Aviation & Aerospace

About The Hong Kong Polytechnic University – Soaring with a Vision

The Hong Kong Polytechnic University [PolyU] is the largest government-funded tertiary institution in Hong Kong, with total student numbers of more than 32,000. Through our faculties and schools – the Faculty of Applied Science and Textiles, Faculty of Business, Faculty of Construction and Environment, Faculty of Engineering, Faculty of Health and Social Sciences, Faculty of Humanities, School of Design, and School of Hotel and Tourism Management, the University **connects education and research to the real world** as manifested in our motto "To learn and to apply, for the benefit of mankind". Our applied research and innovations have been applauded and honored worldwide for meeting the evolving needs of society and making the world we live in a better place. The University has also maintained a **close partnership with industrial and commercial sectors, and collaborated with numerous universities worldwide** in order to contribute to the society with its expertise, state-of-the-art technology and resources. All these efforts have enabled PolyU to bring about significant impacts to the development of Hong Kong, the nation and the world.

Innovation and Technology Development Office

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PolyU

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

ITDO Innovation and Technology Development Office
創新及科技發展處

Innovation and Technology Development @ PolyU

Being one of the strategic areas of development at PolyU, **knowledge transfer** has always been awarded its meed of attention and due focus from the University. It has marked numerous footprints in the University's history. PolyU has spared no efforts in sustaining its long-established eminence particularly in this area of excellence. Our **application-oriented innovation and technology development** serves to address people's needs and the community's advancement along the continuum of research through knowledge transfer to its ultimate creation of high impacts to the society. We are keen to **foster partnerships among universities, government, industry and public** at large and **minimize the gap in technology readiness** between research outcomes and society's needs.

To this end, the **Innovation and Technology Development Office [ITDO]** at PolyU is commissioned to provide and maintain an effective, sustainable **intellectual property management** system for the needs of PolyU, and to facilitate **technology development and collaborative research** to cope with PolyU's mission on innovation, application and knowledge transfer.

Aviation & Aerospace @ PolyU

Steered by its pioneering vision, "Be a leading university that excels in professional education, applied research and partnership for the betterment of Hong Kong, the nation and the world", the Hong Kong Polytechnic University ("PolyU") is destined to deliver its mission **"to advance knowledge and the frontiers of technology to meet the changing needs of society"**. It lays down a solid foundation initiating knowledge transfer, enlightening innovation as well as nurturing technology development from which PolyU capitalizes on sustaining its applause-winning achievements.

We pioneer advances in numerous areas and here are some of our footprints on the trail of innovation in **Aviation & Aerospace.**

Aviation

AVIATION SERVICES RESEARCH CENTRE (ASRC)

Steering the Development of Hong Kong into a World-class MRO Research Hub

Leveraging the strengths of PolyU, the ASRC aims at developing innovative technologies for the maintenance, repair, and overhaul ("MRO") industry towards the improvement of safety, efficiency, standards, and its capacity in view of the blooming aviation industry growth.

2002
Started collaboration with **HAESL**.

2012

MoU signed with **Boeing** to establish **1st ASRC** in Hong Kong.

2013
ASRC Phase I **Opening**.


Secured **HK$19.44M** funding from ITF.

2015
Celebrated **2nd Anniversary** of ASRC.

2 research achievements with **HK$51M** funding from ITF.

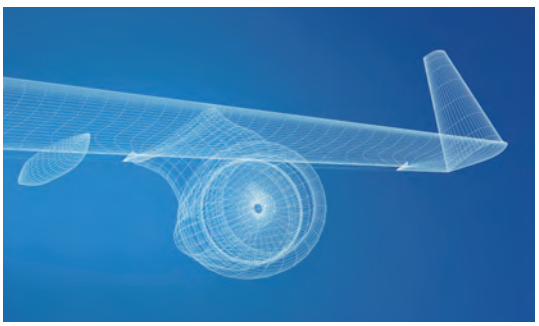
2016

Prof. Mark Hayman, ex-**HAECO**'s Group Director of Engineering & Operations **joined ASRC** as CEO.

2017
Signed strategic collaborative research framework with **CASIL**. **ASRC Phase 2** at Block X is targeted to be in operation.

Advancing Research Excellence and Industry Growth

PolyU aspires to nurture close collaborations and boost a better synergy in aviation researches through a research network which includes the PolyU, overseas research institutions, public service corporations, local industries, and governmental departments, in order to bring advanced technologies to the aviation industry; and also to train up quality talents, such as design engineers and aircraft engineers, specializing across various areas, so as to provide solid research and development support for the rapidly expanding areas. Other related industries such as hospitality and tourism, engineering, and materials sciences will also be expected to flourish, leading to immense industrial and social impacts – with sustainability.

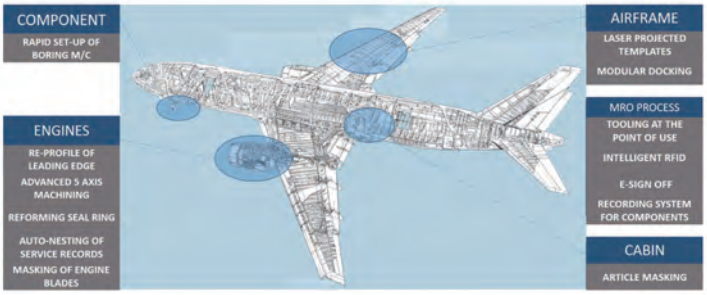


PolyU has a long time commitment on aviation-related education, application-oriented R&D, and the efforts of collaborating with the industry, in order to bring our innovation to the real world. The establishment of Hong Kong's first Aviation Services Research Centre ("ASRC") with the Boeing Company and three local partners – Hong Kong Aircraft Engineering Company Limited ("HAECO"), Hong Kong Aero Engine Services Limited ("HAESL"), and China Aircraft Services Limited ("CASL"), is an evident and a major milestone of our industrial partnership.

a Completed Project

ASRC research topics have three major sources:

1. Generic research projects funded via ASRC membership fee.
2. Projects funded by Innovation and Technology Commission.
3. Special projects commissioned by companies.



b Development of a Hangar Shop 3D space Utilization Decision Support System for Aircraft Maintenance Providers

PolyU had collaborated with China Aircraft Services Limited in developing a Hangar Shop 3D Space Utilization Decision Support System in aircraft maintenance services. It is an artificial intelligent decision support system to support the daily scheduling and planning of Hangar Shop activities with the aim of space utilization optimization.

c RFID-based air cargo processing system and employ software agents to facilitate the important task of flight planning

PolyU implemented Radio Frequency Identification (RFID) technology in air cargo processing system, in order to enhance Hong Kong's competitiveness in the air freight forwarding industry. Flexible RFID Encoder and Decoder (FRED) uses a flexible XML-based data encoding scheme and a data compaction algorithm, in which essential air cargo data can be written onto RFID tags efficiently and according to user specified data format for identification and processing purposes. This integrated system also provides movement detection capability and tag rewriting mechanism to enhance its flexibility. FRED application can be further extended to support a wide range of RFID-based applications.

FRED application on a RFID-enabled air waybill label

d Consortium for Aerospace Engineering and Aviation (CAAR)

PolyU has a strong commitment to develop aerospace researches, and has successfully nurtured a critical mass to tackle aero-related issues in the past 20 years. The establishment of Consortium for Aerospace Engineering and Aviation in 2012 is dedicated to develop all high-quality aerospace-centric technologies research and development for meeting the industrial, commercial and community needs of the society. Research areas includes:

- Green Engines and Combustion
- Aeroacoustics
- Advanced Composite materials and Structure Health Monitoring
- UAV/MAV (Unmanned Aerial Vehicle/Micro Aerial Vehicle

e Other relevant research

PolyU has extensive experiences in industrial collaborative projects for famous aircraft manufacturers, such as Airbus, Boeing, Bombardier Inc. Canada, and LORD Corporation USA. Commercial Aircraft Corporation of China Ltd. (COMAC) is also invited to participate in new technology development – noise abatement in cabin, for C919, the Chinese new generation of large commercial passenger aircraft.

Mr Pierre Delestrade, Senior Vice President for North East Asia of Dassault-Aviation, shares a helicopter view of attributes to the lasting success of Dassault-Aviation for a century with PolyU community.

Aerospace

SUPPORTING MOON & SPACE EXPLORATION

Hong Kong's First-class Aerospace Research and Development Institute

A key challenge in developing these tools and devices is their endurance under harsh and extreme conditions such as large temperature differences, microgravity environment, vacuums, high levels of dust and cosmic radiation, and the behavior and interaction of materials under different environments. They also need to cope with various unforeseen hazards such as jamming due to excessively hard rock fragments.

A team of PolyU pioneers at our Department of Industrial and Systems Engineering [ISE] and the Industrial Centre [IC] have been working ambitiously and at the same time meticulously to bring to the world advances in aerospace related technologies, contributing in leaps and bounds to our understanding of the universe.

a Camera-Pointing System // Pinnacle of National Technological Achievement with a Local Touch

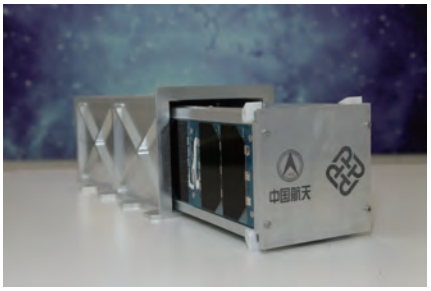
Jointly developed by researchers at PolyU with the China Academy of Space Technology [CAST] (CAST currently the most important research and engineering base for China's space flight missions), the Camera Pointing System [CPS] was the first Hong Kong-made and developed instrument being deployed for China's lunar exploration program since its launch in 2007. In December 2013, the CPS was deployed with the Chang'e-3, which soft landed at 44.1° Latitude North of the moon, an area also known as Sinus Iridum or the "Bay of Rainbows". The CPS measures 85 cm (length) x 27 cm (width) x 16 cm (depth) and weighs 2.8 kg. It was installed in the upper part of the lander and capable of moving vertically by 120 degrees and rotating sideway by 340 degrees to capture images of the moon for lunar mapping as well as movement of the rover.

b The Soil Preparation System // Mars Rock Corer

To be deployed in the upcoming Sino-Russian missions to explore "Phobos," the Soil Preparation System [SOPSYS] was initially developed as the Mars Rock Corer, and to be launched with the European Space Agency's 2003 Mars Express Mission (later aborted) for grinding, drilling, coring and gripping rock samples. It is compact, lightweight at less than 400 grams, and consumes energy as low as two watts. It could be applied in wide range of environments to support in-situ analysis, which is part of a crucial step in understanding the evolution of the universe. Some of the technologies developed for SOPSYS were applied in the Camera Pointing System.

PolyU has been actively supporting space exploration by developing sophisticated space tools and devices for various national and international space missions. With our tradition to overcome some of the most difficult challenges for mankind and deliver the highest quality engineering pieces, the space tools co-developed by PolyU and our collaborators have embarked on their space journey in as early as 1995; since then we have been contributing towards some of the significant milestones in space exploration.

c Development of Microsatellite Platform and Deployment System



In September 2015, a microsatellite platform and deployment system was developed by PolyU's researchers, which contributed to China's successful launch of "20 satellites in one rocket" of "Long March 6". As jointly developed by PolyU and Aerospace Dongfanghong Development Ltd. Shenzhen, China [SZDFH], a low-cost aerospace technology was applied to the first batch of microsatellite launched by China - "Kaituo-1B"; it piggybacked on the SZDFH-developed mother satellite "Kaituo-1A". Kaituo-1B weighed only around 2 kg. Compared with conventional satellites which weight from a few hundred to a few thousands kilograms each, cost reduction is significant, in the development and production of microsatellite for carrying small-sized payloads and instruments into space. Besides, this technology can also be applied to a wide range of industries, including aviation, pharmaceutical industry, advanced materials, and educational sectors.

d Other Aerospace-related Research

Apart from the various tools and devices that support space exploration, PolyU experts are also continuously engaged in the well-being of astronauts, who spend much time under the microgravity environment. Cross-disciplinary research on adjustments of the human body under weightlessness, skeletal muscle health, physiological and pathological changes, mental health, etc., are on-going at our Department of Industrial and Systems Engineering [ISE] and Department of Rehabilitation Sciences [RS].

The PolyU–CAST Collaboration // Origin of an Engineering Marvel

The China Academy of Space Technology [CAST], established in 1968 with the late aerospace scientist Qian Xuesen as the founding president, is the most important research and engineering base for China's space flight missions. In recognition of PolyU's commitment and track record in the arena, CAST officially started collaborations with PolyU in 2010 to establish the Joint Laboratory in Precision Engineering for Space Applications, to which it donated advanced space research equipment. In 2013, PolyU further signed an agreement with CAST to establish the Joint Laboratory in Mechanics and Space Environment Engineering.

International reputation

PolyU reaches out across borders to advance our development in education and research. Starting from 1990s, PolyU made its mark internationally for making space tools for the European Space Agency and the Russian Space Agency. As part of the European Space Agency's "Mars Express Mission" project, a sophisticated device known as the "Mars Rock Corer" was developed by PolyU's project team. It was installed at the "Beagle 2 Lander", and was launched in 2003 towards Mars, so as to core into hard rocks and to retrieve rock fragments from the depth of the rock for analysis.

PolyU is continuously creating strong collaboration network with international technology community. Recently, we are exchanging ideas with US and France's leading organizations in Aeronautics and Aviation sectors, like Dasssault Aviation, Airbus, Institut National des Sciences Appliquées de Toulouse [INSA], Ecole Nationale de l'Aviation Civile [ENAC]. PolyU will continue to extend our innovation and technology development from the nation to the world.

Our Aviation & Aerospace, Transportation & Navigation - related Faculties and Departments

At PolyU, we embrace collaborative research and development during our innovation process. Whatever your unmet needs are, we have a team of experts ready to help you tackle your challenges.

Faculty of Applied Science and Textiles

Department of Applied Physics
- Nanomaterials
- Photonic Materials and Devices
- Smart Materials and Devices
- Theoretical and Computational Physics

Department of Applied Mathematics
- Applied Optimization and Operations Research
- Applied Statistics and Financial Mathematics
- Engineering and Computational Mathematics

Faculty of Construction and Environment

Department of Civil and Structural Engineering
- Transportation

Department of Civil and Environmental Engineering
- Urban Hazards Mitigation
- Transportation

Department of Land Surveying and Geo-Informatics
- Surveying, Navigation and Positioning
- Geodesy and Geodynamics
- Photogrammetry and Remote Sensing
- Geographic Information Systems
- Digital Cartography

Faculty of Engineering

Department of Computing
- Big Data Analytics and Information Retrieval
- Graphics, Visualization and Multimedia
- Networking and Mobile Computing
- Pattern Recognition and Machine Intelligence
- Systems and Software Engineering

Department of Electrical Engineering
- Photonics & Smart Materials and Devices Technologies
- Railway Engineering
- Power & Energy Systems
- Power Electronics and Utilization

Department of Electronic and Information Engineering
- Communications Research
- Signal Processing
- Thin Film and Optoelectronics
- Intelligent Control and Computing

Department of Industrial and Systems Engineering
- Advanced Materials Processing
- Advanced Optics Manufacturing
- Products Design and Miniaturization
- Logistics Engineering

Department of Mechanical Engineering
- Aerospace Engineering and Aviation
- Sound and Vibration
- Fluid-Structure Interactions

Interdisciplinary Division of Aeronautical and Aviation Engineering
- Aircraft services engineering
- Aviation information systems
- Aircraft component design and manufacture
- Air transportation

Aviation & Aerospace, Transportation & Navigation - related Research Institutes & Centres
- Aviation Services Research Centre
- Consortium for Aerospace Engineering and Aviation Research
- Consortium for Sound and Vibration Research
- Hong Kong Branch of National Rail Transit Electrification and Automation Engineering Technology Research Centre
- Research Centre for Fluid-Structure Interactions
- Smart Railway Research Laboratory

The Industrial Centre … Multi-disciplinary expertise and technologies under one roof

The Industrial Centre [IC] of PolyU is the training centre for professional engineers, as well as a one-stop technical solution provider during the innovative process. IC has a large range of technical experts who possess real industrial application experience and knowledge, who are capable of integrating PolyU's multi-disciplinary innovations with the best technical advice and solution for our partners - turning your innovative concepts and ideas into workable industrial design or even real products and systems to meet your special needs.