maxcy Monument for a tour.

Dress ready to walk! Tour will end around 11 am. Free roaming in Columbia after!


Maxcy Monument on the University of South Carolina Horseshoe

ACADEMIC CONFERENCE
Tuesday, March 5, 2024

@USC ALUMNI CENTER: 900 Senate Street, Columbia, SC 29201

Opening Session: 9:00 am - 10:30 am

9:00 am — **Welcome Note**
- Ramy Harik, Chair of ACM6 / Professor, University of South Carolina

9:10 am
9:20 am — **Welcome to the University and Columbia, SC**
- Dean Hossein Haj-Hariri
- Chair Travis Knight

9:30 am — **Opening Keynote**
- Dr. Sean Black, Senior Vice President at Spirit

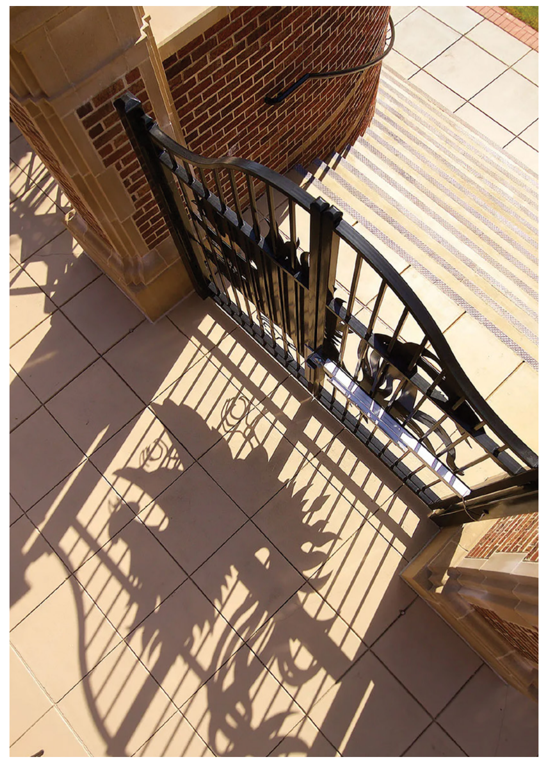
Ramy Harik, Chair of ACM6 / Professor, University of SC

Hossein Haj-Hariri, Dean, College of Engineering and Computing

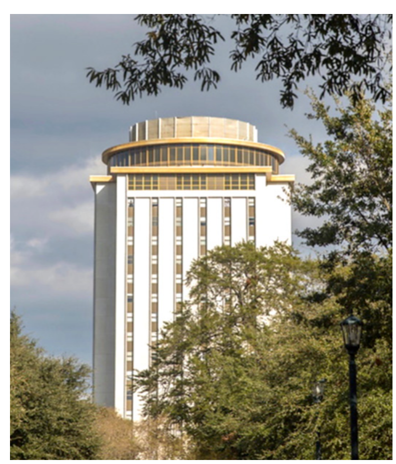
Travis Knight, Chair / Professor, University of South Carolina

Dr. Sean Black, Senior Vice President of Spirit

10:30 am	●	**Group Photo**
10:45 am	●	**Break**
11:00 am	●	**Session 1** - Process Parameters and Planning
12:00 pm	●	**Lunch**
1:00 pm	●	**Keynote 2** - Dawn C. Jegley, NASA ISAAC Lead
1:45 pm	●	**Session 2** - Mechanics and Repair
2:45 pm	●	**Break**
3:15 pm	●	**Session 3** - Thermoplastics
4:15 pm	●	**Educational Panel** **Moderator** - Keith Young from Boeing **Panelists** - Oleksandr Kravchenko from Old Dominion University - Roudy Wehbe from Toray - Julien van Campen from TU Delft - Chase Murray from Blue Origin
5:00 pm	●	**End of Day 1**
6:15 pm	●	**Dinner at *Top of Carolina***



Dinner Location:
The *Top of Carolina* restaurant is located on the 18th floor of the University of South Carolina's Capstone House, 900 Barnwell Street, Columbia, SC 29201.



OPENING KEYNOTE: Tuesday, March 5, 2024

Dr. Sean Black, Senior Vice President, Chief Technology Officer and Chief Engineer
Spirit AeroSystems, Inc.

9:30 am

Composites and the Next Decade

We live in the era of composite commercial aircraft. Over the past two decades, aircraft manufacturers have launched major composite aircraft programs. Both the Boeing 787 and Airbus A350 are now in high-rate production and flying all around the world. By weight, they boast the highest composite-materials content of any commercial aircraft to date. Notably, all the large composite structures Spirit produces, such as components of the 787 and A350, are manufactured via Automated Fiber Placement (AFP). After roughly 15 years in these programs, OEMs and suppliers have learned extensively about the capabilities of AFP and composite materials. As a result, we better understand the impact of decisions made over a decade ago around the materials, methods, regulation, and processes. Furthermore, there is increasing growth in demanding applications. All desire the performance of composite materials and the benefits of high-rate automated production, and require cost performance at a program level. Thermoplastics, advanced composite materials, robotics, digital methods, control algorithms, simulation tools, generative AI, and other technologies will impact the next 10 years of Automated Composite Aerospace production.

BIOGRAPHY:

Dr. Sean Black is the Executive leader of Spirit AeroSystems Engineering and Technology teams of 1,600 engineers across 11 global locations. Black has over 30 years' experience in complex international development programs in the Aerospace and Defense sectors, including full aircraft lifecycle experience and accountability to deliver large scale development and research projects to specification, quality, and regulatory requirements within a program matrix structure. His experience extends across multiple aerospace platforms, OEMs customers, and corporate level delegated design authority holder. Black started his career at BAE SYSTEMS Advanced Technology Centre in the UK as a Research Engineer, later serving as Engineering Manager for BAE SYSTEMS Aerostructures business unit. Black transferred to Airbus with the launch of the A350XWB program where he held a variety of leadership roles both in Europe and the United States, spanning the full development lifecycle from "clean sheet" design to industrial ramp up. In his last assignment with Airbus as Senior Director - Head of A350XWB US Program Management, he worked closely with a number of Tier 1 Aerostructure, Cabin and System suppliers across North America to secure critical development milestones. Prior to his industrial career Black held a Lectureship in Mechanical Engineering at the University of Dundee (Scotland).

Session 1: Process Parameters and Planning

Tuesday, March 5, 2024 @ 11:00 am

Paper Title: The effect of automated fiber placement process parameters on shear strength of prepreg bonded samples

(Authors: Kheradpisheh, Meisam; Hojjati, Mehdi)

Name: Mehdi Hojjati
Title: Professor
Affiliation: Concordia University
Linkedin: https://www.linkedin.com/in/hojjati-mehdi-80753563/

Mehdi Hojjati

Paper Title: The influence of tow tackiness on tow pull-up during the manufacturing of a composite pressure vessel

(Authors: Nedelcu, Alex; Florindo, Andre M.M.; Peeters, Daniël MJ; de Vlieger, Maarten; Castro, Saullo; Han, Sungi)

Name: Andre Florindo
Title: Automated Manufacturing Engineer
Affiliation: SAM XL
LinkedIn | www.linkedin.com/in/andre-florindo

Andre Florindo

Paper Title: Determination of shape of composite structure containing curvilinear fibers made by automated fiber placement using finite element analysis

(Authors: Hamiddpour, Mohammad; Hoa, Suong Van)

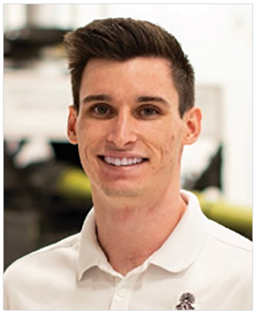
Name: Suong Van Hoa
Title: Professor
Affiliation: Concordia University
Linkedin: www.linkedin.com/in/suong-hoa-40254b51/

Suong Van Hoa

Paper Title: Artificially Intelligent Process Planner for Automated Fiber Placement

(Authors: Godbold, Matthew; Brasington, Alex)

Name: Alex Brasington
Title: Artificially Intelligent Process Planner for Automated Fiber Placement
Affiliation: University of South Carolina
Linkedin: www.linkedin.com/in/alex-brasington/



Alex Brasington

KEYNOTE 2: Tuesday, March 5, 2024

Dawn C. Jegley
NASA ISAAC Lead

1:00 pm

Automated Composite Manufacturing at the NASA Langley Research Center

The NASA Langley Research Center obtained the Integrated Structural Assembly of Advanced Composites (ISAAC) robotic system in 2014 to add state-of-the-art automated manufacturing of composites to our traditional in-house design, analysis, and experimentation capabilities. ISAAC is used to explore fabrication of parts with novel designs and for research into new composite manufacturing techniques. Automated fiber placement (AFP) was the initial manufacturing capability on ISAAC and has been used to support a range of aeronautics and space projects including the Advanced Composites Project (ACP), Composites for Exploration Upper Stage (CEUS), and Advanced Air Transportation Technologies (AATT). In addition to AFP, ISAAC can now provide through-thickness reinforcement of composites by adding stitches through dry fabric prior to resin infusion. Stitching is of interest since it can improve damage tolerance, reduce final assembly time, and reduce inspection requirements. ISSAC can stitch traditional single-needle seams and perform stitching operations using two needles when access is only available to one side of the part. Stitching capability is being advanced in the High-Rate Composites Aircraft Manufacturing (HiCAM) project today. This lecture will describe the work with ISAAC today and new exciting plans for the future.

BIOGRAPHY:

Dawn Jegley has worked in the area of structural mechanics at NASA Langley Research Center for 33 years. She currently works in the Structural Mechanics and Concepts Branch in the Research Directorate. She has worked both aircraft and spacecraft projects. During that time, her primary focus has been lightweight structures made from composite materials. She has experience in the analysis and testing of small and large structures including large-scale partnerships with industry. She has authored or co-authored over 75 technical papers on subjects including damage tolerance, the influence of cutouts, postbuckling behavior, analysis development and full-scale testing. She currently leads the Integrated Structural Assembly of Advanced Composites Activity and supports both the Advanced Composites and the Advanced Air Transport Technology Projects. Ms. Jegley received her MS degree in Structures and Dynamics from George Washington University and her B.S. in Aeronautics and Astronautics from MIT.

Session 2: Mechanics and Repair

Tuesday, March 5, 2024 @ 1:45 pm

Paper Title: In-situ Automated Fiber Placement gap defects filled by Fused Granular Fabrication
(Authors: Raps, Lukas; Atzler, Fynn; Chadwick, Ashley; Voggenreiter, Heinz)

Name: Lukas Raps
Title: M.Sc
Affiliation: German Aerospace Center (DLR) – Institute of Structures and Design
Linkedin: www.linkedin.com/in/lukas-raps-8077a5106/

Lukas Raps

Paper Title: Variable stiffness design to reduce the life-cycle impact of composite parts
(Authors: van Campen, Julien)

Name: Julien van Campen
Title: Assistant Professor
Affiliation: Delft University of Technology
Linkedin: www.linkedin.com/in/julienvancampen/

Julien van Campen

Paper Title: Mechanics of Resin Rich Regions Formation in AFP Preform with Staggered Fiber Tow Gaps
(Authors: Ravangard, Ahmadreza; Clyde Jamora, Von; Bhagatji, Jimesh D.; Kravchenko, Oleksandr)

Name: Ahmadreza Ravangard
Title: PhD. Student
Affiliation: Old Dominion University
Linkedin: www.linkedin.com/in/ahmad-ravangard-16a3ba203/

Ahmadreza Ravangard

Paper Title: Development of a Robotic and Automated Multi Tool for Autonomous Composite Repair
(Authors: Hilton, Stephen; De Backer, Wout)

Name: Stephen Hilton
Title: Research Assistant
Affiliation: University of South Carolina
Linkedin: www.linkedin.com/in/stephen-hilton-301

Stephen Hilton

Paper Title: Development and benchmark of model-based controls for thermoplastic Automated Fiber Placement
(Authors: Brandt, Lars; Wüstner, Johannes; Deden, Dominik; Kupke, Michael; Ament, Christoph)

Name: Lars Brandt
Title: Research Scientist
Affiliation: German Aerospace Center (DLR)
LinkedIn: www.linkedin.com/in/lars-brandt-6432121a1/

Lars Brandt

Paper Title: Hot Powder Bed Compaction: A Rapid Fabrication Approach for Thermoplastic Composite Prepreg Components
(Authors: Bhagatji, Jimesh D.; Kravchenko, Oleksandr)

Name: Jimesh D. Bhagatji
Title: PhD Student
Affiliation: Old Dominion University
LinkedIn: www.linkedin.com/in/jimesh-bhagatji-a88636125

Jimesh D. Bhagatji

Paper Title: Assessment of the Effect of Processing Parameters on Peel Failure of Laser-Assisted Automated Fiber Placed Thermoplastic Composites
(Authors: Wynn, Mathew; Zobeiry, Navid)

Name: Mathew Wynn
Title: Materials Scientist
Affiliation: University of Washington, Materials Science & Engineering
LinkedIn: www.linkedin.com/in/mathew-wynn/

Mathew Wynn

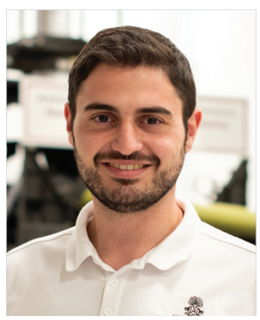
Paper Title: Grid stiffened panel made by Automated Fiber Placement (AFP) in-situ consolidation of thermoplastic composites
(Author: Schmidt, Raphael)

Name: Farjad Shadmehri
Title: Associate Professor at Mechanical, Industrial and Aerospace Engineering
Affiliation: Concordia University
LinkedIn: https://www.linkedin.com/in/shadmehri/

Farjad Shadmehri

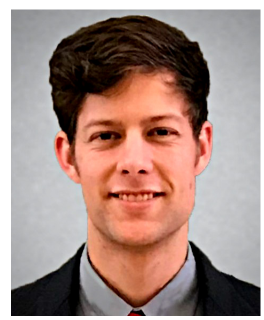
Moderator: Keith Young from Boeing

Oleksandr Kravchenko, Old Dominion University



Roudy Wehbe, Toray

Julien van Campen, TU Delft



Chase Murray, Blue Origin

Educational Panel at 4:15 pm

In the rapidly evolving field of advanced composites manufacturing, the bridge between education and industry requirements is crucial for nurturing the next generation of innovators and professionals. Our panel discussion seeks to explore the pivotal questions surrounding the current state of composites education and the path forward to ensure students are well-equipped for their future careers in this dynamic industry.

Panelist

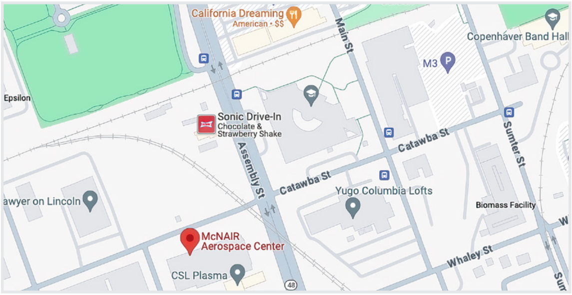
- Keith Young, Moderator
- Oleksandr Kravchenko from Old Dominion University
- Roudy Wehbe from Toray
- Julien van Campen from TU Delft
- Chase Murray from Blue Origin

ACADEMIC CONFERENCE
Wednesday, March 6, 2024

@Alumni Center: 900 Senate Street, Columbia, SC 29201

9:00 am		**DAY 2 Rundown**
9:15 am		**Keynote 3** - Dr. Waruna Seneviratne NIAR ATLAS Director
10:00 am		**Special Talk 1: Maximilian Holland** - Generative AI in Engineering
10:20 am		**Break**
10:30 am		**Session 4** - Automated Fiber Placement
11:30 am		**Special Talk 2: Martin Brown** - Development of Xenon Flashlamp Heating of Composite Materials
12:00 pm		**Boxed Lunch at McNAIR**
1:00 pm		**Post Doctoral Posters** **sponsored by SAMPE Carolinas**
1:00 pm		**McNAIR Tours**
4:00 pm		**McNAIR Reception** - Welcome note by Dr. Paul Ziehl, Director of the McNAIR Center
3:00 pm		**End of Day 2**

McNair Tours: The McNAIR Center is located at 1000 Catawba Street, Columbia, SC 29201.



KEYNOTE 3: Wednesday, March 6, 2024

Dr. Waruna Seneviratne
NIAR ATLAS Director

9:15 am

Multi-disciplinary Manufacturing Ecosystem for Developing Future Work Force through Applied Learning

The manufacturing sector is considered the backbone of economic development and prosperity of a nation. To meet aggressive demands for modernization of technologies used across the border, aircraft industry and their suppliers must undergo significant technology advancements and future workforce must be equipped with advanced hybrid, scalable, flexible, and extensible tools to adapt to growing complexities. Manufacturing-centric educational program that encompasses various science, technology, engineering, and mathematics (STEM) disciplines throughout product life cycle from conceptual design to fleet sustainment requires an established eco- system around manufacturing innovation. To successfully integrate traditional design and manufacturing processes with novel advanced technologies and digital engineering, educational and outreach program must prepare future workforce with tools and applied-learning experience necessary to utilize scientific, mathematics and engineering principles during production to meet demands. In addition to preparing the future workforce, current efforts must be expanded to integrate the current workforce seamlessly adapting to advancements in the workplace through seminars and outreach programs. Wichita State University's National Institute for Aviation Research (NIAR) established the Advanced Technologies Lab for Aerospace Systems (ATLAS) in 2019 as a multi-disciplinary manufacturing ecosystem to develop a workforce that is trained on advanced manufacturing systems. This manufacturing innovation center fits well into NIAR's mission to strengthen university research capabilities; provide applied learning opportunities for students; and support the aviation and manufacturing industries.

BIOGRAPHY:

Dr. Seneviratne is currently the Director of Advanced Technologies Lab for Aerospace Systems (ATLAS) at WSU/NIAR and manages a research portfolio that includes projects from FAA, DoD, DHS, NASA, and aircraft industry in the areas of advanced manufacturing and inspections, durability and damage tolerance, certification, and aging of composite aircraft structures. He is an active member of Composite Materials Handbook (CMH-17) and his previous research findings have contributed to damage tolerance, disbond delamination, data review, and statistics working group, and supported world-wide composite damage tolerance and maintenance workshops sponsored by FAA, USN, and EASA. Prior to joining Wichita State, Dr. Seneviratne worked as a Stress Analyst for Airbus-Wichita and was responsible for performing detailed stress analysis on AIRBUS A380 passenger aircraft wings per FAA and EASA regulations and preparation of certification documents.

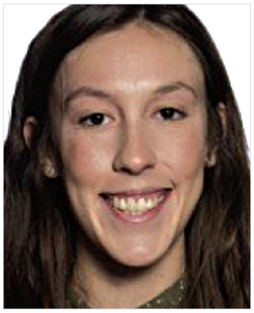
Paper Title: Model based data-driven optimisation of automated fibre placement set up
(Authors: Mahapatra, Sarthak; Chen, Siyuan; Chiappini, Attilio; Hallett, Stephen; Belnoue, Jonathan)

Name: Sarthak Mahapatra
Title: PostGrad Researcher
Affiliation: Bristol Composites Institute, University of Bristol
LinkedIn: www.linkedin.com/in/mahapatra-sarthak

Sarthak Mahapatra

Paper Title: Three-dimensional finite element-based data-driven thermal model of in-situ Automated Fiber Placement
(Authors: Fontes, Allyson; Shadmehri, Farjad)

Name: Allyson Fontes
Title: PhD Student
Affiliation: Concordia University
LinkedIn: www.linkedin.com/in/allysonfontes



Allyson Fontes

Paper Title: Tape lateral movement at the compaction roller during AFP composites layup under steering conditions
(Authors: Pantoji, Siddharth A; Peeters, Daniël MJ; Kassapoglou, Christos)

Name: Siddharth Pantoji
Title: PHD Researcher
Affiliation: TU Delft
LinkedIn: www.linkedin.com/in/siddharthpantoji

Siddharth Pantoji

Paper Title: A Digital Environment for Simulating the Automated Fiber Placement Manufacturing Process
Authors: Francis, Benjamin; Brasington, Alex; Godbold, Matthew; Harik, Ramy)

Name: Ben Francis
Title: Graduate Researcher
Affiliation: University of South Carolina
LinkedIn: www.linkedin.com/in/benjamin-francis-9438331a1

Ben Francis

Special Talk 1: Wednesday, March 6, 2024 @ 10:00 am

Maximilian Holland, M. SC
Fraunhofer Institute of Casting, Composite, and Processing Technology (IGCV)

Title: Generative AI in Engineering

Maximilian Holland

Generative Artificial Intelligence can generate text, images and other data based on textual user requests (prompts). Following the public release of ChatGPT at the end of 2022, many powerful Large Language Models (LLMs) have become available for individual use. This talk summarizes some key fundamentals of the technology for non-experts. It outlines future pathways to utilize Generative AI for engineering applications, such as the design of CFRP components. The built-in capabilities of ChatGPT with respect to answering technical questions are tested and discussed. Secondly, hybrid software architectures which merge LLMs with conventional computational engineering tools are demonstrated.

Special Talk 2: Wednesday, March 6, 2024 @ 11:30 am

Martin Brown, Applications Manager
Excelitas Noblelight, Ltd

Title: Development of Xenon Flashlamp Heating of Composite Materials

Martin Brown

As the composites industry continues to develop and moves towards using materials such as fibre reinforced thermoplastics, as well as lower cost or greener materials, the need for a flexible heating technology that combines high levels of power, controllability and safety is becoming more apparent.

In this presentation, Excelitas Noblelight will introduce the Discovery and Enterprise systems and describe the latest developments in the design, optimization, simulation, and implementation of its Xenon flashlamp-based humm3® heating technology.

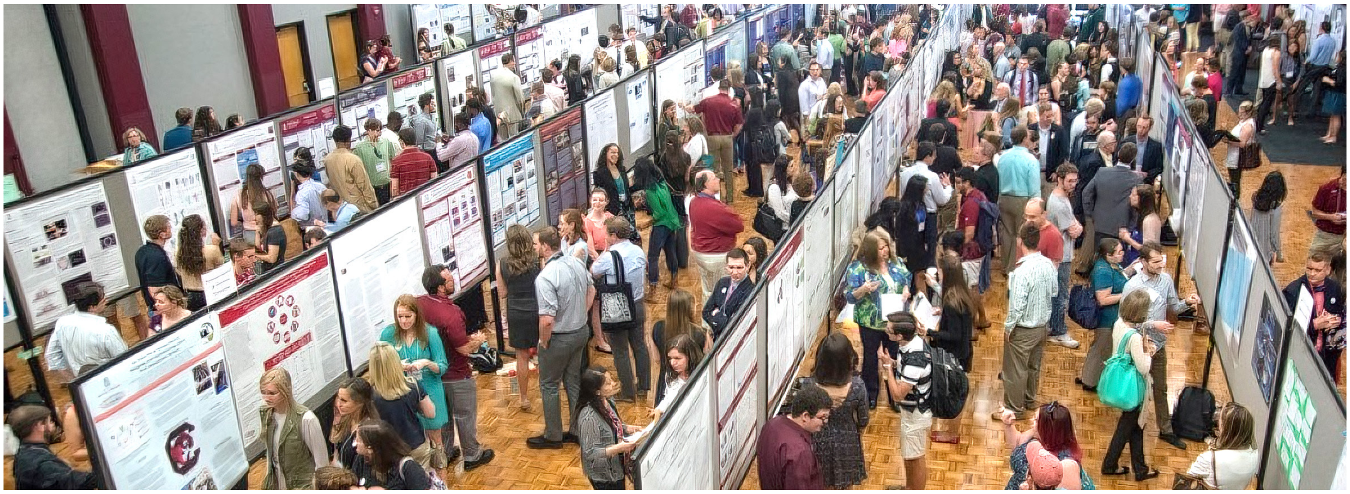
Excelitas Noblelight will summarize recent research work investigating how the pulsed, broadband Xenon heat source impacts tape to tape bond strength of thermoplastic composite materials. Analysis of processed materials using X-ray photoelectron spectroscopy, FTIR and SEM was performed to look at changes to polymer chemistry,crystallinity and void content. Finally, peel tests were performed to measure bond strength and assess failure modes of bonded faces.

Excelitas Noblelight will summarise their capabilities in optical measurements and simulations. This, coupled with commercial FEA and CFD software packages from ANSYS, have applications in product design, as well as thermal simulations of the AFP process.

The humm3® technology is now being ultilized in further applications, including the filament winding of thermoplas-tic materials for pressure vessels and pipes, large area rapid production of dry fibre structures, and staking/welding through layers of material.

Excelitas Noblelight Ltd, Cambridge, UK
Mr Martin Brown, Excelitas Noblelight Ltd, Cambridge, UK (martin.brown@heraeus.com)
Dr. Michael Edwards, Excelitas Noblelight Ltd, Cambridge, UK (michael.edwards@heraeus.com)
Professor David Williams, University of Bath, Bath, UK (dpw40@bath.ac.uk)

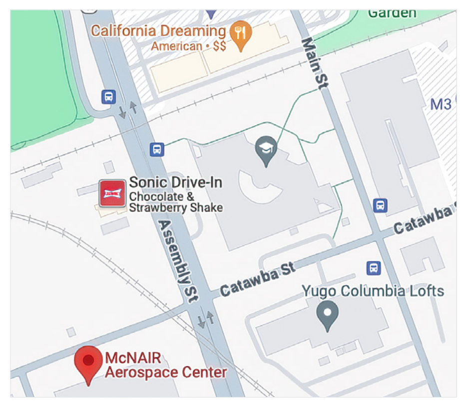
1:00 pm: Post Doctoral Posters sponsored by SAMPE Carolinas

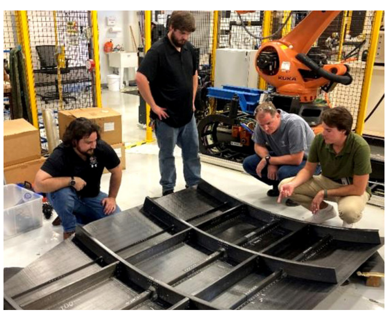


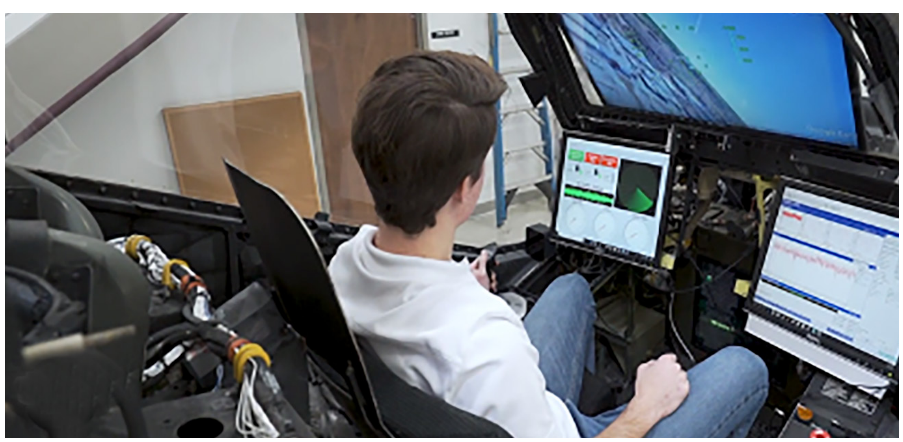
1:00 pm: McNAIR Tours

The McNAIR Aerospace Center research activities include areas such as composites, predictive maintenance, digital transformation, 3D printing, drones and unmanned vehicles, and combustion for aerospace applications.

The McNAIR Center is located at 1000 Catawba Street, Columbia, SC 29201.







3:00 pm: McNAIR Welcome Reception

Welcome note by Dr. Paul Ziehl, Director of the McNAIR Center.

BIOGRAPHY:

Paul Ziehl serves as the Associate Dean for Research in the College of Engineering and Computing and Director of the McNAIR Center for Aerospace Innovation and Research. He received his Ph.D. from the University of Texas at Austin in 2000 and joined USC in 2004. His work has been sponsored by NASA, the US DOD, private industry, and others resulting in over 200 publications and multiple patents in his areas of interest. He currently oversees a team of researchers including post-doctoral fellow/research professors, Ph.D. candidates, M.S. candidates, and undergraduate research associates. His research lies at the intersection of data driven discovery and physics-based modeling with a focus on material state awareness in aerospace composites and similar materials. He directs the NASA University Led Initiative 'Atoms to Aircraft to Spacecraft' with a focus on advanced air mobility vehicles in partnership with three academic institutions and contributes to the NASA supported Hi-Rate Composites Aircaft Manufacturing (HiCAM) initiative.

Dr. Paul Ziehl, Director of the McNAIR Center

ACADEMIC CONFERENCE
Thursday, March 7, 2024

@McNAIR Center: 1000 Catawba Street, Columbia, SC 29801

9:00 am — **Keynote 4**
- Dr. Sayata Ghose, Technical Fellow, The Boeing Company

9:45 am — **Session 5**
- Composite Manufacturing

10:45 am — **Break**

11:00 am — **Session 6**
- Curing and 3D Printing

12:00 pm — **Lunch**

1:00 pm — **Special Talk: Siemens**
- John O'Connor, Director, Aerospace Product Market Survey at Siemens Digital Industries Software

1:45 pm — **Session 7**
- Process Planning and Experimental

2:45 pm — **Break**

3:15 pm — **ACM7 and Beyond**

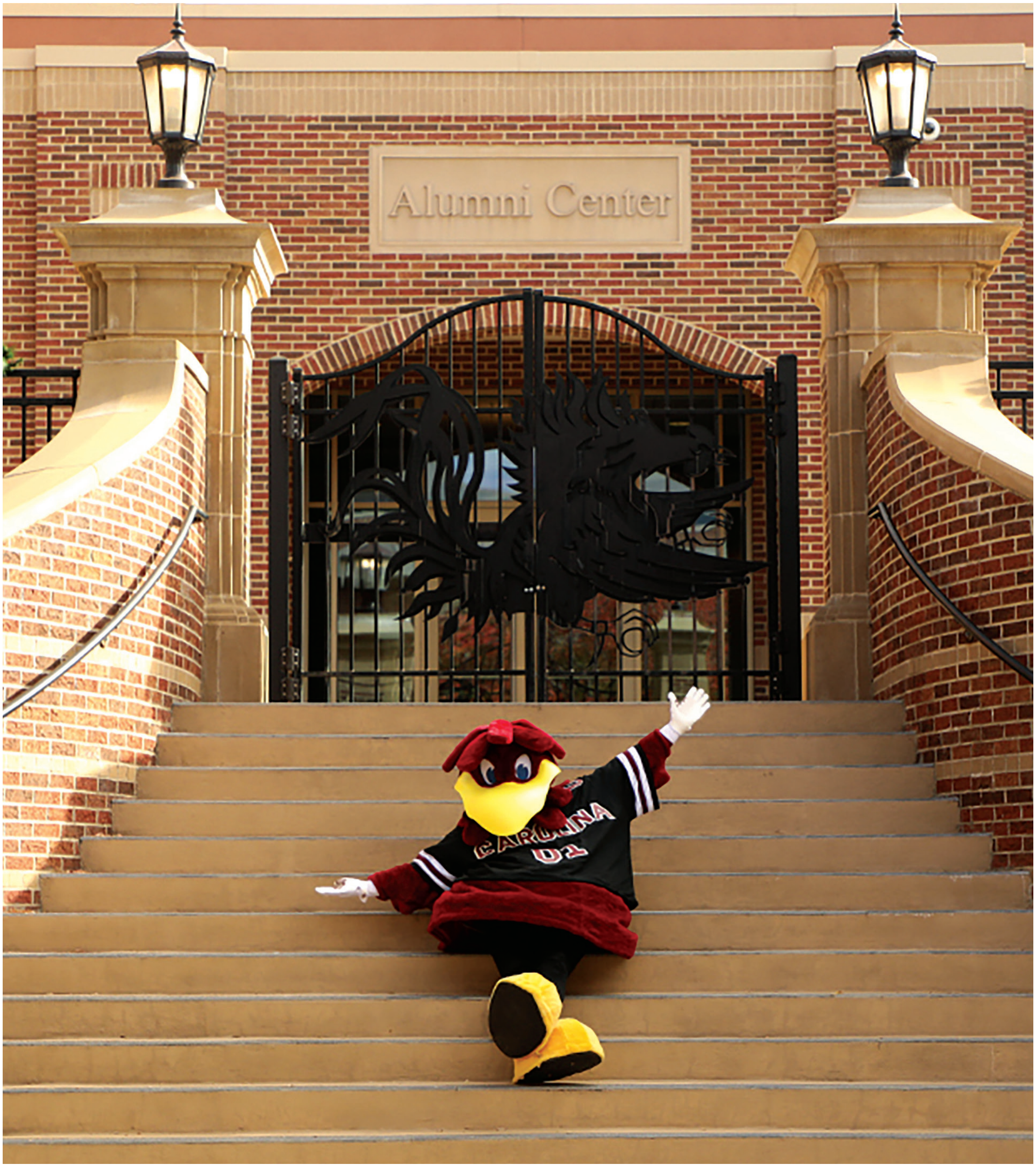
4:00 pm — **End of Day 3**

7:00 pm — **Gala Dinner at Presidential Dining Room**

11:00 pm — **End of Day**

Gala Dinner

The Gala Dinner is located at the Presidential Dining Room at the USC Alumni Center on the corner of Lincoln and Senate Streets.



South Carolina Gamecocks

The University of South Carolina's varsity sport teams are known as the "Gamecocks". This unique moniker is held in honor of Thomas Sumter, a Revolutionary War hero from South Carolina who was nicknamed the "Carolina Gamecock" after British General Banastre Tarleton said Sumter "fought like a gamecock."

KEYNOTE 4: Thursday, March 7, 2024

Dr. Sayata Ghose
Technical Fellow, The Boeing Company

9:00 am

Automated Fiber Placement at Boeing: Past Present and Future

With over a hundred years of experience in the aerospace industry, the manufacturing of composites has evolved significantly at The Boeing Company. The industry has gradually moved from the more time-consuming hand layup processes to automation. This transition provided greater focus on reduced touch labor, providing significant improvements in material placement accuracy and process efficiency. The technology started with contour tape laying systems using wider tape to build large surface area components of the B-2 aircraft in the 1980s. In the 1990's robotic automated fiber placement (AFP) was introduced providing a greater range of motion placing highly steerable narrow band width materials. While AFP was used regularly in Boeing defense and space applications including in the world's first tiltrotor aircraft (V-22), the advent of the 787 program accelerated the need for exponential growth using this technology both within Boeing and across the industry. Large clean rooms employing state-of-the-art AFP machines to support high volume large acreage structures like wings and fuselage components were built and AFP technology became more commonplace within Boeing and across the supplier base. Over the last 2-3 decades, significant advances have been made in terms of machine speeds, in-process material heating and inspection systems. AFP systems also advanced NC programming, material placement simulations and characterization. This talk will provide a brief history of the AFP process within Boeing, recent advances as well as discuss future opportunities in this area.

BIOGRAPHY:

Dr. Sayata Ghose attained her Ph.D. in Polymer Engineering from The University of Akron following a B.S. in Chemistry and B.Tech in Polymer Engineering. She then worked at NASA Langley Research Center for 7.5 years before joining The Boeing Company in 2011 where she has been working on materials producibility and composites fabrication. Ghose has 18+ years of experience processing and characterizing elastomers, nanocomposites, aerospace prepregs and high temperature resins. Her academic work includes 26 peer-reviewed journal publications, ~60 conference proceedings,15 poster presentations, 2 book chapters, >1000 citations, 10 U.S. patents, 1 patent application publication as well as multiple invited talks and funded proposals.

Session 5: Composite Manufacturing

Thursday, March 7, 2024 @ 9:45 am

Paper Title: Stress-reduced Multi-orbital Placement of Towpregs on Cylindrical Foam Cores in Continuous CFRP Rod Production
(Author: Bogenschütz, Marco)

Name: Marco Bogenschütz
Title: M. Sc.
Affiliation: Leibniz University Hannover,
Institute of Production Engineering and Machine Tools (IFW)
LinkedIn: de.linkedin.com/company/ifw

Marco Bogenschutz

Paper Title: The Effect of Through Thickness Reinforcement Angle on the Disbonding Behavior in Skin-Stringer Configuration
(Authors: Morris, Christopher J; Kravchenko, Oleksandr; Bhagatji, Jimesh D.)

Name: Oleksandr Kravchenko
Title: Associate Professor
Affiliation: Old Dominion University
LinkedIn: www.linkedin.com/in/okravchenko/

Oleksandr Kravchenko

Paper Title: In Development: 3D Printed Large Format Composite Tooling Using a Robot-Mounted Pellet Extruder
(Authors: Das, Aywan; De Backer, Wout)

Name: Aywan Das
Title: Graduate Research Assistant
Affiliation: University of South Carolina
LinkedIn: www.linkedin.com/in/aywan112-kuet/

Aywan Das

Paper Title: Advancements in Bimodal Foam Generation in PLA-PBSA Biopolymer Blends via Supercritical Fluid-Assisted Injection Molding
(Authors: Sai Aditya Pradeepa, Hrishikesh Kharbasb, Lih-Sheng Turngb, Abraham Avalosc, Joseph G. Lawrencec, Srikanth Pilla)

Name: Gang Li
Title: Professor
Affiliation: Clemson University, Department of Mechanical Engineering
LinkedIn: www.linkedin.com/in/gang-li-a177bbb/

Gang Li

Paper Title: Development of a Tension Measuring Test Bench to Determine Optimal Print Head Configuration for Continuous Carbon Fiber Printing
(Authors: Fisher, Jessica I; De Backer, Wout)

Name: Jessica Irene Fisher
Title: Graduate Research Assistant
Affiliation: University of South Carolina
LinkedIn: www.linkedin.com/in/jessica-fisher-12605619a/

Jessica Irene Fisher

Paper Title: CFRP Layer-by-Layer curing using research based automated deposition system
(Authors: Hartley, Robin; Kratz, James)

Name: Robin Hartley
Title: Research Associate
Affiliation: University of Bristol
LinkedIn: www.linkedin.com/in/robin-hartley-phd-799493113/

Robin Hartley

Paper Title: Contact-Based Tool-Path Mapping for Multi-AxisOverprinting on Non-Native Workpieces
(Authors: De Backer, Wout; Walker, Jacob; Bailey, Patrick)

Name: Wout De Backer
Title: Professor
Affiliation: University of South Carolina
LinkedIn: www.linkedin.com/in/wdebacker

Wout De Backer

Paper Title: Use of Non-Isothermal Cure Cycles for Reducing Cure Induced Deformation in Laminated Composites
(Authors: Madhura Limaye, Dwayne Morgan, Amit Makarand Deshpande, Sai Aditya Pradeep, Srikanth Pilla, Gang Li)

Name: Madhura Limaye
Title: PhD Candidate
Affiliation: Clemson University, Department of Mechanical Engineering
LinkedIn: www.linkedin.com/in/madhura-limaye/

Madhura Limaye

Special Talk: Thursday, March 7, 2024

John O’Connor
Director, Aerospace Product and Market Strategy
at Siemens Digital Industries Software

1:00 pm — **Enterprise Composites Product Development**

Increasing Growth and Profitability with Enterprise Composites Product Development

The digital factory for composite aerostructure development requires three complementary sets of capability: product lifecycle management (PLM), factory automation, and motion control. The ultimate goal of these capabilities is the complete digital representation of the physical value chain of a composite aerostructure and its smooth transition to production. PLM focuses on the virtual design of optimized composite structures and planning for high rate production. Factory automation enables highly efficient real world manufacturing facilities. And motion control provides high speed, precise automation technologies. To advance the state-of-the-art for composite aerostructure development, these capabilities must integrate in a sophisticated way. We call the solution created for this purpose “Enterprise Composites.” This presentation will review key components of our Enterprise Composites solution for world-class composite aerostructures development and production.

BIOGRAPHY:

John O’Connor is the Director of Product & Market Strategy at Siemens Digital Industries Software. Mr. O’Connor has served in many roles ranging from technical sales management to business development. Prior to Siemens PLM Software, Mr. O’Connor was a Senior Design Engineer at Lockheed Martin where he led a variety of product design teams. Mr. O’Connor holds a Master of Science degree in Materials Engineering from Rensselaer Polytechnic Institute and a Bachelor of Science degree in Mechanical Engineering from the University of Massachusetts at Amherst.

Paper Title: Experimental method to determine the mode-I in-situ bond strength-toughness development during automated placement of uncured thermoset carbon/epoxy tows
(Authors: Chakraborty, Debrup; Kodagali, Karan; Rajan-Kattil, Sreehari; Miller, Dennis; Sockalingam, Subramani; Sutton, Michael)

Name: Debrup Chakraborty
Title: Graduate Research Assistant
Affiliation: McNair Aerospace Center, Mechanical Engineering, UofSC
Linkedin: www.linkedin.com/in/debrup-chakraborty/

Debrup Chakraborty

Paper Title: Defects of in-situ consolidated thermoplastic composites manufactured by automated fiber placement
(Authors: Hoa, Suong V; Fereidouni, Mahmoud)

Name: Suong Van Hoa
Title: Professor
Affiliation: Concordia University
Linkedin: www.linkedin.com/in/suong-hoa-40254b51/

Suong Van Hoa

Paper Title: Large Language Model based Agent for Process Planning of Fiber Composite Structures
(Authors: Holland, Maximilian)

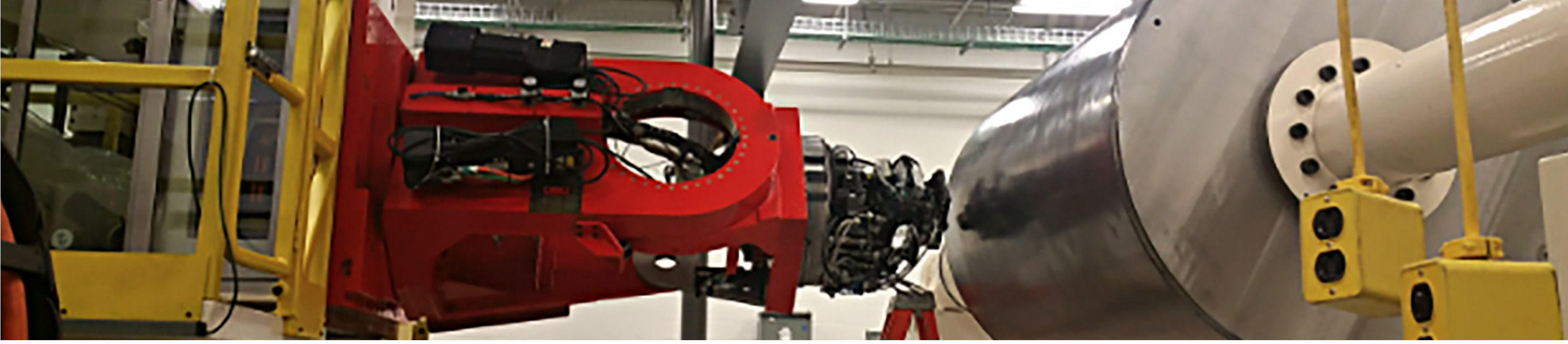
Name: Maximilian Holland
Title: M.Sc
Affiliation: Fraunhofer Institute of Casting, Composite, and Processing Technology (IGCV)
Linkedin: www.linkedin.com/in/maximilian-holland-b078831b6/

Maximilian Holland

Paper Title: Manufacturing and Performance of Sandwich Composite Panels with Recycled PET Foam Core Made by Continuous Roll Forming
(Authors: Mandegarian, Sepanta; Hojjati, Mehdi)

Name: Mehdi Hojjati
Title: Professor
Affiliation: Concordia University
Linkedin: www.linkedin.com/in/hojjati-mehdi-80753563/

Mehdi Hojjati



Selected papers published in the SME Manufacturing Letters,
Recent Advances in Automated Composites Manufacturing

Composites manufacturing, like other manufacturing techniques, is finding itself in a race to integrate digital technologies, which are disrupting the manufacturing domain. We are seeing integration of digital threads and digital twins with advanced automation, along with artificial intelligence and industrial internet of things being used to improve the efficiency of manufacturing processes. This interest in the digitalization of manufacturing is aiming to accelerate the material discovery process, while digital technologies integration in manufacturing is seen as the key to unlocking new paradigms in composites manufacturing that are not attainable with today's practices. In the world of composites manufacturing, getting a novel design to the manufacturing floor is a nightmare of its own, therefore the proposed digitalization paths of design and manufacturing should be done in a way that enhances existing practices and does not impede them.

This special issue will provide a platform for findings that push the frontiers of composites manufacturing through the application of newly emerging digital technologies and processes.

Composite Manufacturing processes of interest are: Automated Fiber Placement, Automated Tape Laying, Pultrusion, Filament Winding, Thermoforming, Additive Manufacturing with short/continuous fibers.

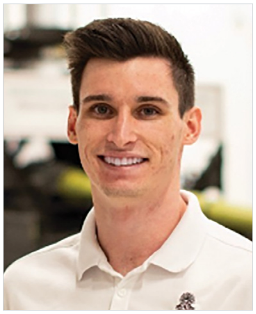
The topics include, but are not limited to:

- Applications in Physics-based modeling for process planning and defects management
- Data-driven modeling in reference to manufacturing parameters, process data, inspection, etc.
- Hybrid modeling through the combination of data/data driven models and physics-based models
- Digital twins and digital threads for composites manufacturing
- Design for Manufacturing
- Inspection techniques (both in-situ and NDI)
- Testing and experimental techniques

Guest Editors

Ramy Harik
University of South Carolina, Columbia, South Carolina, United States of America
(Automated Fiber Placement; Composites; Process Planning)

Oleksandr Kravchenko
Old Dominion University, Norfolk, Virginia, United States of America
(Material Characterization; Mechanics; Process Modeling)



Alex Brasington
Lockheed Martin Corp, Bethesda, Maryland, United States of America

ACADEMIC CONFERENCE
FRIDAY, March 8, 2024

@McNAIR Center: 1000 Catawba Street, Columbia, SC 29801

8:30 am	Leave from McNAIR
10:00 am	Free time in Charleston + Lunch
12:30 am	Departure to Boeing
1:00 pm	Tour of Boeing
3:00 pm	Departure from Boeing to Columbia
5:00 pm	Expected Arrival in Columbia

@THE BOEING COMPANY, NORTH CHARLESTON, SC

Image: Paul Thompson

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Dr. Ramy Harik, Chair

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Chair

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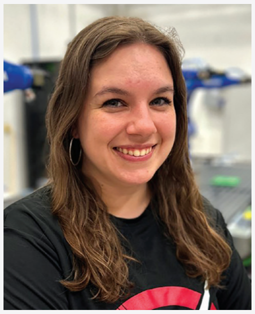

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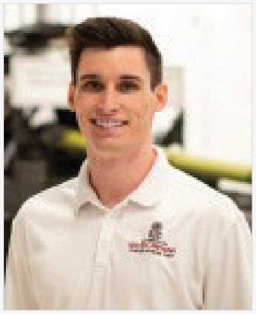

Alex Brasington
(Co-Chair)

Organizing Committee

Matt Godbold,
Co-Chair

Ibrahim Yousif
(Co-Chair)

Ben Francis

THANK YOU FOR JOINING US FOR THE ACM6 2024