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ASRC News

QUARTERLY NEWSLETTER OF THE AVIATION SERVICES RESEARCH CENTRE

The An-225 Mriya, largest aircraft ever built

In this big issue

Message from the new CEO, Robert Voyle

As we approach the end of our first ten years as a Global Boeing Research Centre, which is in itself an incredible milestone, we look forward to the next five years with great hope and anticipation of what that will bring.

There has been a large number of personnel changes in the past year and whilst we are sorry to see people leave we welcome a new breed of interns and researchers to assist us.

Now, with a new focus on disruptive and innovative technologies we intend to drive sustainability in support of MRO & Manufacturing across China and Southeast Asia.

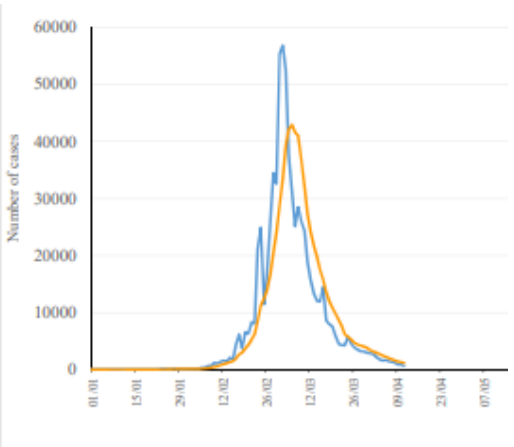
We have grown a lot since those early years back in 2012 thanks to the endeavours of staff members past and present in addition to the PolyU and our members.

Now based at a state-of-the-art facility in the centre of the APAC aviation hub that is Hong Kong, we remain fully focused on fulfilling the Research & Development ambitions of our members, and remain faithful and thankful to Boeing, HAECO, HAESL and the ITC for their continued support.

ASRC - Open to research; Open for business.

COVID CONSEQUENCES

In Early January cases of the Omicron variant of Covid-19 were detected in Hong Kong and by February cases had risen exponentially.
Staff of the University were urged to attend in person only for critical operations and in general staff of the ASRC reverted to 'Work From Home' protocol. Essential staff continued to attend to receive deliveries and ensure cleanliness in the office and workshop.
Fortunately all project staff and students could access the ASRC server via the University VPN and conduct meetings via Webex and MS Teams. Seminars were attended via "zoom" and "Google Meet" platforms.
COVID infections continued to rise through February but by the end of March numbers were falling and semi normal activities resumed with a skeleton crew in the office and workshop allowing some progress on projects.



Staff Leaving

The brains and driving force behind the establishment of the ASRC in 2012 was Prof Stephen O'Brien.
Steve took the idea to the University senate and to Boeing and against all the odds managed to get everything aligned and agreed for a joint venture to be initiated. HAECO and HAESL were quick to join after that, once again a testament to the drive and enthusiasm of Prof O'Brien.
The ASRC expanded rapidly between 2015 and 2017 and under his guidance many projects were awarded and successfully delivered to the benefit of the member companies and the wider community in the SAR and beyond.
Steve retires in effect this March and we all wish him a happy and fruitful retirement.
Many thanks for all you have done for the ASRC.

Technology Corner - Radar

When first demonstrated around the start of the second world war, no-one could have imagined how pervasive this technology would become.

Originally radar was used for Radio Direction and Ranging of incoming enemy aircraft and was developed rapidly during WW2. It used frequencies generated at first by large cavity magnetrons in the 10 cm range of wavelength.
A big advance was the miniaturisation of the system and installation on fighter aircraft of night time operations. Airborne radar is now ubiquitous in both commercial, general and military aircraft.

Most detection systems rely on reflected energy from the sun (vision) or the intrinsic temperature of the body (thermal imaging) but radar illuminates the target and observes the reflection. The reflected energy is scattered and a portion of it is returned to the source which in many cases acts as the receiver as well as the generator.

Today, high energy radar signals are generated in a klystron waveguide and modulated by transistor circuits. The transmit pulse is in the order of one microsecond and then the radar switches to receive mode for two to three milliseconds to pick up the return signal. In this way, with an oscillating phase array radar, a two dimensional picture is created of conditions forward of the aircraft.

In commercial radar systems the radar is primarily used to view the weather systems forward of the aircraft at around 870nm. The use of polarized and doppler shifted radar allows for higher detail on rain, ice and windshear.

Airborne weather radars use X–band radiation at 9.5 GHz with doppler shifting wind shear and other weather phenomena.

Radar is of course also used in other transportation industries such as automotive and marine in addition to astronomy and law enforcement.

Mr. Mannion is Lead of the Data, Materials and Instrumentation Stream of the ASRC

Machining Distortion Minimisation

In the process of manufacturing aero structures, a considerable amount of material is removed from the blank material to create a monolithic structure. This of course requires substantial machining on a multi axis machining centre. One drawback in the production of these monolithic structures is that the machining process can leave behind some stresses which manifest as distortion in the part.

This project aims to develop a machining strategy for both three and five axis machines that will minimise the remaining distortion. The parts will be measured 'on-machine' for strain during final cuts and the data from the machine will be added to this to create a model of the process. This can be run in a digital twin to make predictions on the changes resulting from modification of the machining parameters such as feed, speed and depth of cut (among others). The residual stresses in the final part will be measured by incremental hole drilling through strain gauge rosettes and this information will also be used to verify the model. We shall endeavour to make use of the local (Guangdong) China Spallation Neutron Source to do neutron diffraction measurements and get a value of the stress in the core of the blank or even the finished structure. The ASRC are uniquely positioned to carry out this project as we have the use of a high speed machine and a high torque machine in the centre.

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 as a depositional repair process may sound like science fiction, but cold spraying is very much science fact that will bring benefits to aviation component repair in spraying application.
The dynamic work-hardening process involved enables large areas to be bonded rapidly with purely mechanical clean adhesion; heat produced from the powder and substrate (work-piece) collision to 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 will be carried out to identify the critical particle velocity tolerance window for successful repairs on selected components in relation to spray particles of interest.

At present due to the global heath pandemic the cold spray system has not been installed. Everything is in place for the system to be set up but there is a requirement for the Japanese OEM to supervise the setup and certify the safety of the system. The ASRC had pressed the Japanese OEM and eventually installation began on the 1st of June 2021. Installation was supervised remotely by three cameras using MS Teams. At present the sound proof booth has been erected and the equipment placed in situ. We now await a decision on how to perform the final commissioning of the gas gun.

Largest Aircraft ever constructed

Aviation Classics — The Antonov 225 Mriya

The Antonov 225 and its junior sister ship the Antonov 124 were constructed in the days of the old Soviet Union with a view to support the USSR space programme and carry booster rockets, later it would carry the USSR answer to the Space Shuttle. I had a rocky career as the USSR broke up and it wasn't until 2000 that it was completed in the form we came to know. It went on to spend most of its life engaged in humanitarian or commercial activities across the globe.

Unloading Cargo

The aircraft was one of a kind. A second version was only 70% complete with a possible completion time of three years if funding was available.

The aircraft was truly massive at 84 m long, wingspan of 88.4m and a height of 18.1m. Its take off weight was 640,000 kg with a payload of 253,820 kg. Its 6 D-18T three shaft turbofan engines would run for 5 mins on the runway at full throttle to check if they were ok. If they lasted that time they were fine to fly. Recently it was flying covid related PPE from manufacturers in China to locations that were in need of supplies.

An-225 Mryia in take off configuration

The aircraft appears to be irrevocably damaged in the current Ukrainian conflict.

ASRC Equipment - The Renishaw Equator

The Renishaw company produce a comparator/ gauging machine which behaves like a three axis automatic translation probe carrier. The repeatability of movements is sub micrometer allowing CMM resolution of gold standard parts to be available on the shop floor.
A number of fixtures are available for the gauge and a large number of sapphire probes can be selected by the moving head.
A gold standard or previously CMM assessed part can be measured in a programmed repeatable way and then this program runs on parts as they are produced to compare (equate) them with the standard.

The Renishaw Equator

In the ASRC we have used the gauge with precision slip gauges to measure parts for verification of the machining process and to create gold standards for our optical scanners and 3D imaging devices.

Don't forget - World Metrology Day - 20 MAY 2022

Membership Benefits of the ASRC

Companies who join the ASRC as members should have a primary involvement in Aircraft Maintenance, Repair and Overhaul or should benefit from involvement and investment in technologies which may spin off from this field 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

GBA 大灣區航空 GREATER BAY AIRLINES

Greater Bay Airlines is the newest aircraft and route operator in Asia.
It achieved approval to operate from the HK government and is very much based in Hong Kong.

Initially it was launched as Donghai Airlines before changing to Hong Kong Bauhinia Airlines and finally rebranded in July 2020 as Greater Bay Airlines. At present it only has one B737 -300 with one more on order and it is using that aircraft for cargo flights. However there are plans to expand and to operate routes to Singapore, Bangkok and Phuket from the middle of this year, pandemic permitting. It's always good to see competition in the airline business and we wish them all the best for their growth once air travel opens up once more.

Staff Profile:

Ms Heidi Chow, Executive Officer

Without a doubt the cardinal point of the ASRC in its journey to where we are today has been our Clerical Officer Ms Heidi Chow. Heidi has poured oil on troubled water, pointed many a junior engineer in the right direction and repeatedly navigated the stormy seas of administrative obfuscation to deliver a satisfactory and timely result for the centre and the staff.

With a wealth of administrative experience behind her and a function knowledge of the procedures in the University, Heidi was a natural choice for Steve to pick when he and Andrew set up the ASRC back in 2012. Heidi was instrumental in establishing the ASRC as a unique entity in the University and had to set up the finance and personnel functions that enabled the ASRC to operate as a self–funding Boeing centre whilst still complying with the procedures embraced by the University and the general Civil Service administrative straight jacket that blankets many government affiliated and sub-vented bodies in Hong Kong.
Her cheerful smile and willingness to help has been essential to get to the state we are in today. As we go forward and she plans to bid us fair well, one thing is certain - Heidi has done more to make the ASRC what it is than any other person.

Activities

4 FEB visit by HAECO Group General Manager, Cary Cho

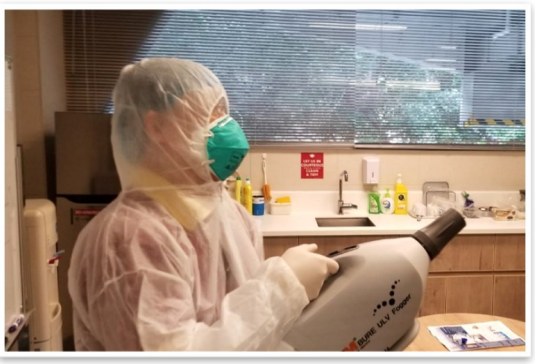
7 FEB - Visit by Techmart Industrial Ltd

17 FEB - Visit by Airport Authority and HK International Aviation Academy

15 MAR - Visit by Henry Hooi and Ada Tse of pH Capital (Volar)

Visit by HK Airport Authority

Visit by VOLAR staff



Sterilising the office — post COVID-19 infections among staff members

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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