

1st Annual Student Showcase

Summary Report

Presented by: PowerUp America

P^UwerUp America

Leading the Charge in Sustainable Transportation Solutions

Sincere Thank you to the Sponsor of the Student Showcase, PowerUp America, whose unwavering support has made this event possible, and not only fuel our endeavours but also pave the way for a future where advanced air mobility becomes an integral part of the global market.

PowerUp America is an electric vehicle charging network that is setting the standard for EVs, eVTOLs, and all other forms of electric aviation. PowerUp America focuses on the community at its core, aiming to provide customers with a convenient and reliable charging network, building a robust network of charging stations to ensure that wherever you are, you can charge with ease.



Student Showcase Word Cloud:

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Letter from the Master of Ceremonies

Celebrating AAMI's 1st Student Showcase

With nearly a decade of experience in the aviation industry, as a pilot and researcher, fascinated by the potential of flight to connect people and places, and all the impacts and inspiration lies behind this accelerating industry, I am being honored to serve as a member of the advisory board of the Advanced Air Mobility Institute (AAMI), an organization dedicated to educating and advocating for the broadest public benefit through the aviation ecosystem globally, and it is committed to protecting people, their rights, and the systems we rely on and ultimately fostering young minds, igniting innovation, and cultivating future leaders.

That was a privilege serving as the emcee for The First AAMI Student Showcase, an inaugural event that wasn't just about displaying students work, but about empowering the next generation of Advanced Air Mobility (AAM) pioneers, a rapidly-emerging, new sector of the aerospace industry with a vision of a safe, accessible, automated, and affordable air transportation system.

At this showcase, sponsored by PowerUp America (leading the charge in sustainable transportation solutions), provided a platform for students to share their work with the public, gain valuable feedback, and connect with potential mentors and collaborators, and we are confident that these brilliant minds will play a vital role in shaping a sustainable future of mobility and making AAM a reality. Student presentations were a testament to the passion of these brilliant young minds, youth ambassadors and dedication of our research council. The energy was electric! Fresh perspectives, innovative ideas, and technical expertise – these are the very tools they possess to bring this revolutionary technology to life.

The AAM Institute is at the forefront of this exciting new frontier in aviation. The mission, "Fair Winds Homeward," reflects our commitment to ensuring that AAM is developed and implemented in a way that benefits all of society, through dignity, safety and security.

— We invite you to join us in supporting the next generation of AAM pioneers to assure, empower and inspire our community, and to transform Civilization to Type-1 by serving Generation Jetson.

Soaring Towards the Future.

Cordially,

Amin Vafadar Board of Advisors Advanced Air Mobility Institute



Message from the Chair

In the Advanced Air Mobility Institute we are thrilled to launch the inaugural Research Council Student Showcase. The purpose of the Showcase was to provide insights into the cutting-edge research in various areas of the advanced air mobility (AAM), as well as to honour current Research Council Members and their contribution into the research in emerging aviation. The AAM Scholars and guest speakers showcased the cutting-edge research about various aspects of advanced air mobility.



Innovative research is important to proactively address the needs of the industry and inform policy in the AAM sector. The importance of this sector on a global scale cannot be overstated. It is imperative that we embrace collaboration to keep pace with the evolving needs of our interconnected world. From enhancing urban mobility to logistics and emergency response, advanced air mobility holds the key to unlocking limitless possibilities.

With a diverse array of projects, the AAM Institute's Research Council Student Showcase stands as a beacon of progress, propelling the future of air transportation towards unprecedented heights, and share the vision of tomorrow's leaders in AAM research. This summary report provides key highlights from the showcase event.

Dr. Oleksandra Molloy

Research Council Chair Advanced Air Mobility Institute

Invited Speaker

Lukas Asmer, a researcher at the German Aerospace Center (DLR),delivered а comprehensive presentation on the evolving landscape of urban mobility and unmanned contextualized aircraft. Lukas the current discourse on mobility by referencing historical cases and highlighting its potential impact on transportation systems. Drawing parallels to the Gartner Hype Cycle, Lukas suggested that UAM has reached a stage of heightened expectations, driven by publications like the Uber Elevate Paper and consulting reports. He emphasized the





Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

importance of viewing UAM from a holistic perspective in order to establish UAM as an innovative means of transport. Changes in individual components in a system of systems can influence each other in a positive or negative way. The presentation then delved into the Horizon UAM project, a collaborative effort involving various research fields within the DLR. Lukas outlined five main work packages: system simulation, vehicle design, safe operations, infrastructure development, and public acceptance.

In the system simulation work package, Lukas discussed efforts to evaluate the complexity of UAM systems and forecast global demand and fleet size under different scenarios. He highlighted the importance of economic viability in determining operating costs and ticket fares for various UAM applications attempts, notably Henry Ford's prediction in 1940 regarding the convergence of airplanes and motorcars. He noted that recent advancements in electric propulsion systems and vehicle design concepts have reignited interest in the vision of the flying car.

Lukas elaborated on the selection of certifiable system and powertrain architectures, as well as efforts to develop safe, comfortable, and accessible cabin concepts using design thinking methods. Safe operations were identified as a critical aspect of UAM, with a focus on developing machine learning algorithms and collision avoidance systems. Lukas highlighted the need for certifiability in machine learning applications and described efforts to enhance navigation frameworks for multi-sensory environments. He outlined research initiatives aimed at understanding public perceptions of UAM through telephone surveys, noise measurement tools, and virtual reality simulations.

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Invited Speaker

Julia Reichel, a representative from Mercuri Urval, a global leadership development and executive search company, shared insights into the evolving landscape of the AAM industry. She provided a comparative analysis between traditional aviation businesses emerging and eVTOL ventures. highlighting the need for legacy companies to pivot towards more sustainable and socially responsible practices, contrasting with the inherently innovative and environmentally conscious nature of modern startups. This paradigm shift underscores the importance of adapting organizational structures, processes, and leadership styles to meet the demands of an increasingly dynamic and fast-paced industry.



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Furthermore, Julia emphasized the significance of soft skills alongside technical expertise in the AAM sector. She emphasized the pivotal role of teamwork, emotional intelligence, effective communication, creativity, adaptability, and fearlessness in navigating the complexities of modern aviation and aerospace endeavors. While technical skills are essential, it is the complementary soft skills that often distinguish successful professionals and leaders in the field, enabling them to collaborate effectively, address challenges, and drive innovation.

In addition to discussing the importance of soft skills, Julia offered practical advice for students and graduates entering the industry, particularly regarding interview preparation. She stressed the importance of thorough research on potential employers, readiness for competency-based interviews, active notetaking during interviews to demonstrate engagement, and strategic questioning to understand one's role in contributing to the company's overarching mission and vision. Moreover, Julia encouraged candidates to close out interviews with confidence, seeking clarity on the next steps and proactively addressing any potential reservations or concerns from the interviewer's perspective.

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Student Showcase

Nils Widmaier

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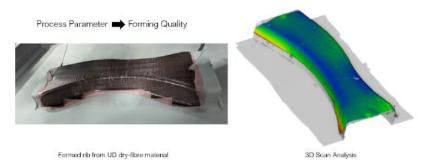
Short Bio: Nils Widmaier is a third year PhD candidate at Swinburne University of Technology in Melbourne, Australia. He has a Bachelor's and Master's degree in aerospace engineering from University of Stuttgart in Germany and experience as a research



assistant in fibre composite manufacturing and testing. Specifically, his expertise is in fibre composite materials, aerospace structures and high-volume manufacturing processes. His PhD research is focused on a preforming and forming process of unidirectional carbon fibre tape materials. The main forming techniques used is a double diaphragm forming process to make best use of near-net-shape preforms and minimize material waste.

Nils discussed advancements in manufacturing techniques for composite materials in the context of advanced mobility. He introduces the concept of using fiber composite materials to meet the lightweight demands of emerging technologies and emphasizes the need for new manufacturing approaches to keep up with growing demands. Swinburne University's involvement in advanced mobility research, particularly through the Aerostructures Innovation Hub, is highlighted, showcasing collaborations with both SMEs and large corporations like Boeing. Nils presented a case study on automated forming of a rib structure, resembling typical aerospace applications, to demonstrate successful forming capabilities of dry-fibre tape in a high-volume manufacturing area. Good repeatability and quality were achieved. Future research directions will focus on modern manufacturing aspects like traceability and modeling approaches.

Double Diaphragm Forming: Dry-fibre tape rib result



Syed Mujahid

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CV: click to open

Short bio: Syed Mujahid is a recent graduate in aeronautical engineering with expertise in aircraft design. Previously, he served as an aircraft design intern at Mallard Enterprises in the USA. He



presented research on designing an efficient cabin layout for air ambulances to address delays in ground ambulance transport due to factors like traffic and weather.

The research outlines the need for integrating air ambulances to improve hospital access and proposes optimizing the interior layout for patient comfort, medical equipment accessibility, and efficient transport. The design includes a division of the cabin into sections for avionics and patient care, with strategically positioned medical equipment, display screens, and storage space. The cabin features a hydraulic door mechanism, ample storage, and a paramedic seat with 360-degree rotation for easy access.

A 3-D model showcases the exterior and interior design elements, including LCD lights, a stretcher, an ACG monitor display, and medical equipment cabinets. The design aims to provide a comprehensive solution for integrating efficient air ambulance cabins into various aircraft configurations.



Brie O'Sullivan

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Short Bio: Brie O'Sullivan, a third-year PhD candidate at Western University in Ontario, Canada, presents her extensive work on the utilization of medical delivery drones to enhance healthcare access in sub-Saharan Africa. Her insightful presentation delves into the intricacies of implementing sustainable



drone delivery systems in resource-limited settings. Brie's background in public health and global health systems informs her approach to leveraging drones for medical purposes. She also highlights her role as a policy analyst and youth engagement lead at the Canadian Office of International Affairs and her involvement as a drone research consultant and STEM education consultant.

Brie elucidates the concept of medical delivery drones, specialized UAVs designed to transport emergency supplies such as vaccines, medicines, blood products, and even donor organs. These drones are equipped with temperature controls to maintain the integrity of cargo, including cold chain requirements, and are available in various configurations to suit diverse needs.

Focusing on sub-Saharan Africa, Brie emphasizes the region's pivotal role in pioneering medical drone delivery technology. She references the Medical Delivery Drone Database (MD3) by UPDWG, showcasing Africa's dominance in sustained drone delivery operations. Despite facing challenges, several projects in the region have thrived, serving as global exemplars. For her PhD research, Brie plans to conduct detailed case studies on three thriving initiatives in Rwanda, the Democratic Republic of the Congo (DRC), and Madagascar.

In Rwanda, Brie highlights the success of Zipline, a company that has collaborated with the government to create a comprehensive national drone delivery system, catering to millions in rural areas. The project, supported by various stakeholders, including governments and non-profits, exemplifies the potential of public-private partnerships in healthcare innovation. Moving to the DRC, Brie discusses the challenges posed by complex geography, instability, and poverty and how non-profit organizations like VillageReach have navigated these obstacles to implement a provincial-scale medical drone delivery system. Despite local funding constraints strategic partnerships with the government and private sector have enabled the project to expand its reach and impact.

In Madagascar, Brie explored the unique geographical and infrastructural challenges faced by initiatives like Population Services International and AerialMetric in delivering essential medical supplies to remote regions. Despite these challenges, external funding from organizations like USAID and the Global Fund has fueled their operations.

Brie concluded her presentation with a glimpse into the practical application of medical delivery drones, sharing videos captured during her recent trip to Madagascar. These videos depict drones in action, showcasing their role in bridging healthcare gaps and improving access to vital medical supplies in remote communities.



Nabil Hagag

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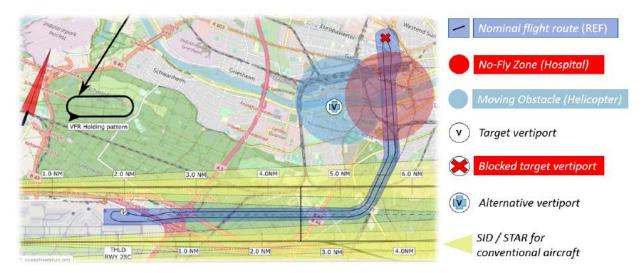
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Short bio: Nabil Hagag is a PhD Candidate at the German Aerospace Research Center (DLR), delves into the intricacies of mission-based flight guidance for advanced air mobility, particularly focusing on energy demand considerations.



He underscored the paramount importance of ensuring safe and reliable flight operations, stressing the need for robust contingency procedures to handle offnominal flight missions like emergency situations effectively. Drawing attention to the backbone of EU aviation regulations, Nabil highlighted the significance of considering energy demand calculations within dynamic urban scenarios, where factors like maneuvers and unforeseen circumstances play pivotal roles.

In his research, Nabil aims to provide a realistic assessment of energy demands for various types of advanced mobility vehicles, with a particular emphasis on VTOLs (Vertical Takeoff and Landing aircraft) operating within a range of up to 100 kilometers. He explores different propulsion systems, including battery, fuel cell, and hybrid solutions, taking into account the certification limits and regulatory frameworks set by aviation authorities. Nabil proceeded to share results from operational range calculations, offering insights into energy consumption patterns during hover and cruising phases of flight for quadcopter configurations. These insights, derived from real-world projects and simulations, underscore the necessity of minimum energy reserves and contingency procedures to ensure mission success and safety.



Christopher Conrad

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Short bio: Christopher Conrad is a PhD candidate at Cranfield University and a researcher within the European SAFIR-READY project. He received his Bachelor's degree in Electrical and Electronic Engineering from the University of Malta in 2022, and his MSc in Advanced Air Mobility (AAM) Systems from Cranfield University in 2023.



His research interests include AAM, UAS traffic management (UTM), vertiport management and intelligent algorithms. In 2023, Christopher received the SESAR European Young Scientist Award for his work on vertiport traffic flow management and continues to be actively engaged in AAM and UTM research.

Christopher provided an overview of his research on collaborative decisionmaking for UTM. He underscored the growing importance of UTM systems in transforming the aviation industry and addresses the need for dynamic and nonbinary prioritization schemes to enable effective and collaborative decisionmaking within emerging federated UTM ecosystems.

The research aims to develop a distributed yet integrated decision-making framework that promotes cooperation and communication among stakeholders. It also employs new prioritization schemes to fairly resolve conflicts over resource allocation. Christopher discusses the challenges of accurately reflecting the urgency of different mission applications, balancing the multiple objectives of various actors, and fairly accommodating new on-demand business models. He further highlights the importance of ensuring that decision-making algorithms are safe and robust in cases of unavailable or corrupted data and malicious UTM actors.

Christopher concluded by outlining the progress made in developing and simulating the decision-making architecture and emphasized the importance of collaboration for further advancements in UTM.

Noah Li

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Short bio: Noah Li, a student at Boston University, presented his research on acoustics, focusing on aircraft engine noise reduction. He discussed the complexities of turbofan engines and the various components contributing to aerodynamic noise.



Noah emphasizes the importance of noise reduction due to its impact on human health and regulatory implications from organizations like the FAA. His research involves simulations to study aircraft engine design and noise, using methods like eddy simulation and semi-analytical methods based on the cascade model. Noah's recent work includes studying broadband interaction noise and developing hybrid approaches using machine learning neural networks. He also mentioned ongoing projects involving non-uniform inflow effects and lane placement, with upcoming presentations at aeroacoustics conferences.

Noah highlights his affiliation with the Unsteady Fluid Mechanics & Acoustic Lab at Boston University, mentioning funding from projects sponsored by NASA. He also mentions research on high-fidelity simulation in urban areas and exploring cavitation as a raindrop breakup mechanism during hypersonic flight.

Mohammad Azizuddin Imtiaz

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Short bio: Mohammad Azizuddin Imtiaz is currently a Research Assistant during his Master's of Aerospace Engineering at the Department of Mechanical and Aerospace Engineering, Indian Institute of Technology (IIT) Hyderabad. At the Student Showcase, he presented his current work on aerodynamics



and performance of UAVs/MAVs. He was previously a junior research fellow gaining experience in the delivery of key research and development projects funded by various government organizations in India over the past six years in the areas of structural analysis, aerodynamics, CFD, FEA and eVTOL design.

Aziz discussed his involvement in India's first fully autonomous passenger eVTOL project, where he led the aerodynamics and flight mechanics team, and assisted in system integration and flight testing of the vehicle. He explains how he studied interactions between propellers, aiming to minimize their interference and optimize performance as a part of his Master's thesis.

He described an experiment he designed to analyze these interactions, using electric motors and sensors to precisely measure thrust, torque, and RPM. Mohammad shares preliminary findings indicating that optimal distance between propellers minimizes interaction effects, leading to improved performance. He mentioned ongoing investigations into the analysis of thrust and torque signal data to further understand the dynamic characteristics. Aziz will be graduating soon, and he is actively looking for job opportunities globally.

Nihal Tezcan

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Nihal Tezcan, a student at the University of Salford studying master's degree in Sustainable Air Transport Operations and Planning, shared research on urban air mobility preferences in Manchester, focusing on organizational aspects



and noise impact. She raises concerns about noise pollution in urban mobility compared to conventional transportation methods and discusses the significant environmental footprint of lithium batteries used in electric vertical takeoff and landing (eVTOL) vehicles. Nihal highlighted Vertical Aerospace, a prominent British company known for its innovative eVTOL designs and contributions to sustainable urban mobility. Founded in 2016, the company has made strides in developing efficient, eco-friendly solutions.

Nihal suggests exploring multimodal transport systems that integrate urban air mobility with existing transportation modes like buses, trams, and trains in Manchester to enhance connectivity and reduce travel time. As part of her research, Nihal proposes conducting noise measurements at key locations such as Piccadilly Station, Victoria Station, National Express bus station, and Manchester Barton Aerodrome to evaluate the noise levels generated by different transportation systems. These preliminary findings aim to inform noise mitigation strategies and community engagement efforts.

Ottavio Pedretti

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Short bio: Ottavio Pedretti is an architect and a PhD candidate in the Architectural, Urban, and Interior Design program at Politecnico di Milano. Since 2020, he has been a tutor in different design studios for the B.SC. degree program at Politecnico di Milano. He held

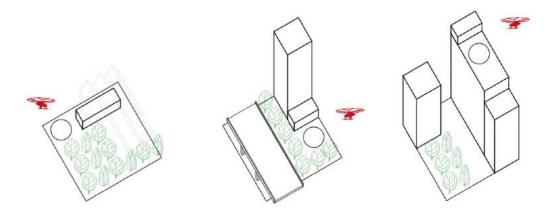


a master degree from Politecnico di Milano with a thesis on the relationship between abandoned industrial buildings, cotton mills, and the surrounding living space, slums, in India.

The PhD research titled "Pioneering Infrastructure. Experimentation on Design Strategies for Urban Air Mobility In Italy" focuses on the challenge of land infrastructure for Urban Air Mobility, funded by the PNRR (the Italian *National Recovery and Resilience Plan*).

Ottavio's research is a pioneering endeavor in architecture, focusing on integrating sustainable design and social acceptance into urban air mobility infrastructure. The study of vertiports from an architectural perspective is novel, requiring comprehensive investigation due to the limited existing examples. His research addresses this gap by exploring the architectural design aspects necessary to integrate vertiports into existing urban environments successfully. Ottavio employs various methodologies, including interviews, case studies, and AI-generated imagery, to envision future scenarios and analyze the architectural challenges of vertiports, such as their vertical capabilities and impact on surrounding built environments. He draws inspiration from historical imaginaries and contemporary technologies, aiming to integrate air mobility infrastructure into the urban environment to improve spatial quality and regenerate urban areas.

Ottavio's case studies, particularly focusing on the Napoli region due to its geographical and infrastructural characteristics, serve as a model for Italy. He employs a design-driven research approach to examine the design strategies needed to integrate vertiports into urban environments. Ottavio outlines scenarios for emergency response, goods delivery, and passenger transportation, emphasizing the need for flexible design to meet future needs.



Ottavio Pedretti, Design Strategies, 2024

Makayla Galler

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Short bio: Makayla Galler is a high school senior and captain of the USA Drone Soccer team. At the Student Showcase, she explained drone soccer, an exhilarating sport that combines traditional soccer with flying drones. Makayla recounted her team's achievements and emphasized the sport's growth and mentorship from the South Korean team. She described the



game's dynamics, where players control drones inside a large arena resembling a cage, ensuring safety and preventing drones from flying away. Two sizes of drones are used, resembling soccer balls and beach balls, respectively. Makayla explained the game's rules, positions, and strategies, highlighting the fast-paced nature and mid-air collisions akin to drone combat. Each team member plays a specific role, contributing to offense and defense strategies. Between rounds, teams repair drones, akin to pit stops in racing, underlining the importance of teamwork and efficiency.

Makayla underscored the educational value of drone soccer, promoting STEM learning and collaboration. She introduced her company, Pilot Prodigies, aimed at bringing STEM experiences to underserved students through drone soccer workshops and demonstrations.

Kayla Gray

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Short bio: Kayla Gray is a recent graduate from the University of Oklahoma College of Law with a Juris Doctorate that includes a certificate in International and Comparative Law. Mrs. Gray discusses the need for proactive measures in regulating new technologies like the autonomous transportation industry.



There are great opportunities for autonomous transportation, but it is important to consider potential negative impacts such as privacy breaches, forced labor, and human trafficking. Kayla introduced multistakeholder initiatives (MSI) as a solution, citing examples like the Global Network Initiative for Internet privacy. She highlighted the creation of the Autonomous Transportation Public Trust Initiative (ATPTI), aimed at proactively protecting human rights in the autonomous transportation industry. Kayla underscored the collaborative effort involving companies, nonprofits, and academics to ensure effective regulation. Through the ATPTI, the focus remains on safeguarding human rights from the outset of the Advanced Air Mobility industry.

Petar Lulchev

Petar Lulchev, a Master's student in Aeronautical Engineering from Sweden, presents his thesis on planning and integrating a U.S.-based package delivery system in rural regions. His thesis is part of the larger logistics project called 'Request in Germany.' Petar outlined the challenges and motivations for the project, emphasizing the need for sustainable transportation solutions in rural areas. He discussed the logistics model proposed by the Request project, which involves regional and local distribution centers, as well as the use of drones for delivery. Petar explained the methodology for planning and evaluating such operations, including surveys, risk assessment, and the development of a preliminary mission evaluation tool. He presented initial results from the tool, showing the relationship between range, energy requirement, payload mass, and headwind. Petar concluded by discussing future steps, such as refining the estimation model and conducting flight tests.

Vice Chair Recap

As the Vice Chair of the Research Council, I was excited to aid in the planning of our inaugural Research Council Student Showcase. This event was designed not only to showcase cutting-edge research, but also to foster collaboration, encourage the exchange of ideas, and highlight the future direction of our industry. It brought together researchers from various fields, demonstrating the holistic approach needed to tackle the challenges on the horizon in the advanced air mobility industry.



The event underscored the importance of integrating diverse perspectives. We saw presentations that spanned the spectrum of our field, from technological advancements and industry impacts to equity in transportation and building public trust. These presentations illustrated how each aspect is crucial for the development and implementation of Advanced Air Mobility solutions.

The diversity within our Research Council itself, with members from various global regions and disciplines, reinforces the AAM Institute's commitment to a comprehensive approach when advocating for the sustainable development of Advanced Air Mobility. This diversity is crucial for addressing the multifaceted challenges we face and for driving innovation in a way that is inclusive and forward-thinking.

I would also like to extend my gratitude to our guest speakers, Lucas Asmer from the German Aerospace Center and Julia Reichel from Mercuri Urval, for their valuable contributions. Their insights added depth to our discussions and broadened our understanding of the global landscape of advanced air mobility. Additionally, a special thanks to PowerUp America for their sponsorship helped provide a platform for our student researchers to showcase their work.

Thank you to everyone who participated and contributed to the success of this showcase. Your work and engagement are vital as we continue to advance this exciting field. Let's continue to work together to shape the future of advanced air mobility.

Nick Tepylo

Research Council Vice Chair Advanced Air Mobility Institute

