



ASRC Offices with Innovation Tower - Autumnal Dusk

Cathay Pacific Pilot Cadets

The University has taken responsibility for the ground school theory training of a large number of pilot cadets for Cathay Pacific Airways. Around 300 prospective pilots split into 9 classes have progressed through university instruction in the science and engineering of flight including principles of flight, meteorology, human performance, general & radio navigation, instrumentation and air law. As part of their course the students were entertained to a full 2 hour tour of the ASRC with detailed descriptions of projects, past and present. This served to remind them that from the flight deck to the maintenance hangar, aircraft operations is very much a team job. The Students were keen to ask for more details about our various projects from radome testing to laser paint ablation and from



3D metal printing to aeroengine blade balancing. It all forms the continuum of technology required to keep aircraft in service with efficiency, safety and minimal environmental impact.

The staff of the ASRC congratulate the first class of graduates and we hope that they have a great career with the proud flag carrier of Hong Kong SAR.



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New Projects Launched

One project was launched and one approved this quarter as we started the 'ReCAM' project and prepared for the L-PRESS project. ReCAM involves investigating differing methods of recycling metal swarf into AM powder. Specifically it will investigate means of recycling hard metals such as Titanium and Inconel. At present these metals are recycled but used only in lower value components and products, we hope to show that they can be used in higher value parts. We will compare virgin parts made from feedstock with atomized and 'in-house' ball milled material using three of our AM processes. SLM, DED and Cold Spray.

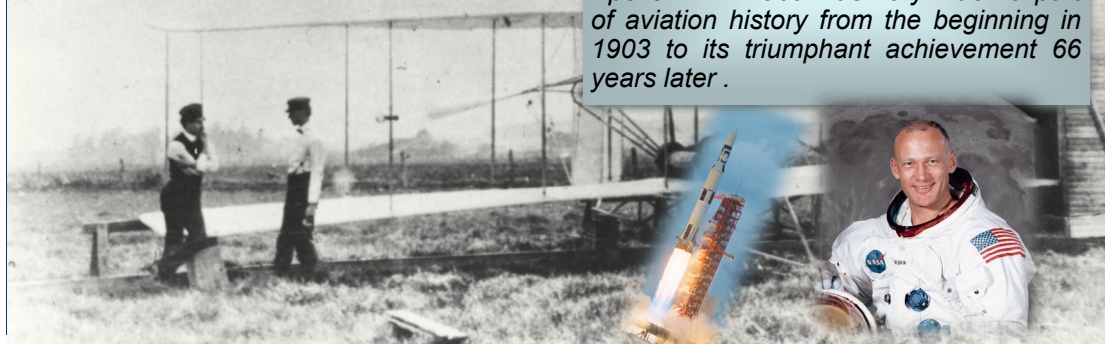
The L-PRESS project aims to show that we can identify the elemental and compound species released during laser paint ablation and in the process extract the fumes, particles and odours produced as a byproduct of the paint removal. Investigations will focus on LIBS and assorted filter absorption technologies.

NOVEMBER

Aviation History Month

Interesting History Fact : - Buzz Aldren's father was a good friend of the Wright brothers.

So the man who flew to the moon on Apollo 11 in 1969 was very much a part of aviation history from the beginning in 1903 to its triumphant achievement 66 years later .



November was Aviation History Month

Aviation Classics, the Fairey Rotodyne

Long before interest in eVTOL inner-city and intra-city transport took hold we had in the 1950 the Fairey Rotodyne. This was a transitional powered helicopter cum autorotating gyrocopter with turboprop engines.

For vertical take off, hover or landing the massive 14 meter blades were spun by tip mounted jet engines that burned a mix of fuel and compressed air bled from the turboprop wing mounted engines. After transitioning to level flight the autorotation of the rotors would support over half the weight of the aircraft and it could reach speeds in excess of 150 knots. In short, one wonders why we do not see these craft gracing the skies of every city today. The reason we don't is largely due to the noise made by the rotor in VTOL mode. Although this was being reduced as development continued it was very significant and funding the project became a problem. There was initial support from the military but this was withdrawn as alternatives were found and the project was dropped with the last flight of the single prototype being in 1962. The prototype was first flown in 1957 where the observation was that it would "stop conversations at 2 miles out". The noise and the lack of government support along with disagreements among the engine manufacturers and power issues ultimately were the demise of the concept. Will we ever see something like it again though?



Airworthiness Course hosted in ASRC

Cranfield University, The Hong Kong Institution of Engineers and the ASRC co-hosted the **HKIE Airworthiness Course** in October and early November for two weeks. Participants were given a tour of the facilities as part of the experience and material was delivered by experts from Cranfield University and HKIE. This is a recurring course which is of great benefit to the Hong Kong Aviation Industry. ASRC were fortunate to have one of our staff

and a graduate of Cranfield attend the course at the discretion of the HKIE, which proved to be a useful experience for our staff. The course focused on all aspects of airworthiness including the importance of MRO planning and implementation. Attendees were presented with a certificate, having completed 90% of all materials. The attendees came from HKAIA, HKCAA, PolyU and HKIE. ASRC is the ideal venue for such programs combining the academic environment with the applied industrial environment.



Membership Benefits of the ASRC

Companies who join the ASRC as members should have a primary involvement in Aircraft MRO or aerospace manufacture or should benefit from involvement in technologies which may spin off from these fields of research and development.

If you feel you are in one of these categories and would like more information on benefits and details on how to join, have a look at the website at www.asrc.hk or contact our CEO, Mr Robert Voyle (robert.voyle@polyu.edu.hk).

In principle there are different levels of membership with different levels of access to research in the ASRC. Almost certainly there is a membership level that is a good match for your company.

Asian Airline Profile



Lion Air is a low-cost airline based in the Indonesian capital Jakarta. Founded in 1999 it started operations one year later and now operates throughout the Asian region with internal flights and flights to Malaysia, China, Philippines and Saudi Arabia.

Lion Air operate a largely Boeing 737 variant fleet and have been working with Boeing to obtain IATA membership along with Garuda.

Lion Air were the launch customer for the 737-900ER and ordered up to 60 aircraft in 2005 and over 230 aircraft in 2011- one of the biggest orders for Boeing at that time.



A Lion air B737-900ER in split Lion Air / Boeing livery

Sustainability Corner

ESG Goals are now considered right at the start of every ASRC project. But what is that? And what does this mean?

ESG stands for Environmental, Social and Corporate Governance. Nowadays, organisations become more and more accountable and responsible in their practices in regard to environmental and social issues. The ASRC is also moving step by step in this direction, as it is clear that our activities must positively impact the present while securing our common future. Knowing which ESG goals to target and measure them is a way to effectively keep investors satisfied, to strengthen our reputation, to ensure complying with environmental regulations, while developing our solutions for a better future of the industry. Common ESG goals include reducing greenhouse gas emissions, investing in sustainable energy, increasing workplace diversity, and providing transparent financial practices. ESG goals can have a positive impact on the environment, social fabric, and overall sustainability while improving accountability and credibility for organizations.

At the ASRC, besides the Health & Safety assessment for each project, we have included a sustainability page in our project monthly reporting. The objective is to make it clear internally and for the project stakeholders how the project contributes to a sustainable future. There are 17 ESG Goals which are split in 5 different categories (People, Prosperity, Planet, Peace and Partnership — Note all these start with 'P' and hence they are called the 5P Principles). The whole mission of the ASRC and most of our projects support a variety of the 17 goals. Our major strength with regard to ESG goals are those related to quality education, economic growth and of course industry, innovation and infrastructure. Climate action is also something we are increasingly targeting.



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

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 recently commenced a project to develop a better way to record this data. We will investigate novel methods of damage detection such as terahertz imaging, 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. Generation of the model will commence by LIDAR scanning of aircraft and on wing measurements to establish the location of stringers, etc. 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.

With a fully populated CAD model, some AI technology can be used to attempt to predict any unscheduled maintenance in the future. This data will be of great use for the MRO and the operator of the aircraft.

Project Descriptions

ITC funded Open source projects underway in the ASRC

Intelligent Wire Arc Welding Additive Manufacture (iWAAM)

Welding is used as 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 components can be rescued and scrap reduced.

Automated WAAM protects operators from hazardous torch light and toxic fumes. The proposed system will speed up and optimize WAAM process and increase the process capacity of local MRO industry. This technique is targeted to critical components in transportation, energy industry and may also be applied to marine propellers and chassis strengthening for automotive.

For these new government-funded projects, the ASRC is looking to hire Postdoctoral Fellows and Research Assistants. The appointment period is twelve to twenty-four months. A highly competitive remuneration package will be offered.

More information about the duties and qualification on our ASRC Career page: <https://www.asrc.hk/career.html>

Recycling Metal Chips into AM Feedstock (ReCAM)

Aerostructure and aeroengine manufacture produces a large amount of swarf and machined chips during production of monolithic parts. As much as 95% of a material is removed to create the part. This removed material is typically recycled into other components of lower value and tolerance. Our new project aims to test out alternative methods of recycling chips into fine precision powders to be used in additive manufacturing processes such as SLM, DED and Cold Spray.

Powder will be produced using conventional methods and material properties compared with powder produced from in house ball milling and Hydrogenating De-Hydrogenating processes.

Tests will include residual stress, tensile strength, impact resistance, wearing and fretting, hardness, salt spray test, crystal structure, optical microscopy and SEM analysis.

Laser Paint Removal

EcoSocialSustainability (L-PRESS) (Starting Jan 1 2024)

When carrying out ablation of paint or other organic materials using high power YAG lasers, there is an unavoidable amount of gas and ablated particles which are released in the environment. Although laser ablation is much more efficient than current paint removal processes by sanding or with chemicals, the fumes and gasses emitted during this process can range from bothersome to hazardous.

This project intends to identify, in real time, the nature of the ablated components using LIBS technology (Laser-Induced Breakdown Spectroscopy), so that the laser parameters can be tuned in-process and the emitted gasses are reduced at the source. The second deliverable of this project is to capture the volatiles efficiently so that they can be brought to a treatment area. The treatment system is likely to be a wet scrubber associated with a series of filters.



Daniel CHAN Tan-ni

Staff Profiles:

Daniel CHAN

The majority of staff who make up the ASRC are trained in Mechanical or Aeronautical Engineering and have experience in aviation at some level. We are most fortunate however, to have in our ranks, Daniel CHAN, PolyU graduate from the School of Design. Daniel trained as an Industrial Product Designer with an interest in drones, UAVs and aviation in general. After joining the ASRC as an intern researcher for one year he transferred to become a full member of staff. Daniel has worked on a number of projects and has used his skills in design and graphical communication to enhance reports and proposals for a range of members and clients. He is currently embarked on the creation of dimensionally accurate CAD model renderings of 787 and 777 aircraft for the AeDiT project and he has been involved heavily in a closed source project on turbine blade repair. We are very lucky to have such a complimentary talent in the ASRC.

Activities/ visits

- 04 OCT Rochester Institute of Technology
- 05 OCT Cathay Pacific Cadets
- 12 OCT Nanjing Municipal Government
- 25 OCT HKIE Airworthiness Course
- 27 OCT Dalian Government Officials
- 30 OCT Jiansu Government Officials
- 30 OCT PReCIT PhD students
- 31 OCT Sichuan Chengdu Bureau
- 03 NOV LMS Flight Management Students
- 09 NOV Cathay Pacific Cadets
- 13 NOV Shandong Government Officials
- 13 NOV PolyU Alumni (IRE)
- 15 NOV Fuzhou University (Jinjiang)
- 16 NOV Guangdong Science and Technology Cooperation Research
- 17 NOV PolyU MBA Alumni (Xi'an)
- 20 NOV Dalian University of Technology
- 22 NOV ASPIC conference attendees
- 23 NOV PolyU Alumni (MIS - Hangzhou)
- 23 NOV China Association for Science and Technology
- 23 NOV Guangzhou Huashang College
- 24 NOV ASPIC conference attendees
- 24 NOV LMS Evening Class
- 29 NOV Zhejiang University
- 30 NOV ESTACA (France)
- 30 NOV Robot Exhibition (Tokyo)
- 04 DEC Northwest Polytechnic University
- 05 DEC Mallard Enterprises
- 06 DEC Guangdong Delegation
- 08 DEC Sun Yat Sen University
- 12 DEC IAGA visit
- 13 DEC Civil Aviation University of China
- 19 DEC Chongqing & Liverpool University



Cathay Pacific Pilot Cadets



Dr HP TANG at Tokyo Robot Exhibition



Chung Yat University / Chinese Academy of Science



Mainland China PhD Students

The ASRC on Social Media

ASRC maintains four active social media accounts, namely 'Facebook', 'LinkedIn', 'YouTube' and 'Instagram'. These are updated from time to time after visits and special events in the centre. As we bounce back from the past couple of years these sites have started to update more often to allow followers to keep up with our activities. Check it out.



ASRC News Issue #19 October 2023 — December 2023



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