ISSUE
#26
ASRC News
AVIATION SERVICES RESEARCH CENTRE
QUARTERLY NEWSLETTER
JUL – SEP 2025

In this big issue

Boeing and ANA Fellows Visited ASRC

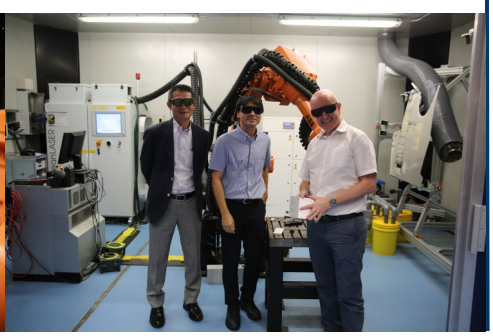
Exploring the Laser Ablation Demonstration

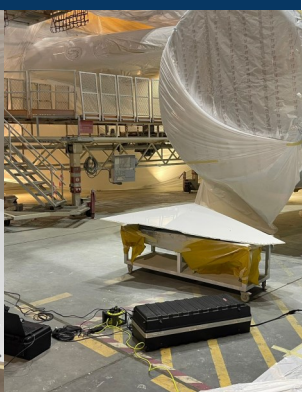
In September 2025, we welcomed Boeing and All Nippon Airways (ANA) representatives for a demonstration of our laser-based aircraft paint removal technology. This innovative laser ablation enhances maintenance efficiency while reducing hazardous waste and environmental impact, supporting our commitment to eco-social sustainability and safer workplaces.

The Boeing teams also visited Hong Kong Aircraft Engineering Company Limited (HAECO) and Hong Kong Aero Engine Services Ltd (HAESL) to reinforce collaboration with this founding ASRC member, a global leader in Maintenance, Repair, and Overhaul (MRO) services.

Additionally, Mr. Arne Lewis from Boeing, with 37 years of aerospace expertise, delivered a guest lecture to aeronautical engineering students. As Chairperson of ASRC's Technical Advisory Committee, his insights bridged industry knowledge and academic learning, inspiring future aviation professionals.

Together with ANA, Boeing, HAECO, and HAESL, the ASRC remains committed to advancing sustainable aviation technologies while fostering innovation, research, and development.





A350XWB Wing Panel Scanning

ASRC staff recently supported an urgent task at HAECO CLK Hangars by scanning a replacement A350XWB wing panel. The task was part of a planned composite repair tooling requirement, with a service notification time of only 18 hours. Thanks to efficient coordination, the scan was completed within 3 hours. This support was delivered as a free membership service, showcasing our commitment to providing timely and practical support to industry partners. Using the Creaform MetraSCAN 3D system, capable of capturing up to 1.8 million measurements per second within an 8 x 8 x 8m envelope, the team successfully digitized and modelled the aircraft component with speed and precision. This case highlights ASRC's capability to respond rapidly to industry needs

Sustainability

Aerostructure Digital Twin and Planet SDG's

The 'Planet' principle is a central pillar of the 2030 Agenda, prioritizing the protection of our natural systems as the essential foundation for all sustainable progress. The AeDiT project embodies this vision, aligning its core objectives with key Sustainable Development Goals (SDGs), specifically Sustainable Cities (SDG 11) and Responsible Consumption (SDG 12). Our project is driven by three clear environmental targets: drastically reduced paper usage, the significant reduction of physical consumables, and a major decrease in energy consumption.

By implementing a fully digitized workflow for aircraft damage inspection, the AeDiT system eliminates most of the printed documentation. For a single aircraft over its 20-year life, this saves an estimated 13,120 pages of paper. This equates to 27 boxes of paper and over HKD 12,400 in saved material and toner costs. Furthermore, the system's advanced 3D damage mapping entirely removes the need for physical tags on aircraft. For a large maintenance organization, this innovation saves up to 300 meters of tag annually, minimizing waste.

The most significant impact is a 76% reduction in electricity consumption per maintenance check. Energy usage drops from 817 kWh to just 196 kWh. This is achieved by eliminating high-power equipment and, crucially, by reducing inspection times. Shorter tasks cut energy-intensive hangar lighting usage by 75%. This shift to a streamlined digital system demonstrates a firm commitment to operating within our planetary limits, proving that economic activity can successfully coexist with environmental stewardship.

Mr Nicolas Detalle is a PRF in the Data, Materials and Instrumentation Stream of the ASRC

Project Descriptions

ITC-ITF / ASRC Member Funded Open Source Project

Aerostructure Digital Twin (AeDiT)

Recording and displaying the history of maintenance on an aircraft is presently very much a paper legacy process. However there is a push within the MRO industry to implement a platform based software system to record, display and communicate maintenance activities on the airframe. The ASRC have commenced a project to develop a better way to record this data. We will investigate novel methods of damage detection and geolocation of the data using active thermography, ultrasound, enhanced visual methods and hyperspectral scanning with a drone. The data will be recorded and displayed on a 3D model of the aircraft. Once completed, the CAD model will be used to accurately record a maintenance activity with the option of sharing the data with the OEM should stress analysis be required when considering the repair.

Recycling Metal Chips into AM Feedstock (RecAM)

During the production of monolithic aerostructure and aeroengine components, up to 95% of the original material is removed, generating a large volume of machined chips. These are typically recycled into lower-grade components with reduced specifications. The RecAM project aims to develop innovative, low-cost, localised recycling methods to transform these chips, particularly Titanium Alloy into high-quality precision powders. This is increasingly important as sourcing raw titanium becomes more challenging. The resulting powders will be used in advanced additive manufacturing processes such as Selective Laser Melting (SLM), Directed Energy Deposition (DED), and Cold Spray. Powder production will involve Atomisation and Hydrogenation–Dehydrogenation ball milling, followed by comprehensive characterisation before manufacturing test specimens for benchmarking and destructive testing.

Advanced Masking Techniques on Aero Components (AMTAC)

The goal is to develop some advanced masking techniques for aerospace components. A study on the capability of various maskants against chemical damage from subsequent treatments will be undertaken. Alternative maskants and masking techniques will be explored, new maskant should be resilient to chemical attack and require shorter application time. An automatic masking system will be developed and tested to ensure consistent quality, especially when the masking is applied on irregular surfaces. NDIs will identify any masking flaws and verify the thickness of maskants. It aims to reduce the chemical attack to the component surfaces and hence to eliminate any rework required. The deliverables in this project could be applied in other application such as adhesive and sealant dispensing.

Aircraft Coating and Paint Analysis (ACPA)

This project will use various sensors to assess the integrity and quality of the paint and coating on the airframe such as multispectral, terahertz, and ultrasound imaging in addition to thermal and optical cameras. It will also use machine learning to assess the level of degradation and even the likely causes of the coating degradation. Furthermore, AI will also be used to determine paint-mixing formulation for repairing aesthetic damage to the exterior and interior of the aircraft.

Laser Paint Removal EcoSocialSustainability (L-PRESS)

Laser paint removal is fast, but its downside is the emission of hazardous gases and fumes. This project is tackling this issue by investigating the chemical mechanisms to identify and reduce these volatile byproducts. To achieve this, the ASRC is employing a powerful suite of diagnostic tools: a Laser-Induced Breakdown Spectroscope (LIBS) for elemental analysis, a multi-gas monitor, and an X-Ray spectrometer. We have also engineered a solution for capture, using flow simulations to design and install a more efficient redesigned shroud. Furthermore, we have developed an analysis model to optimize the laser fluence, preventing pyrolysis, and hence cutting gas emissions. By refining the model with precise data on coating reflectance and transmission from new optical integrating spheres, we are ensuring our solutions are both effective and grounded in reality.

Intelligent Wire Arc Welding Additive Manufacture (iWAAM)

Welding is used as an additive manufacturing (AM) process in MRO and its subsequent machining process depends on component damage's geometry. This project's objective is to design and develop an intelligent arc-welding additive manufacturing system for engine components. AM techniques and advanced automated non-destructive inspection (NDI) techniques will be applied to ensure consistent welding quality, so that damaged components can be rescued, and scrap reduced. The advantages of the Wire Arc Additive Manufacturing (WAAM) processes include high material utilization and deposition efficiency, low production cost, and versatile applications.

Aero-Engine Digital Record (AeDR)

Aeroengine overhaul requires detail documentation, as these complex machines comprise multiple systems and hundreds of components. Missing parts, anomalies in fluid and electrical systems, and incorrect placements must be identified, yet these inspections are time-consuming. An automatic video-screening system is proposed to streamline maintenance using drones, robots, or AGVs for scanning. Integrated AI system will improve image recognition for component verification and defect detection, while collision-avoidance function will ensure safety. The system will deliver three key capabilities: digitization of the engine via 3D scanning, component detection using deep learning to verify part presence and information, and defect detection to spot such as cracks and leaks. This innovation aims to enhance accuracy and efficiency in aeroengine MRO operations.

The ASRC has career opportunities for Postdoctoral Fellows, Research Associates, and Research Assistants on several projects. The appointment period is twelve to twenty-four months, with a highly competitive remuneration package. For more information regarding the duties, programme acceptance criteria and application requirements, please visit the ASRC Careers Page.

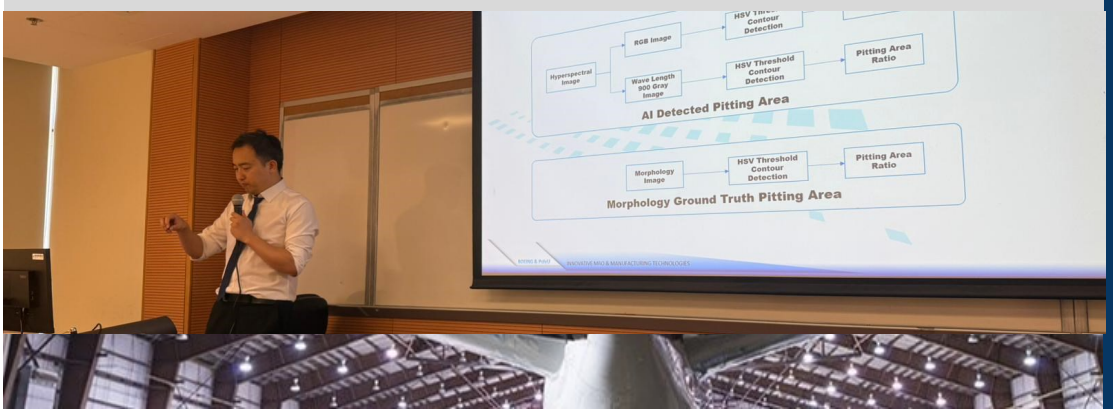
ASRC Demonstration of AeDit & AeDR

ASRC Paper Published and Presented

Artificial Intelligence for Detection of Aluminum Degradation in Aviation Maintenance

Xi JIN, Awais AKHTAR, Kibtia CHOWDHURY, H.P. TANG

Abstract: Corrosion, characterized as an electrochemical or chemical degradation process, poses a significant challenge in the context of aviation Maintenance, Repair, and Overhaul (MRO). While advancements in artificial intelligence (AI) have demonstrated promising capabilities in corrosion prediction, the majority of extant research predominantly focuses on zinc alloys and ferrous materials. This study aims to address this research gap by developing an AI-based predictive model specifically targeting aluminium alloy corrosion, thereby providing valuable insights to support aviation MRO activities. A contour detection-based methodology is proposed for evaluation/classification of pitting corrosion in aluminium plates, with an emphasis on ensuring high predictive reliability. Aluminium alloy specimens were subjected to an ASTM G85 acidic salt fog environment with variable temperature and humidity conditions to simulate corrosion processes. Hyperspectral imaging was employed to digitize the samples, facilitating precise corrosion detection and evaluation for AI model training. Surface characterization was conducted using a Keyence VHX-5000 3D digital microscope with XY-plane stitching and coaxial illumination, producing high-resolution, wide-area images of the corroded surfaces. The findings confirm the feasibility of applying contour detection models utilizing hyperspectral imaging in industrial settings. This framework enhances the predictive capabilities for aluminium corrosion, offering a contribution to the development of corrosion management strategies in aviation MRO. Furthermore, it supports future research on coated aluminium aerospace components, providing a valuable predictive tool to extend material lifespan and reduce maintenance costs.



ASRC Equipment Update

We are excited to announce our new integrating spheres, sophisticated tools for unparalleled light measurement.
These hollow spheres feature a highly reflective, diffuse coating inside. When light enters, it scatters through countless reflections, creating a uniform radiance. This enables precise measurement of material reflectance and transmittance, which is crucial for analysing specialised aircraft coatings and industrial paints. For instance, we can now accurately quantify the colour differences for a range of coatings. This technology provides the reliable, standardized data essential for advancing our research initiatives in coating analysis and laser paint removal.

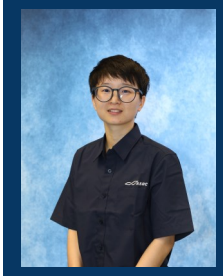
Membership Benefits of the ASRC

Organisations that join the ASRC as members have a primary involvement in Aviation MRO or Aerospace Manufacture, or whom could benefit from the application of the technologies developed from fields of research in support of these areas where they may be commonality, such as energy, marine, and other forms of transportation.

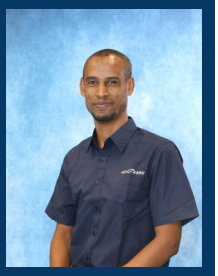
If you feel you are in one of these categories and would like more information on the benefits and details on how to join or cooperate with the ASRC, please contact us via
Mr Robert Voyle, Executive Director
robert.voyle@polyu.edu.hk, or take a look at our website www.asrc.hk.

There are different levels of membership and working relationships that have varying levels of access to research at the ASRC. Almost certainly there is a membership level or collaborative opportunity that is a good match for your organisation.

Staff Profiles



ZHANG Yiwen



IBRAHIM Mesfin Seid

Dr. Zhang is a Postdoctoral Fellow at the ASRC, specialising in advanced composite materials. She obtained her PhD from PolyU, specializing in Fiber-Reinforced Polymer composites, from material characterization and durability assessment to structural analysis and finite element modelling. Currently, she applies this knowledge to the AMTAC project, investigating the deterioration mechanisms of industrial maskants in aggressive chemical environments and developing high-performance alternatives with better chemical resistance for component protection during cleaning processes.

Dr. Ibrahim (Member, IEEE) is a Postdoctoral Fellow at ASRC. He earned his PhD in Industrial and Systems Engineering from PolyU. His research focuses on machine learning and deep learning for reliability assessment, anomaly detection, failure diagnostics and prognostics of electromechanical, optoelectronic and power electronic devices, and metal additive manufacturing. Currently, he is engaged in the RecAM project, applying his expertise and expanding his technical skills in metal powder processing, additive manufacturing, and component testing.

Activities/ Visits

JUL

- ✈ Visit by Aviation Industry Corporation of China (AVIC)
- ✈ Visit by China Aviation Industry General Aircraft (CAIGA)
- ✈ Visit by Air Transport Research Society
- ✈ Visit by China Aircraft Services Limited
- ✈ Visit by Victoria Shanghai Academy - international school student
- ✈ Visit by PReCIT student summer camp
- ✈ Visit by ISE student summer camp
- ✈ Visit by Inner Mongolia Autonomous Region Education Department

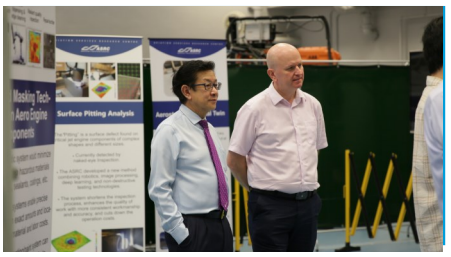
AUG

- ✈ Visit by Hong Kong Tramways Limited
- ✈ Visit by PolyU Department of Electrical and Electronic Engineering
- ✈ Visit by Nanjing Normal University
- ✈ Visit by ISE student summer camp
- ✈ Attended 1st International Conference on Future of AM

SEP

- ✈ Visit by Aviation Industry Corporation of China (AVIC)
- ✈ Visit by China Association for Science and Technology (CAST) and Tongji University
- ✈ Visit by Boeing Fellows
- ✈ Visit by All Nippon Airways, ANA
- ✈ Attended PAM Singapore 2025

Hong Kong Tramways Limited



Department of Electrical and Electronic Engineering

President Teng with CAST and Tongji University

Appreciating Arne Lewis's Support

Boeing Fellows and ASRC Team Visit HAECO

Aviation Services Research Centre
Block X
Hong Kong Polytechnic University
11 Yuk Choi Rd, Hung Hom
Kowloon, Hong Kong
T: (852) 2766 7599
F: (852) 3011 3348

www.asrc.hk

ASRC
INNOVATIVE MRO & MANUFACTURING TECHNOLOGIES

The ASRC on Social Media

ASRC maintains six active social media accounts, namely 'Facebook', 'LinkedIn', 'Website', 'WeChat', 'YouTube' and 'Instagram'. These are updated regularly with project status, visits to the centre, as well as special events. These sites enable increased engagement with our clients, industry and our local community, and allow followers to keep up with our activities.

Check it out!