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ASRC News
AVIATION SERVICES RESEARCH CENTRE
QUARTERLY NEWSLETTER
OCT – DEC 2025

In this big issue

Strengthening Global Engagement and Industry Dialogue

Over the past quarter, ASRC has further deepened its engagement with the global aviation and innovation ecosystem by actively participating in a diverse range of international and regional forums. These platforms provided valuable opportunities for the Centre to showcase research outcomes, exchange perspectives with leading industry stakeholders, and remain closely aligned with the emerging trends that are shaping the future of aviation. Our involvement spanned critical themes such as sustainability in aviation, advanced air mobility, the low-altitude economy, and automation technologies. By contributing to these discussions, ASRC reinforced its role as a bridge between academic research, industrial application, and policy dialogue, ensuring that our work remains both relevant and impactful. Through these engagements, the Centre gained first hand insights into evolving regulatory frameworks, pathways for technology adoption, and the operational priorities of industry partners. This knowledge not only strengthens ASRC's visibility and credibility on international platforms, but also provides a strategic foundation for shaping future research directions, identifying collaborative opportunities, and positioning the Centre as a trusted partner in advancing innovation across the aviation sector.

Looking ahead, ASRC will continue to leverage these networks to translate research into practice, foster cross-border collaborations, and anticipate industry needs, thereby ensuring that our portfolio remains at the forefront of technological and operational transformation in aviation.

13 Years of ASRC

ASRC marked its 13th anniversary on December 12 with a dedicated team session that offered colleagues the opportunity to showcase project outcomes to date, present new ideas and technologies, and reflect on collective achievements throughout the year. The occasion fostered stronger collaboration across teams and underscored the breadth of innovative research efforts underway at the Centre. The celebration concluded on a joyful and memorable note, with cake sharing and informal interactions that reinforced camaraderie among colleagues.

Sustainability

IATA World Sustainability Symposium 2025

The International Air Transport Association (IATA) World Sustainability Symposium 2025, held for the first time in Hong Kong on October 21-22, served as a pivotal gathering for industry leaders. Two ASRC staff members participated in this event dominated by key themes in the agenda: Financing the Transition remains a monumental challenge, with an estimated $4.7 trillion required to achieve net-zero by 2050. There is an urgent need for stable policies, innovative finance mechanisms, and strategies to unlock capital.

Case studies showcased successful partnerships across airlines, Sustainable Aviation Fuel (SAF) suppliers, and regulators to build local ecosystems and ensure supply chain traceability. Discourses also focused on innovative solutions, from scaling SAF production and developing a coherent green taxonomy to operational strategies like contrail management and the role of Low Carbon Aviation Fuels (LCAF) as a crucial interim solution. The need for global policy coordination, credible certification standards, and robust carbon accounting was clear.

ASRC representatives actively contributed to these dialogues, reinforcing our commitment to a sustainable aviation. The takeaway is a marked industry shift: while challenges in funding, feedstock availability, and regulatory harmony persist, there is now a broader consensus and commitment to turn agreements into implementation. The focus is moving from targets to actionable roadmaps, accelerating the collective journey to net-zero. Let's continue to Facilitate,

Mr Nicolas Detalle is a Principal Research Fellow in the Materials, Data and Instrumentation Stream of the ASRC

Project Descriptions

ITC-ITF / ASRC Member Funded Open Source Project

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.

Robotic Assistant Preparation Platform for Aviation (RAPPA)

Modern aircraft has many composite parts that often need repair, which today involves heavy manual work such as filling small surface defects, sanding large panels, and removing paint from cabin seats. These jobs are slow, physically demanding, and sometimes risky to occupational health due to awkward component shapes and hard to reach areas. Metal parts also need polishing to remove corrosion. To improve safety and efficiency, a new robotic assistant platform is proposed for aircraft repair workshops. It can move easily around the workspace and uses multiple tools—such as scanners, sanding heads, polishers, and filler dispensers—to automate tasks. This automated system can scan surfaces, generate robot paths, apply fillers evenly, sand damaged areas, remove paint, and employ machine vision to identify rework spots if needed.

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.

Flying Higher Together – Congratulations Jayden on your MSc!

ASRC Paper Published and Presented at ATRS 2025

LLM-driven Retrieval-Augmented Generation in Aviation Maintenance

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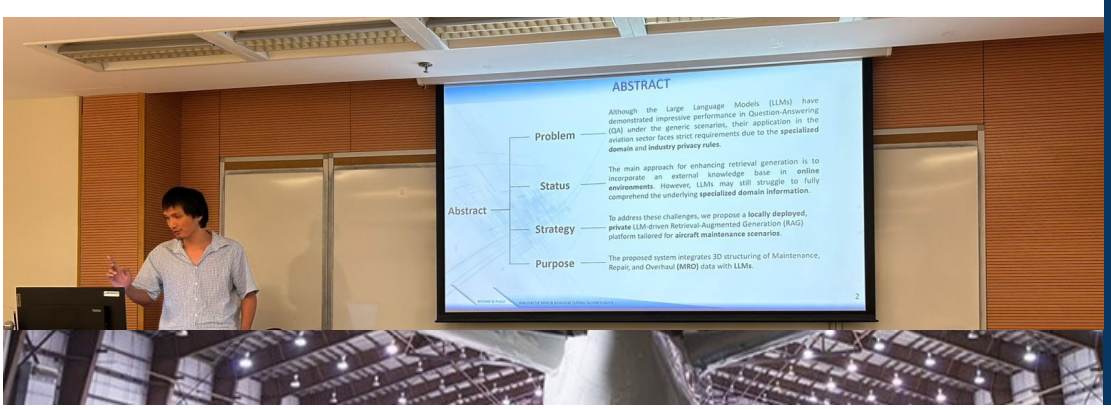
Abstract: Although the Large Language Models (LLMs) have demonstrated impressive performance in Question-Answering (QA) under the generic scenarios, their application in the aviation sector faces strict requirements due to the specialized domain and industry privacy rules. Furthermore, the process of textual vectorization also encounters issues such as lower retrieval recall and reduced information precision rate caused by digital confusion. The main approach for enhancing retrieval generation is to incorporate an external knowledge base in online environments. However, LLMs may still struggle to fully comprehend the underlying specialized domain information. To address these challenges, we propose a locally deployed, private LLM-driven Retrieval-Augmented Generation (RAG) platform tailored for aircraft maintenance scenarios. The proposed system integrates 3D structuring of Maintenance, Repair, and Overhaul (MRO) data with LLMs. Firstly, we designed a 3D coordinate-based spatial structure, embedding each piece of maintenance information into a single coordinate point. Secondly, a locally deployed RAG framework, utilizing Qwen2 and Deepseek-r1 based on Ollama3, is implemented to enable an offline, interactive QA environment. Finally, a continuous questioning strategy is employed to retrieve the coordinates, combined with “deep thinking”, to generate a specialized sensing response aligned with aviation industry standards. Experimental evaluations conducted on three jet aircraft (Boeing 777-200ER) demonstrated recall rates of 96.7%, 97.27%, and 98.82%; precision rates of 95.43%, 97.82%, and 99.23%, respectively. This work proposes a new paradigm for the application of LLM in the aviation sector, showing that RAG can think and retrieve independently in both private and specialized offline working environments. The experimental results indicate that diversified QA interactions based on LLMs can be achieved by rendering the aircraft maintenance information structure in a three-dimensional and integrated manner. The research outcome was presented at the 28th Air Transport Research Society World Conference.



ASRC Equipment Update

In our ongoing work to monitor environmental quality at the ASRC, we rely on precise equipment to analyse water and air samples. The Colorimeter SMART³ is a key tool in our arsenal. This portable, digital colorimeter allows for rapid, on-site testing of over 50 quality parameters. It works by measuring the intensity of colour in a liquid sample after specific reagents are added; the colour change is directly proportional to the concentration of the target substance.

Recent applications at ASRC include measurements of chromium, barium, phosphate and sulphate levels in a solvent to support a study on charcoal filter reactivation. The data confirmed successful removal of some contaminants, with content reduced by 50% after reactivation.

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

Awais AKHTAR

JIN Xi

Dr. Akhtar is a Postdoctoral Fellow at ASRC. He completed his PhD in Mechanical Engineering at PolyU, where he specialized in thin-film coatings, diffusion and degradation behavior of materials, and advanced characterization techniques. His research expertise lies in understanding microstructure –property relationships, coating durability, and surface degradation under demanding environments. At present, he contributes to the ACPA project, applying his knowledge to investigate corrosion mechanisms and assess substrate and coating performance, thereby supporting advancements in aerospace maintenance practices.

Dr. Jin is a Postdoctoral Fellow at ASRC with a specialization in artificial intelligence and computer vision for industrial innovation. His current work focuses on integrating Hyperspectral Imaging (HSI) with established laboratory methods such as XRD, TEM, and SEM within the ACPA project. HSI enables rapid scanning of entire aircraft, producing data cubes with 128 spectral points per pixel. By harnessing advanced GAN models and K-means clustering, Dr. Jin is developing cost-effective and time-efficient corrosion inspection solutions that have the potential to significantly transform maintenance, repair, and overhaul processes across the aviation industry.

Activities/ Visits

OCT

- ✈ Visit by PolyU Department of Logistics & Maritime Studies (LMS)
- ✈ Visit by Aviation Industry Corporation of China (AVIC)
- ✈ Attended IATA World Sustainability Symposium (WSS) 2025
- ✈ Attended Low-Altitude Economy Summit 2025
- ✈ Attended Schneider Innovation Summit Hong Kong 2025
- ✈ Attended International Innovation and Technology (I&T) and AI Co-operation Hub Insights for Hong Kong's Future

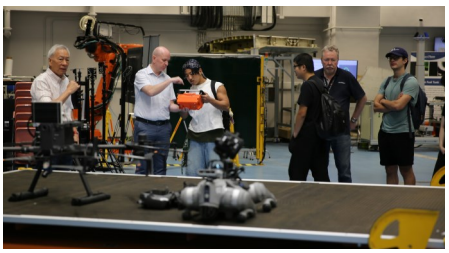
NOV

- ✈ Visit by Global Confucius Institutions
- ✈ Visit by Airport Corporation of Vietnam and Collins Aerospace
- ✈ Visit by Ecole Nationale de l' Aviation Civile
- ✈ Attended Low Altitude Economy Forum X Aviation Week Network AAM Awards 2025
- ✈ Attended South Korea Aero Summit 2025

DEC

- ✈ Visit by China Aviation Group
- ✈ Visit by Chongqing College of Finance and Economics
- ✈ Attended AUTM Intellectual Property and Relationship Management Course
- ✈ International Robot Exhibition (iREX) 2025

Schneider Innovation Summit Hong Kong 2025



PolyU Department of Logistics Maritime Studies

Low Altitude Economy Forum X AAM Awards 2025

South Korea Aero Summit 2025

International Robot Exhibition (iREX) 2025

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ASRC
INNOVATIVE MRO & MANUFACTURING TECHNOLOGIES

ASRC 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.