ISSUE
#15
October – December 2022

ASRC News

QUARTERLY NEWSLETTER OF THE AVIATION SERVICES RESEARCH CENTRE

HAECO Group and EHang explore partnership in advanced air mobility

In this big issue

Open Day 2022

After two years of restrictions the ASRC was able to hold its open day in person on the 1st of December. A number of member company representatives attended the day and were happy with what they saw. In total over 200 people attended during the day in addition to 30 online from the USA and Mainland China.

The newly installed cold spray system was operated three times during the day for members and other interested parties. Other demonstrations included the 'Ecospeed' machining centre, Blisk probing on the 'Starrag' machine, laser paint removal with the 'CleanLaser', equipment moving with the Kuka 'Omnimove'. Static displays of all the other equipment was carried out in the labs.

The Open Day was officially launched by the Deputy President and Provost of the University and along with the other three members and the Engineering Faculty, he was presented with an anniversary souvenir in Borosilicate Crown Glass.

This open Day celebrated a full ten years of research with the Boeing Company and the signing for another five years of Boeing partnership and collaboration along with HAECO and HAESL.

We look forward to a further five years (at least) of cutting edge research and co-operation.

New ASRC Identity

As the ASRC is celebrating 10 years of research partnership with Boeing, HAECO and HAESL and looking forward to a further period of five years, the ASRC thought that it was time for a change of identity, which co-insides with our change in senor management.

A new Logo has been designed and was rolled out at the open day which will be used on all future releases.

The logo combines the mathematics symbol for 'infinity' (∞) with a stylised outline of a aircraft nose and winglet.

The ASRC 'Tagline' has also changed to "*Innovative MRO and Manufacturing Technology*" It will be used in any of three colours dependant on the publication type and background colour scheme.

Green Corner - Wind Turbines

As human activity continues to create climate change inducing sea level rises and mass migration precipitated by related crop failure, we look in this column at measures that we take to mitigate the effects.

The Wind Turbine , so evocative of olden day wind mills - a feature of most European landscapes have returned in large numbers to cover hills and seas with their iconic appearance.

Middle age wind-mills were used to grind wheat to make flour and the European staple food of bread. Now with modern technology the wind turbine can produce electricity directly from the wind. This contributes a large about of energy to the national grids of many countries. At present China is the largest user of wind power followed by the USA. The turbines themselves are rather efficient and turn about 50% of the wind energy in to electrical power. The issues of course are the unpredictable nature of the wind itself, storage of power when not required and maintenance of structures that can be up to 200 meters tall.

The fundamental efficiency is to do with the area swept out by the blades and can reach (16/27) of the power in the wind. Further losses are in the brake and the turbine itself. Construction of the blades is of Glass Fiber Composites and the towers tend to be of steel and concrete. The lifespan of the turbine is in the order of 50 years.

These turbines are a big improvement over fossil fuel and have improved in efficiency fiftyfold in 30 years, but they are not really a long term solution to the Climate Change issue.

Dr Anita XIN is a Team Leader in the Data, Materials and Instrumentation Stream of the ASRC

Machining Distortion Minimisation

Stress and distortion in aerostructure parts costs the aviation industry approx. US$1bn per annum due to corrective action, scrap parts, or later delivery of parts. Therefore, any reduction in this area can give huge benefits to the OEM and its supply chain. This project is now in its final phase, where it is becoming very apparent that distortion can be predicted, and therefore prevented. Over 200 parts from 5 different material suppliers have been machined on high-speed and high-performance machining centres during the project, with residual stress analysis undertaken pre and post machining to determine the levels of stress in the material. Where FEM analysis of machining methodology has been undertaken to simulate the machining strategies and predict stress fields and distortion. In-process monitoring including displacement sensors, vibration sensors, strain gauges, temperature monitoring, spindle monitoring, in process probing, and coolant monitoring have been conducted and managed within a Digital Twin. With CMM inspection of all machined components for geometric verification at the end of the process plus ultrasonic thickness gauging, and conductivity tests. All data collected is analysed and fed into the internally developed AI system (machAI) to support distortion prediction and machining method analysis. With data correlation and regression testing ongoing to help support an industrial standard solution.

Radome Assessment and Transmission Test System

The Radome is a critical, yet passive, component on the airframe. It protects the weather radar and is optimized to have an aerodynamic profile. The transmission at the radar frequency of 9.5 GHz through the radome should be over 95% as this is the standard for Doppler radar which is fast becoming the norm on aircraft and is used to detect wind shear and clear air turbulence.
Should the Radome become damaged, and due to its location this is rather common, the radome is scarf repaired and tested to ensure that the transmission is at the same level as before. The two options for this are to use a large anechoic chamber and test the radome with a weather radar and a radar signal some 50 metres or more away. The second method, which is not the same as certification, is to measure the decibel loss on a point to point basis.
We will use a pitch and catch method to test the radome at each point and produce a map of the decibel loss over the entire radome. This will be overlaid on a map of the subsurface health of the radome obtained by flash thermography using a 8 to 12 micrometre thermal camera translated over the entire component.

Project Descriptions

ITC funded Open source projects underway in the ASRC

Cold Metal Spray Deposition

Firing metallic, ceramic, or composite alloyed powders in the supersonic speed regime of 600 - 1200 m/s at 800˚C in an open environment as a depositional repair process may sound like science fiction, but cold spray is very much science fact, that will bring benefits to aviation component repair applications.
The dynamic work-hardening process involved enables large areas to be bonded rapidly with purely mechanical clean adhesion; heat produced from the powder and workpiece during collision ensures plastic deformation is retained in the zone where it is created, resulting in negligible residual stress, with initial physical and chemical material properties retained.

The challenge however remains in maximizing the utilization of heat generated upon the impact of powder governed by the physics of adiabatic shear instability. R&D work at the Centre continues to be carried out to identify the critical particle velocity tolerance window and angle of attack for successful repairs on selected components in relation to spray particles of interest. Testing on representative specimens for aero engine, landing gear, and structure repair is currently being conducted following a series of ASTM/ISO standards to ensure the results meet recognised global standards, enabling successful fruition of the project, and the industrialisation of a Cold Spray repair solution for aircraft components for the ASRC Members.
With the gun now installed in W core, we are investigating the samples produced whilst applying for further finding to carry out downstream research into material properties and stability of the process.

Last ever 'Jumbo Jet' - Queen of the Skies

Aviation Classics, British Aerospace 146 'Whisper-jet'

The Short body BAe146 was a four engine, cantilever high wing T-Tail Jet built between 1983 and 2001. The four medium bypass engines made the aircraft very quiet earing the marketing name 'Whisperjet". Its short take off run and quiet performance made it ideal for inner city airports around the world. The aircraft was extensively used by the UK Government for VIP flights and ferrying politicians around the country.

The BAe 146 was used by the RAF as a transport

It was powered by four Avco Lycoming ALF 502 turbofan engines with a gearing system that kept the high bypass fan blades' tips below the speed of sound.

UK Government BAe 146 in flight

The first commercial flight was in 1983 and the aircraft is still in service in Africa and in Australia where it is ideal for low volume long haul flights.

There were three variants of the jet with differing capacity. It was available as passenger, cargo, mixed role and customized interior. Of the four operated by the RAF one was used as the Queen's aircraft. Others were used by Middle Eastern nations as Royal flights.

ASRC Equipment - Bluetooth Gauges

The ASRC recently took delivery of some Bluetooth enabled Mitutoyo gauges. These calipers and micrometers are fitted with Bluetooth adapters which allow, at the touch of a button, the reading to be transferred to an excel program, a word document or even a pdf sheet. This is part of the ASRC's drive towards digital transformation in the context of Industry 4.0.

The advantages of this are many. It is a fast transfer of data and it is essentially error free, mitigating the possibility of a transcription error. Such errors can cost industries time and money and are unavoidable feature of human operators. The gauges can transfer the data to a editable pdf drawing thereby creating in real time a workable CAD drawing for MRO concerns to take forward.

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

HONGKONG AIRLINES
香 港 航 空

Hong Kong Airlines operates an all Airbus fleet of 34 aircraft ranging from the workhorse A320 to the A330 and A350. When it launched in 2001 it used hired Bombardier and Boeing aircraft but recently following restructuring and investment from Hainan airlines it switched fully to an Airbus fleet.
The airline was originally owned by businessman Robert YIP and was the first airline to be given an operating licence after the handover. In 2006 it was purchased by MUNG Kin-keung and Hainan Airlines.
The airline until recently served 34 destinations across China and Asia.

The social unrest of 2019 followed by the Covid pandemic hit this airline very badly with many staff released and aircraft grounded. At present it is only operating cargo flights but is planning to ramp up services now that covid and travel restrictions are being lifted.

Staff Profile:

Mr Arda FU Peng-fei

Peng-fei was one of the first staff to join the ASRC in 2012. He was already a researcher in the Industrial Centre when Dr O'Brien formed the ASRC and was happy to make the jump to the new venture. He is a specialist in Robotics, Automation and systems integration and has a tremendous grasp of geometry of co-ordinate systems.
Peng-fei studied Engineering at Bachelor and then Master's level in Harbin Institute of Technology, graduating in 2006. After a shot spell as a teaching assistant in the University he moved to Hong Kong and took up a post in the PolyU Industrial Centre in 2007. He worked as a project officer there until he was attracted to join the ASRC that was being set up. His main contributions to the projects of the ASRC are in robotics and systems integration which means that he has been involved in almost every project carried out in the Centre. He is most capable in both software control and electronics and is currently looking at robotic and radar issues on our Radome Test Rig.

Activities

24 OCT	Visit by Dr Chao-Hsin Lin of Boeing
3 NOV	Visit by Sisi JIN of Boeing Global Accelerators
4 NOV	German Chamber of Commerce visit the Centre
14 NOV	HK Electric visited
14 NOV	US Consulate General visit
16 NOV	Covation Group tour
16 NOV	Hartley McMaster Aviation Group visited
25 NOV	Presentation to Prof HC MAN
25 NOV	85th Anniversary Dinner
30 NOV	Cold Spray training and demo with HAESL
1 DEC	Open Day
8 DEC	German Chamber of Commerce with Leipzig startup companies
12 DEC	AAE Dept with Cathay Pacific Pilot Cadets
13 DEC	Work on Hyperspectral Imaging at HAECO

Sisi JIN of Boeing

Hartley McMaster Aviation Group

ASRC at the Anniversary Dinner

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. Needless to say this has been less frequent over the past couple of years. Despite this we try to keep information flowing on these platforms to allow followers to keep up with our activities.

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