支持亞洲航航空產業 – 香港理工大學的教育課程及研究計畫

Supporting the Aviation Industry in Asia-Education programmes and Research Initiatives in PolyU

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Dean, Faculty of Engineering, Hong Kong Polytechnic University

Supporting the Aviation Industry in Asia-

Education programmes and Research Initiatives in PolyU

Professor H C Man,
Dean, Faculty of Engineering

Prof Henri Hie
Department of Industrial and Systems Engineering

The Hong Kong Polytechnic University

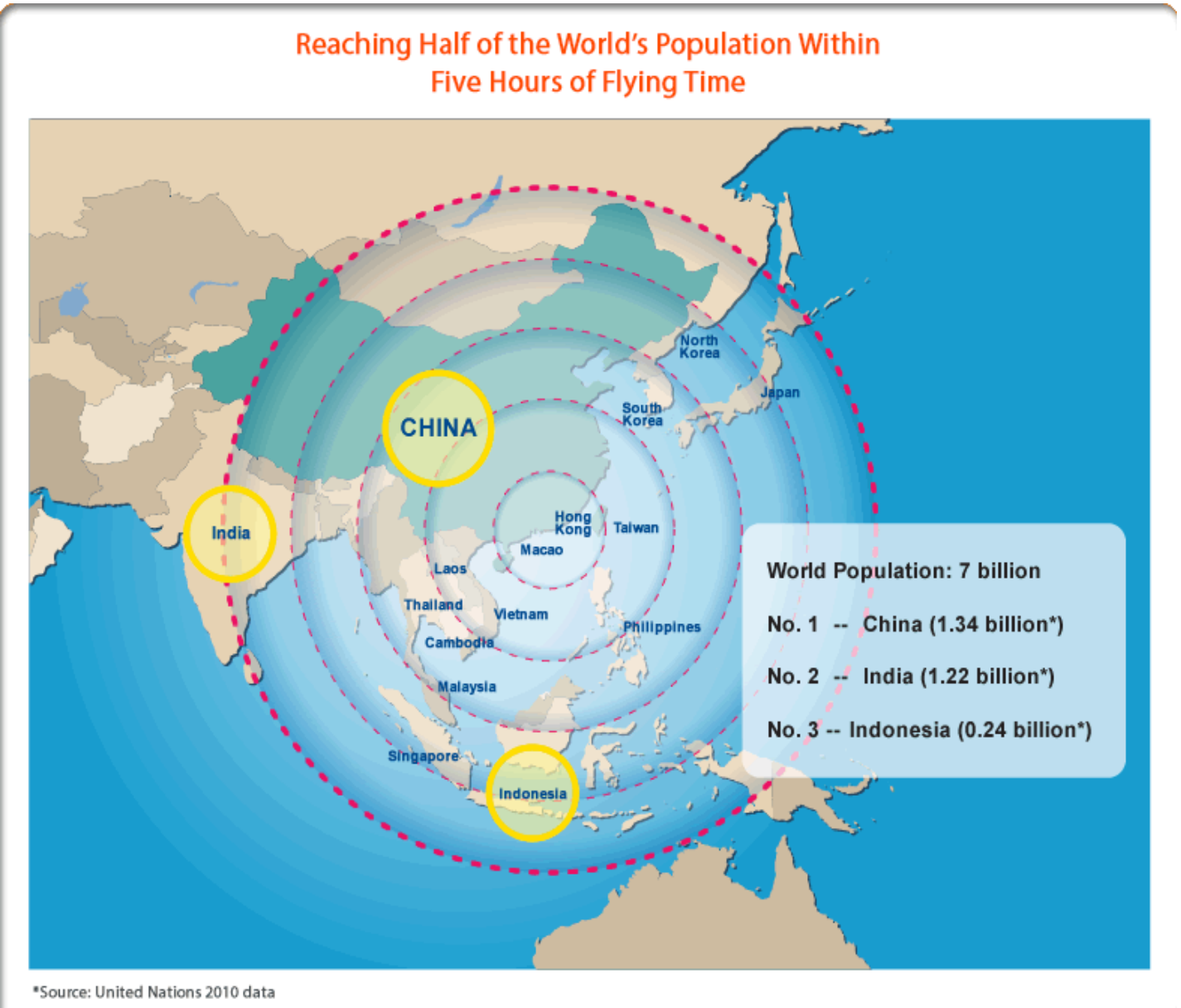
1957	50,000 visitors
1958	The new runway of Kai Tak Airport opened
1973	1.29 million arrivals.
1978	2 million arrivals
1995	A visitor from South Korea was welcomed by the HKTA as Hong Kong's 10 millionth visitor of the year.

Operations and Statistics

year	Passenger movements	Airfreight movements (tons)	Aircraft movements
1998	*28,631,000*	*1,628,700*	*163,200*
2000	*33,374,000*	*2,240,600*	*181,900*
2002	*34,313,000*	1,637,797	*206,700*
2003	*27,433,000*	*2,642,100*	*187,500*
2004	*37,142,000*	*3,093,900*	*237,300*
2005	*40,740,000*	*3,402,000*	*263,500*
2010	50,410,819	4,112,416	306,535
2011	53,909,000	3,939,000	333,760
2012	56,057,751	4,062,261	352,000
2013	59,913,000	4,122,000	372,040
2017	*(oct)72,079,000	4,883,000	417,355

* Oct –previous 12 months

Geographical Advantage



Hong Kong as a transition point to America and Canada

Key Factors:

- Passenger Movements（人流）
- Cargo Movements（貨流）
- Capital Movements（資金）
- Communication（資訊）
- Location and capacity of the airport（機場位置）

中華人民共和國
第十二個五年規劃
粵港澳五大重點發展項目

Twelfth Five-Year Plan of the People's Republic of China Five Major Projects among Guangdong, Hong Kong and Macao

中國
China

廣州
Guangzhou

廣州南沙發展區
Nansha Development Zone
Guangzhou

擬建港深西部
快速軌道線
Proposed Hong Kong-Shenzhen
Western Express Line

深圳寶安國際機場
Shenzhen Bao'an
International Airport

深圳前海發展區
Qianhai Development Zone
Shenzhen

深圳
Shenzhen

廣深港高速鐵路
Guangzhou-Shenzhen-Hong Kong
Express Rail Link

港深西部公路
Kong Sham
Western Highway

皇崗口岸
Huanggang Port

深圳灣口岸
Shenzhen Bay
Port

約 approx 20 分鐘 mins
直達深圳
Shenzhen

新界
New Territories

8號幹線
(沙田段)
Route 8 To
Shatin

九龍
Kowloon

港珠澳大橋
Hong Kong-Zhuhai-Macao Bridge

AsiaWorld-Expo
亞洲國際博覽館

快速海峽繞道
Cross-straits
Bypass

香港國際機場
Hong Kong International Airport

約 approx 20 分鐘 mins
直達中環、沙田
Central, Shatin

香港島
Hong Kong Island

珠海
Zhuhai

大嶼山
Lantau Island

約 approx 20 分鐘 mins
直達澳門及珠海
Macao & Zhuhai

珠海橫琴發展區
Hengqin Development Zone
Zhuhai

澳門
Macao

Connecting Hong Kong with the World

HKIA connects more than 100 airlines serving 180 destinations worldwide (including 44 mainland cities); about 1,050 flight movements daily

Slides from Dr John Chai

HAECO

HAESL

TALSCO

TAECO
Taikoo (Xiamen) Aircraft Engineering Co.Ltd.

TIMCO
aviation services

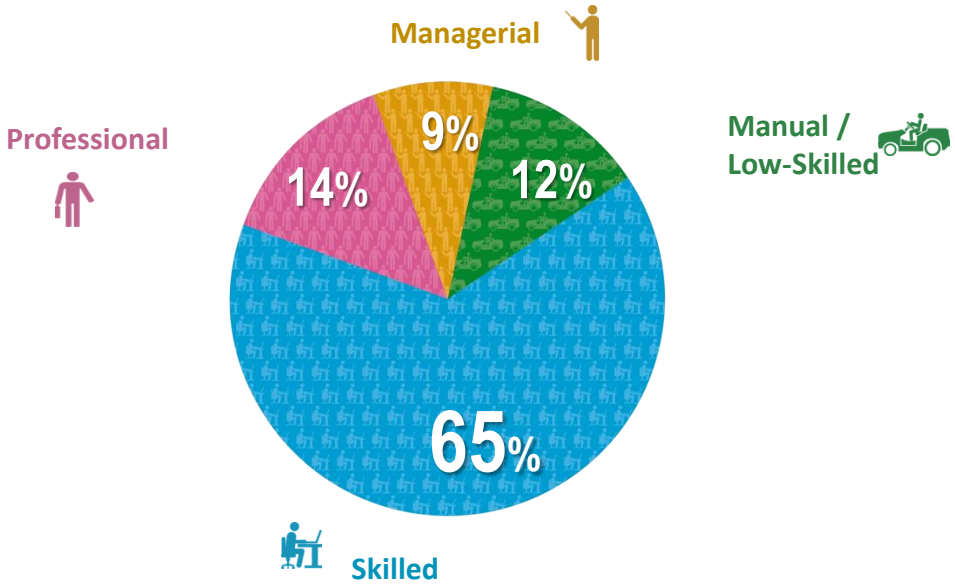
CASL

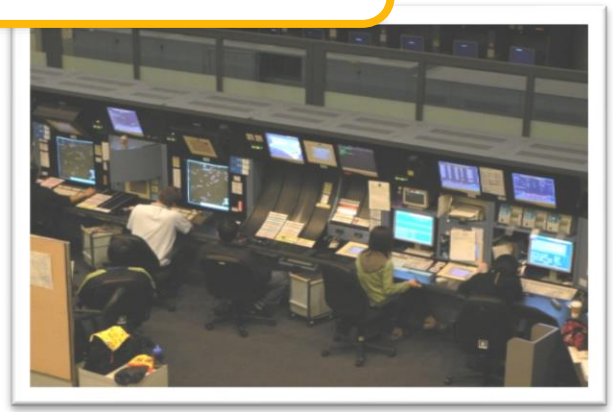
Aircraft Maintenance Hub in the World

Providing > 65,000 Jobs

Airport Workforce in 2013

> 65,000 employees*

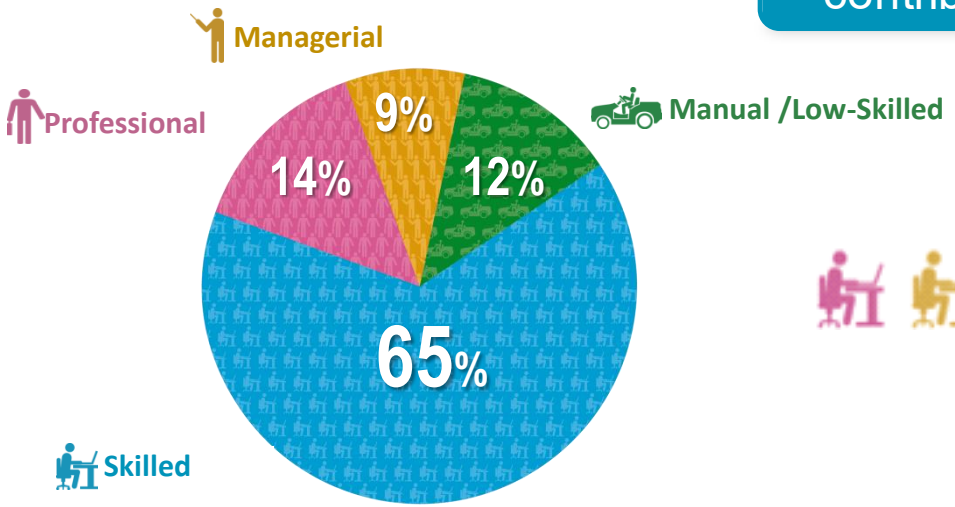




Slides from Dr John Chai

HKIA Three-Runway System creates Economic Benefits and Jobs

141,000 direct jobs
199,000 indirect + induced jobs by 2030



GDP

HK$167 BILLION or 4.6%
direct + indirect + induced contribution to HK's GDP in 2030

Slides from Dr John Chai

BOEING

BOEING EDGE
Flight Services

2014
Pilot & Technician Outlook

Sherry Carbary
Vice President, Flight Services
Boeing Commercial Aviation Services

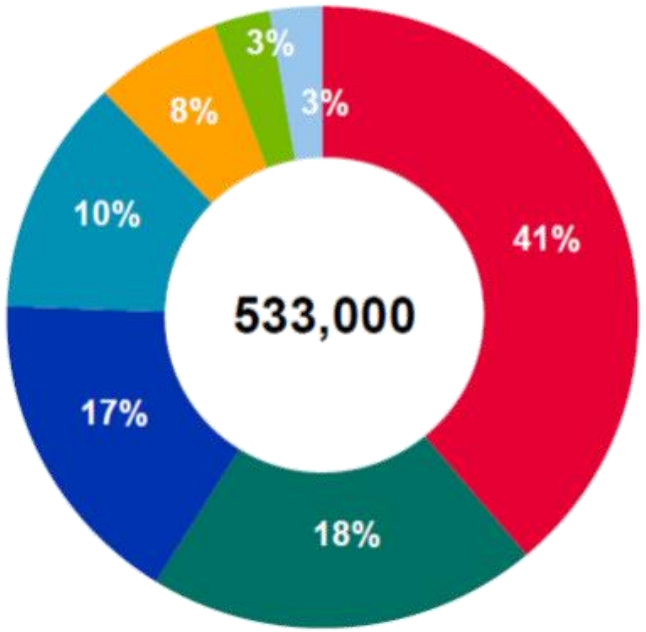
July 30, 2014

Demand for commercial airline pilots

2014 Pilot & Technician Outlook

New pilots by region

2014–2033



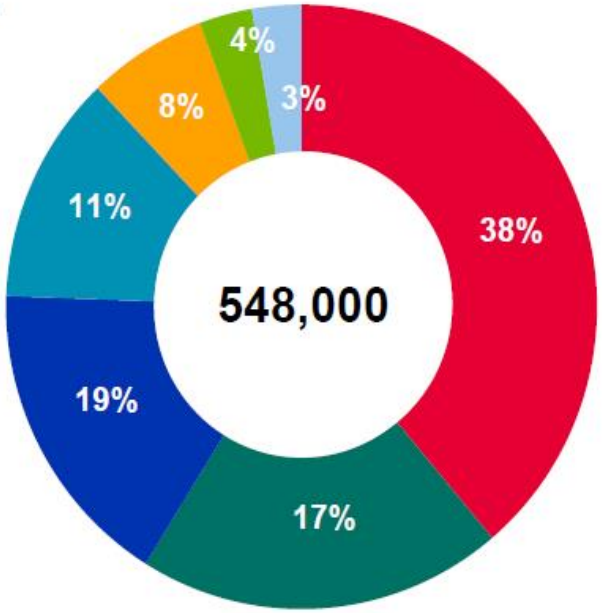
Region	Pilots
Asia Pacific	216,000
Europe	94,000
North America	88,000
Middle East	55,000
Latin America	45,000
CIS	18,000
Africa	17,000
Total	**533,000**

Demand for commercial airline technicians

2014 Pilot & Technician Outlook

New technicians by region

2014–2033



Region	Technicians
Asia Pacific	224,000
Europe	102,000
North America	109,000
Middle East	62,000
Latin America	44,000
CIS	24,000
Africa	19,000
Total	**584,000**

However, are we prepared for this growth and business opportunities in HK ?

- Do we have enough skilled people for this growth?
- Is the traditional “on job training” route carried out by the industry able to provide sufficient human resources capital for this rapid growth?
- How can tertiary education institutions play a role?

We need to work together to come up with innovative ideas for this blooming industry:

- Human resources capital – education and training
- Research and development – engineering and technology
- Business and finance
- Government policy

The Hong Kong Polytechnic University

- The first university in HK to start research collaboration with the Aviation industry
- Industrial Centre designed and manufactured special equipment/workstations
- PolyU Aviation Services Research Centre (PolyU, Boeing, HAECO, HASEL)
- Four government-funded degree programmes for the aviation industry- unique in HK

BEng (Honors) in Air Transport Engineering

民航工程學 (榮譽)工學士學位

2 years (top-up) programme

Launched in September 2014

40 students intake quota for HD and Associate degree holders

Prepare students for the MRO industry

BEng (Hons) Aviation Engineering
航空工程學(榮譽)工學士學位

4 year programme

Launched in September 2016

56 students intake quota for DSE graduates

Prepare students with in depth knowledge in one of the following 4 streams:

-Aircraft Maintenance Engineering
-Aerial Vehicle Autonomy
-Aircraft Services Engineering
-Pilot Ground Theory

BSc (Hons) Aviation Operation and Systems
航空營運及系统學(榮譽)理學士學位

2 years (Top up) programme

Launched in September 2017

40 students intake quota for HD and Associate degree graduates

Prepare students for airport and airlines operation, design, development, planning, and scheduling, implementation and control of various processes, operations, and systems in aviation and related industries.

Bachelor of Business Administration (Honours) in Aviation Management and Logistics

航空管理及物流(榮譽)工商管理學士學位

2 year (Top Up) programme

Launched in September 2017

40 students intake quota for HD and Associate degree graduates

Prepare students for the business operation relating to the aviation industry

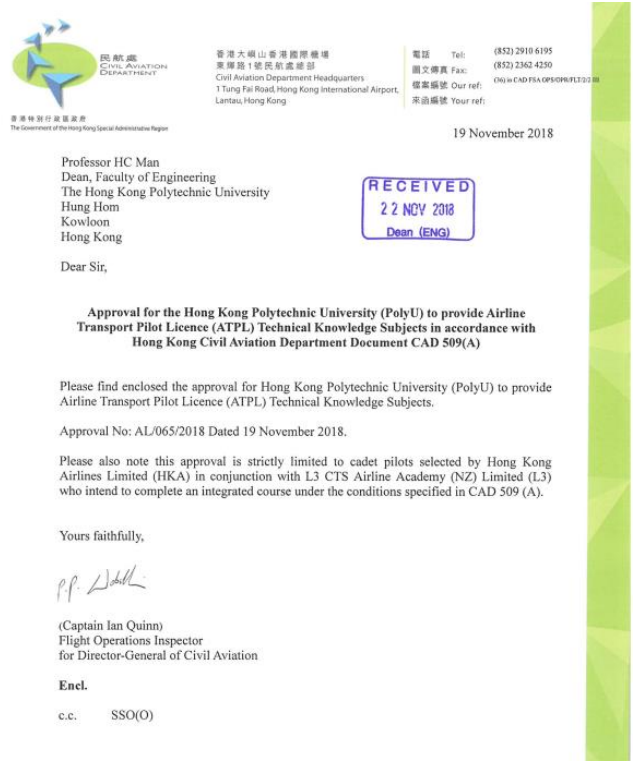
PolyU's Flight Training & Aircraft Maintenance Training Organization

- Objectives
  - To fulfill the need of Asia's rapidly growing aviation market in terms of professional pilots and aircraft maintenance engineers.
  - To establish Hong Kong's leadership in aviation training, with particular emphasis in the Greater Bay Area.
  - To equip the next-generation aviation professionals with solid technical skills and international vision.

- Target audience
  - Students in PolyU's aviation engineering programmes
  - Aspiring young generations in China and Asia

Milestones

- 11/19/2018: Obtained approval for ATPL from Hong Kong Civil Aviation Department (HKCAD).



民航處
CIVIL AVIATION DEPARTMENT
香港特別行政區政府
The Government of the Hong Kong Special Administrative Region

香港大嶼山香港國際機場
東涌陸1號民航處總部
Civil Aviation Department Headquarters
1 Tung Fai Road, Hong Kong International Airport,
Lantau, Hong Kong

電話 Tel: (852) 2910 6195
圖文傳真 Fax: (852) 2362 4250
檔案編號 Our ref: (36) in CAD FSA OPS/OPH/FLT/2/2 III
來函編號 Your ref:

19 November 2018

Professor HC Man
Dean, Faculty of Engineering
The Hong Kong Polytechnic University
Hung Hom
Kowloon
Hong Kong

RECEIVED
22 NOV 2018
Dean (ENG)

Dear Sir,

Approval for the Hong Kong Polytechnic University (PolyU) to provide Airline Transport Pilot Licence (ATPL) Technical Knowledge Subjects in accordance with Hong Kong Civil Aviation Department Document CAD 509(A)

Please find enclosed the approval for Hong Kong Polytechnic University (PolyU) to provide Airline Transport Pilot Licence (ATPL) Technical Knowledge Subjects.

Approval No: AL/065/2018 Dated 19 November 2018.

Please also note this approval is strictly limited to cadet pilots selected by Hong Kong Airlines Limited (HKA) in conjunction with L3 CTS Airline Academy (NZ) Limited (L3) who intend to complete an integrated course under the conditions specified in CAD 509 (A).

Yours faithfully,

p.p.

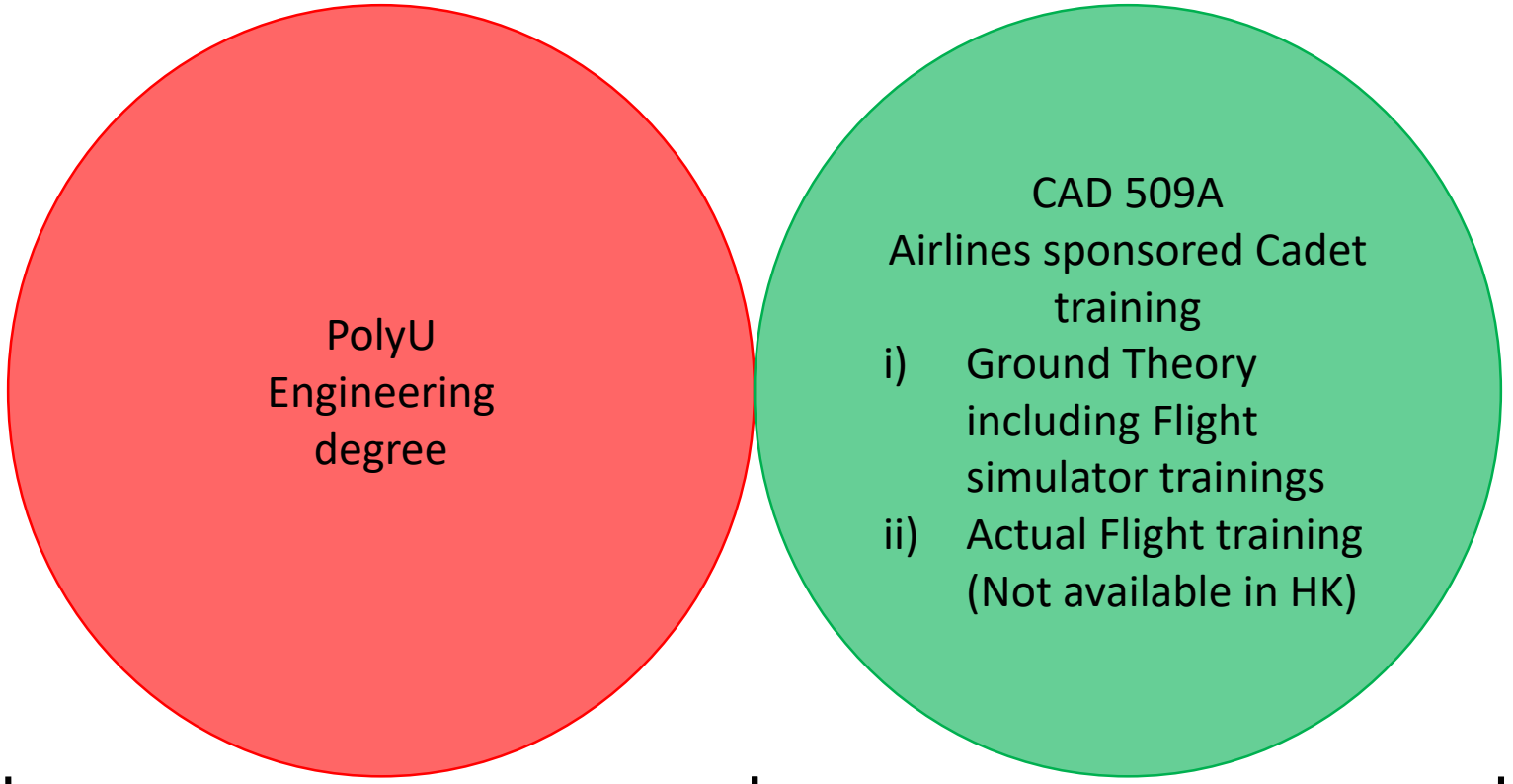
(Captain Ian Quinn)
Flight Operations Inspector
for Director-General of Civil Aviation

Encl.

c.c. SSO(O)

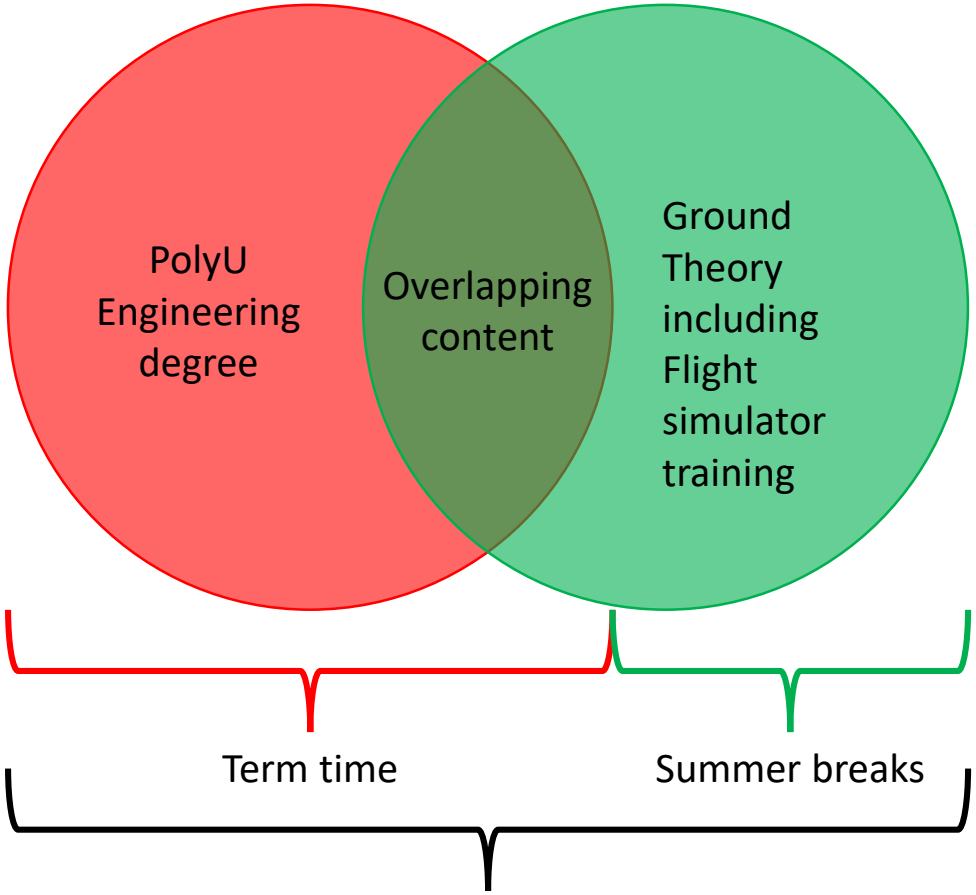
- 31/03/2019: Formal submission to Hong Kong Civil Aviation Department (HKCAD) for HKAR 147 status

Conventional Training Route for ATPL



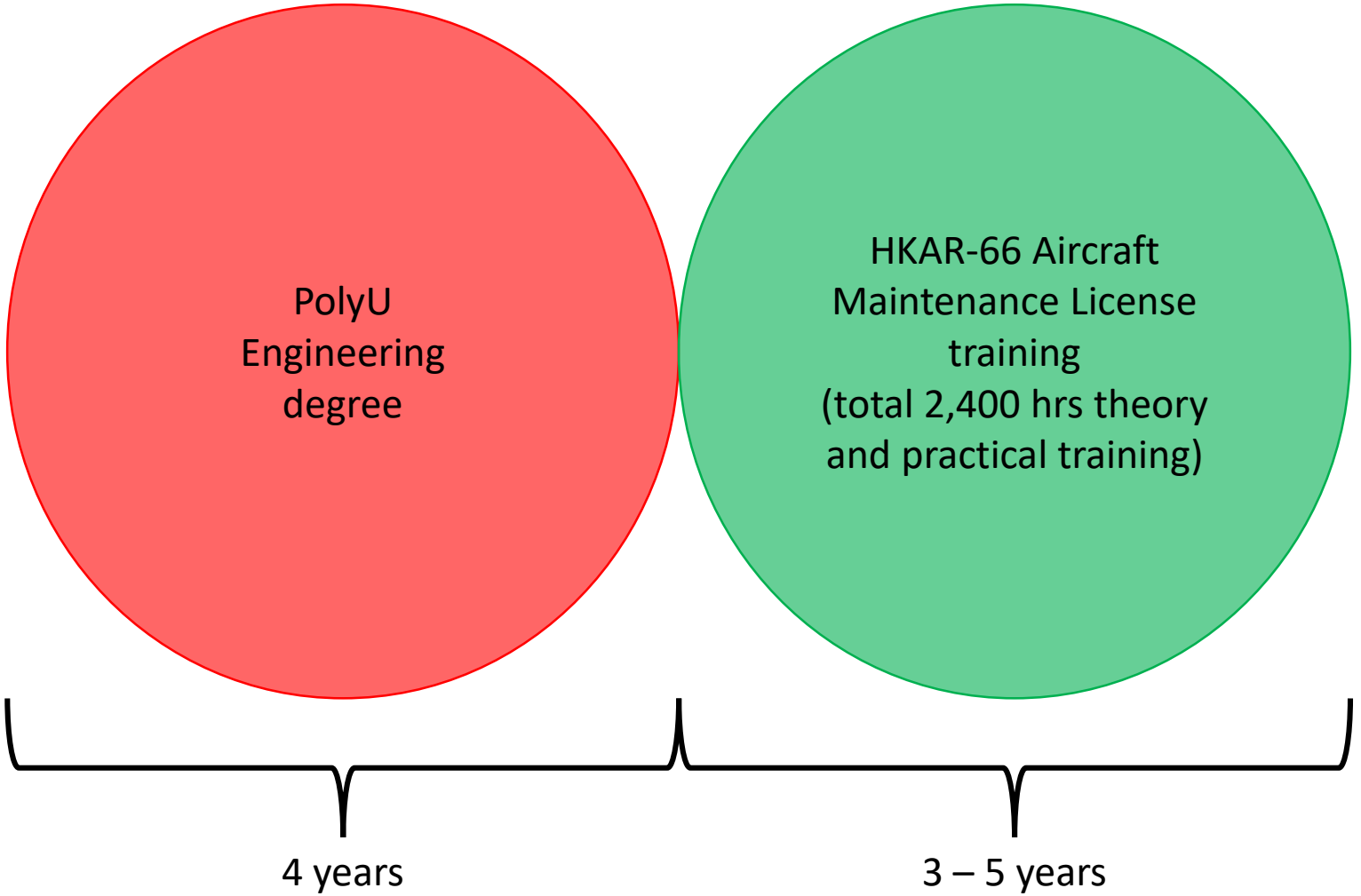
Total of 6 - 7 years

PolyU's Approach for ATPL



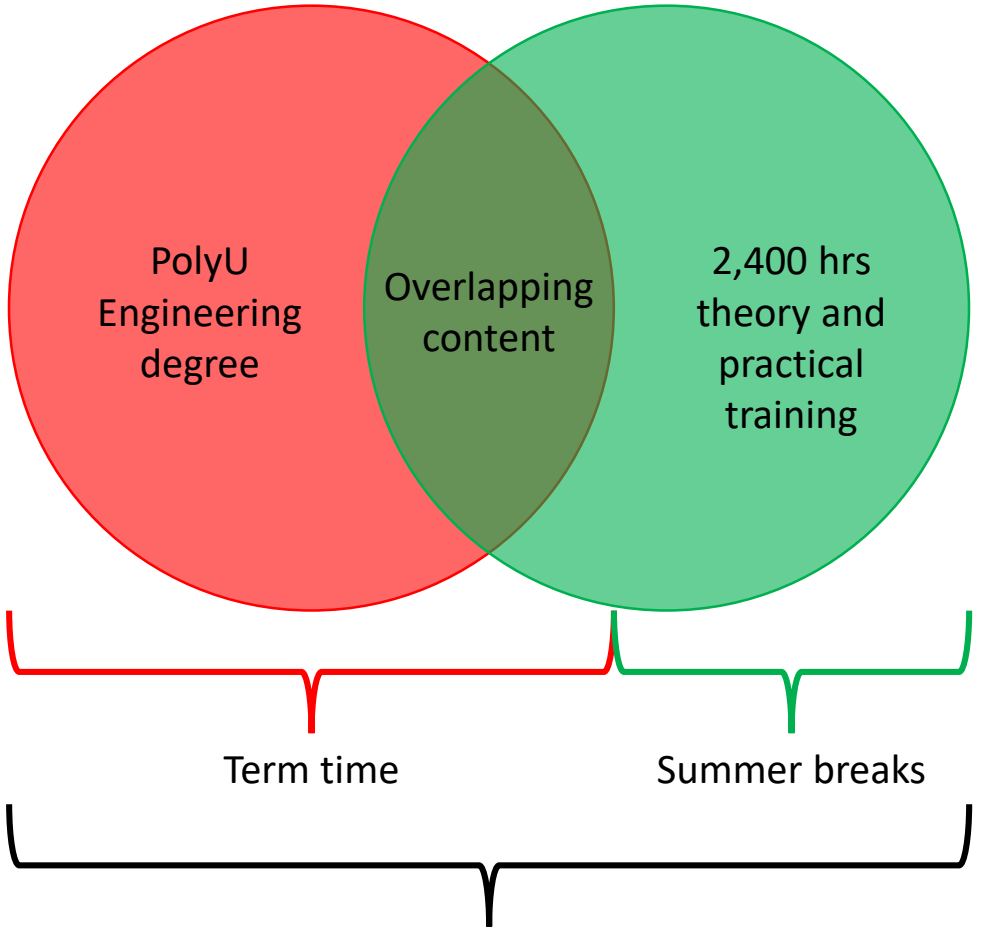
4 years + 1 year of practical flight training by Airlines

Conventional Training Route for Licensed Aircraft Engineers (LAEs)

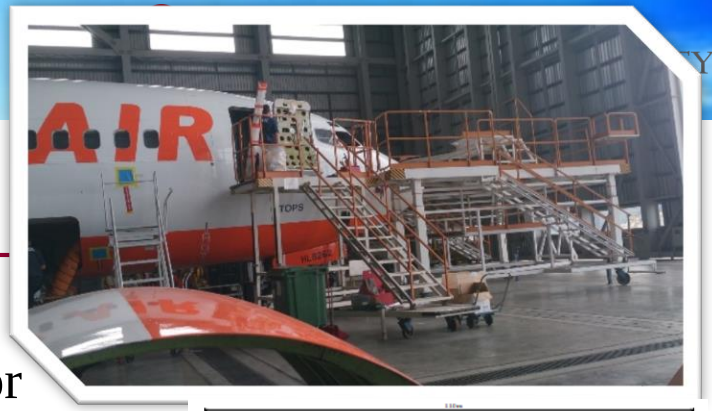


Total of 7- 8 years

PolyU's Approach to LAEs Training



Research Project – Aircraft Positioning

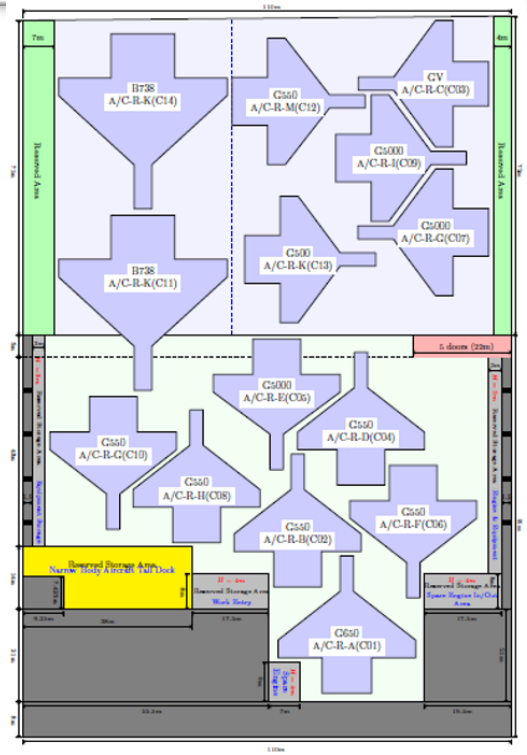


Project Title:

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

Aims:

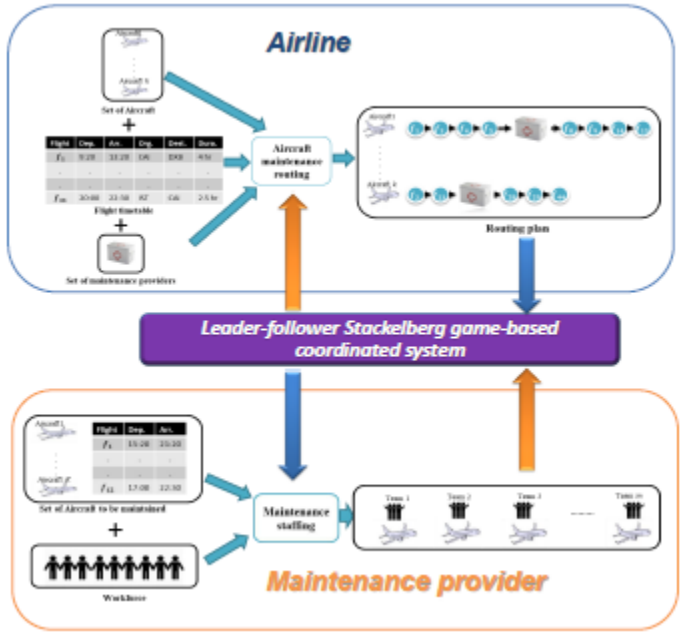
- Develop a Hangar Shop 3D Space Utilization Decision Support System for an aircraft maintenance service provider.
- Maximize space utilization for profitability.
- Minimize the number of aircraft repositioning for reducing the risk of collision.
- Model aircraft as irregular shapes in 3D space to enhance the space utilization

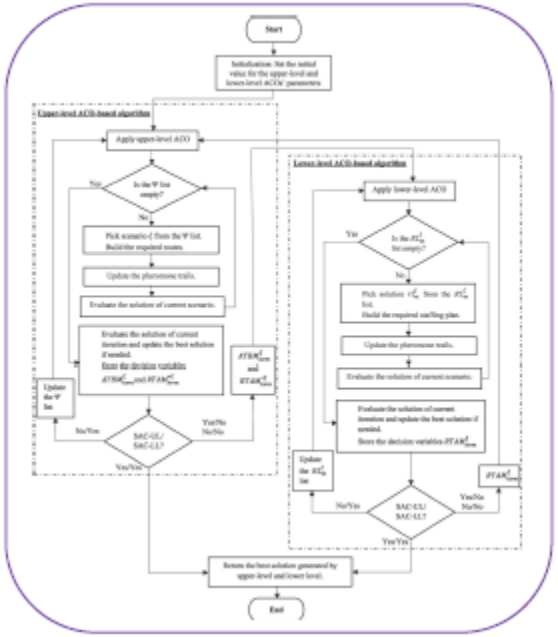


Research Project – Aircraft Routing

Project Title:

Game theoretic model for optimizing aircraft maintenance routing of airlines and maintenance staffing of maintenance providers





Aims:

- Propose a game theoretic model to capture the interrelationship between the routing plan of airlines and staffing plan of maintenance providers.
- Develop an efficient solution algorithm that can build applicable routing and staffing plans.

Research Project – Flight Delay Estimation

Assigning Buffer Time for Flight Delay Problems:

- flight delay affect the flight schedule integrity and flight operations

Aims:

- estimate flight delay probability for crew scheduling

Method:

- machine learning: cascading neural network
- historical data including weather, airport condition, etc.

Benefits:

- to increase airline operations reliability

Publications:

- Risk Analysis x 1,
- Transportation Science x 1 (under review)
- Press Release x 2 (SRA, Travel Data Daily, abc 8 news, Fox 29, etc.),

https://wiley.altmetric.com/details/14881482/news

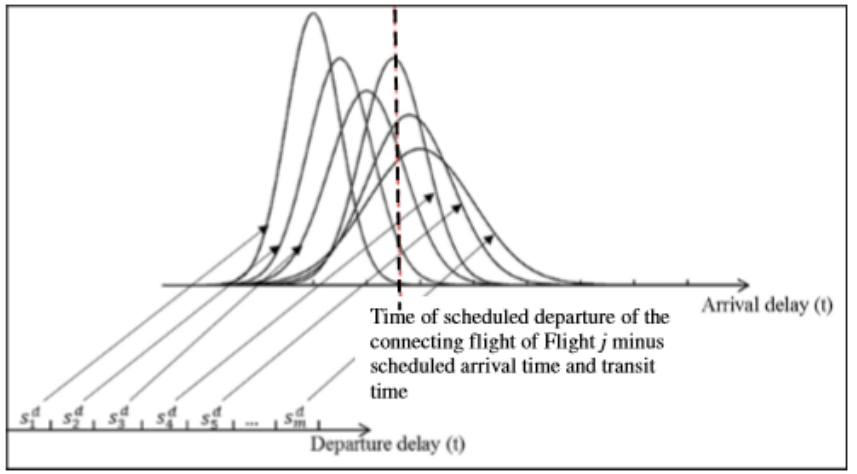
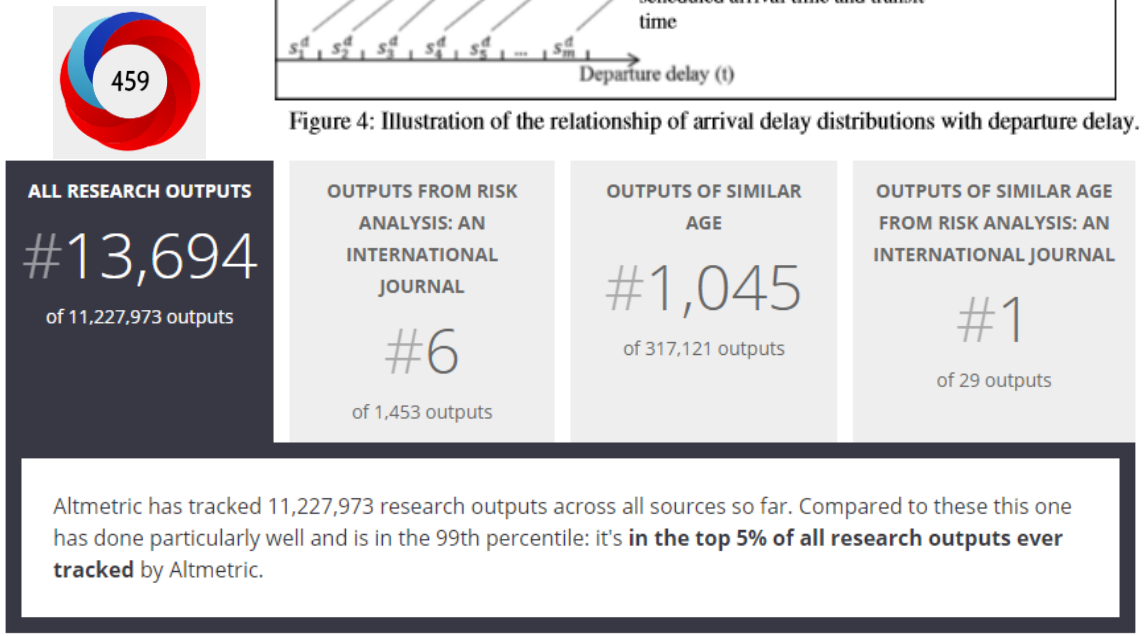


Figure 4: Illustration of the relationship of arrival delay distributions with departure delay.



Research Project – Fuel Consumption Estimation

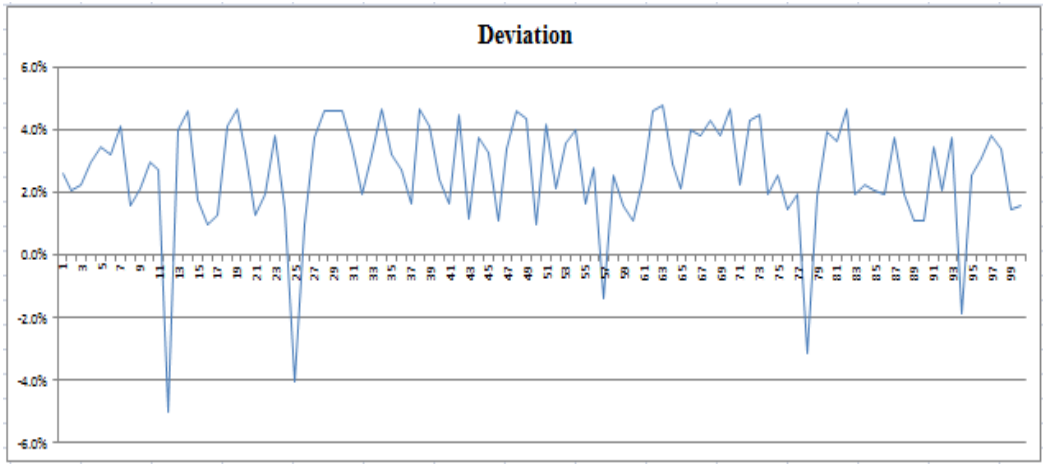
Company: CX

Fuel Estimation Problems:

- inaccurate fuel consumption estimation

Aims:

- minimize error deviation



Method:

- machine learning: new cascading neural network
- Estimated/actual fuel consumption, flight time, weather, wind, air pressure, load balancing, etc.

Preliminarily Results:

- Overall estimation error improved from 1.5% (CX) to 1.05% (ours).
- Indirectly, reduce fuel consumption

Research Project – Ground Operations Scheduling

Company: CASL

Allocation Problems:

- how to plan for the allocation of GSS equipment to flights
- flight arrival time are usually uncertainty

Aims:

- minimize idling and service delay.

Method:

- machine learning
- Historical data: flight, servicing time of GSS, etc.

Benefits:

- increase responsiveness and accuracy

Research Project – Airport Automation

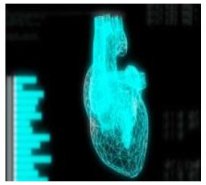
Application of Future Technologies

Automation
Self Bag drop
Autonomous driving mobile shop

Mobile
Mobile check-in,
Shopping,
Smart Parking

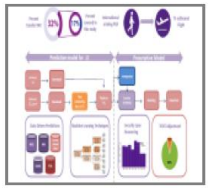
Artificial Intelligence
AI logistics innovation
Cleaning and guidance robots

AR/VR
AR/VR-based smart shopping, virtual fitting



Biometrics
ID validation with walking patterns and heart recognition
Security/Monitoring automation

Wireless communications/ High-functional sensors
Collecting information on passenger flow, trolley location control, IoT-based automatic terminal control



Big Data
Predictive airport operation
Customized customer relations/management

Imaging technology
Image-based airport check-in process,
Detecting criminals and missing children

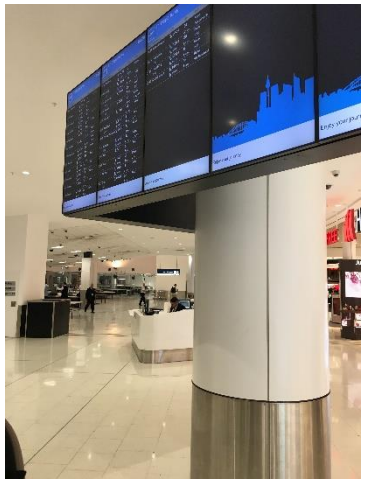
Future Airport Changes

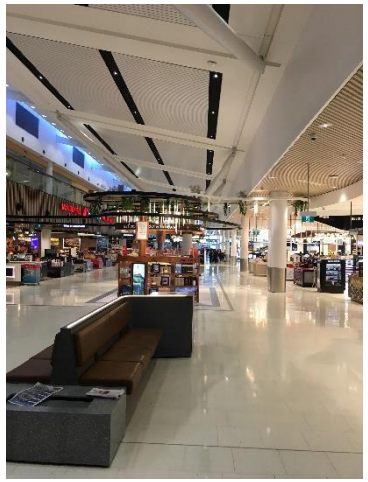
AS-IS	TO-BE
Loading baggage/cargo by workers	Automatic cargo/baggage loading system
Cleaning and delivery based on manpower	Automation with robots
ID check at the immigration desk/ departure gate	ID check upon building entrance
X-Ray reading by security officers	AI/Big data-based automatic reading system
Offline cash/card payment	Mobile payment-based mobile shops
One-way/Temporary cultural event	Digital experience service (VR)
Congestion concentrated on a specific time/place	Induced passenger flow at hours of congestion
CCTV check after an accident	Smart image search service

Implications

Needed to discover convergence services suitable for the airport environment and establish an optimal service model with distributed manpower and role division

Research Project – Smart Airport

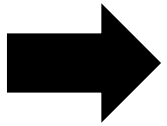




- Big data + behaviour + demand modelling.
- Valuation of infrastructures

Training Plan for the ATPL

	Year 1	Year 2	Year 3	Year 4
Semester 1	Normal study pattern (covers 1/5 ATPL training content)			
Semester 2				
Summer semester			ATPL training	ATPL training



PolyU Engineering degree
&
Pilot Ground Theory

Training Plan for the LAE

	Year 1	Year 2	Year 3	Year 4
Semester 1	**Normal study pattern (covers 1/3 HKAR-66 training content)**			
Semester 2				
Summer semester		**HKAR-66 training**	**HKAR-66 training**	**HKAR-66 training**

PolyU Engineering degree
&
HKAR 66 Provisional License

Major issues

- For the maintenance LAE training, our graduates can get Hong Kong CAD HKAR66 Cat B1.1 license after 2 year work experience.

  They can apply for EASA license afterwards.

- But they are not allowed to work in mailand China

Need to take 2 extra modules (Law and Human Factors) in China to obtain the CAAC B1.1 license.

- We are now exploring on how to solve this issue

- Our graduates will be treasured by MRO in China as they are trained in English environment with international exposure.

Boeing

HAECO

HAESL

PolyU

What we deliver…

To conclude

PolyU is working closely with the aviation industry in providing :

human resources capital and

research and technology development

We need your advice and support to make this more successful

Thank you