1st International Conference on Aviation Future: Challenge and Solution on 27-28 May 2021

RMIT UNIVERSITY

RMIT University and the advent of Digital Technologies in Aerospace and Aviation – Education's Role in the Post-COVID Recovery Endeavour in Vietnam Context

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Aerospace Engineering and Aviation, RMIT University, Melbourne Australia

By the numbers

Largest dual sector University in Australia

- 90,000 students, including 12,000 at postgraduate level – 2,500 higher degree by research students
- ~16,000 international students studying offshore

- Postgraduate research
- Postgraduate coursework
- Undergraduate
- Vocational and training
- Online (Open Universities Australia)
- Foundation Studies

40% international students

22% studying in Australia

18% studying outside Australia

International students at Melbourne campuses: ~20,000

Global reach

Three campuses in Melbourne

- City, Brunswick and Bundoora

Two campuses and a language centre in Vietnam

- **Hanoi, Ho Chi Minh City and Danang**

A hub in **Barcelona, Spain** focused on research and industry collaboration as well as the development of global experience opportunities in Europe for RMIT students

6,500+ students at **RMIT Vietnam**

6,400+ RMIT students at **Singapore Institute of Management**

A further **3000+** students through seven partners in **Singapore, mainland China, Hong Kong, Indonesia and Sri Lanka**

PhDs delivered in partnership with 14+ organisations in **Germany, Austria, China, The Netherlands, Italy, India, Spain, France and Vietnam**

RMIT UNIVERSITY

Reputation - Rankings

- **5-Star university (QS Stars international evaluation system)**
- 15th highest ranked in Australia, 238th in the world[1]
- 117th in the world for employer reputation[1]
- 85th in the world for graduate employability
- Top 51-100 for Electrical and Electronic Engineering (8th in Australia)[2]
- Top 51-100 for Civil and Infrastructure Engineering (9th in Australia)[2]
- Top 151-200 for Chemical Engineering (9th in Australia)[2]
- Top 100-150 for Mechanical, Aerospace and Manufacturing Engineering (7th in Australia)[2]
- Ranked 1st for Sustainable Development Goals: Reduced Inequalities[3]

[1] 2020 QS World University Rankings
[2] 2020 QS World University Rankings by Subject
[3] 2020 THE Impact Rankins 2020

School of Engineering

- 650+ Higher Degree by Research students and 330 academic staff
- $30 million annual research income

- **Excellence in Research Australia 2018**
- **Well above world average – highest rank of 5**
  - Electrical and Electronic Engineering
  - Environmental Engineering
  - Manufacturing Engineering
  - Aerospace Engineering
  - Materials Engineering
- **Above World average – rank of 4**
  - Civil Engineering
  - Mechanical Engineering

RMIT UNIVERSITY

AE A Vision & Mission

At the forefront of Aerospace Eng'n & Aviation Research and Education

Leader in Australia

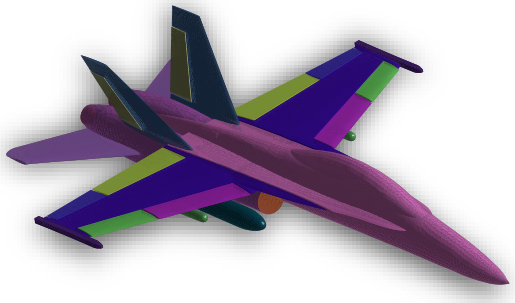
Foster a diverse and inclusive community of world-class students, educators, and researchers which mission is to develop enabling A&A technologies for next generation air transportation systems

ERA EXCELLENCE IN RESEARCH FOR AUSTRALIA — EI ENGAGEMENT AND IMPACT

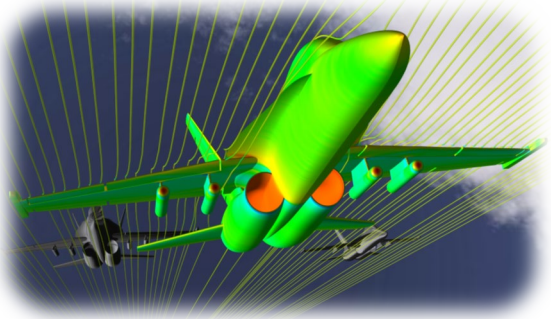
ERA 5 "well above world standard"

Outstanding Leadership in Research and Training Award

AVIATION/AEROSPACE AUSTRALIA Innovation. Partnerships. Diversity.



Modelling



Simulation

Experiments

Forces shaping the Industrial Internet

Internet of Things

A living network of machines data and people

Intelligent Machines

Increasing sys. intelligence through embedded software

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Big Data

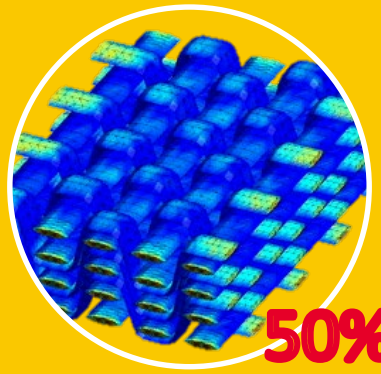
Transforming massive volumes of information into intelligence

Analytics

Generating data-driven insights and enhancing asset performance

RMIT UNIVERSITY

RMIT way: Blending Learning & Teaching with Research & Innovation



50%

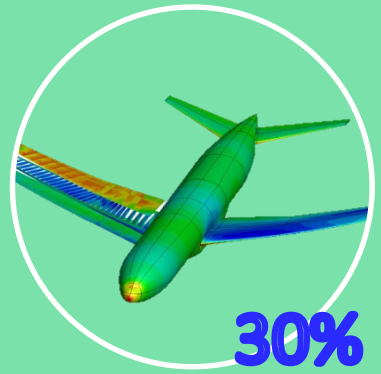
Aerospace Materials and Multifunctional Composite Structures

- Through-life support of ageing airframes and life cycle cost
- Integrity assessment and airworthiness
- Damage tolerance, progression and failure
- Structural health monitoring technologies
- Smart materials and structures, energy storage and harvesting

10%

Unmanned Aircraft Systems Design and Field Operations

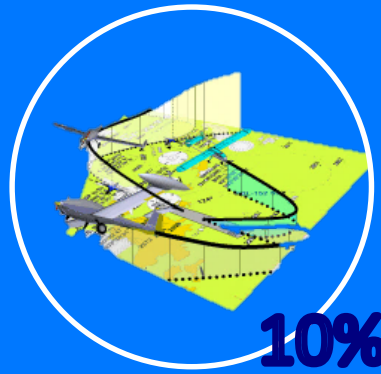
- Architecture and system design autonomy
- Flight operations and airworthiness
- New generation from bio-inspired and MAV to high-altitude long endurance UAS
- UAS integration, sense and avoid
- Safety and regulations



30%

Aerodynamic Loading and Multidisciplinary Design & Optimization

- Fluid-structure interaction
- Aeroservoelasticity and dynamic load predictions
- Advanced solutions to enhance air-platforms performance
- System identification, diagnostics and prognostics, digital twin technologies
- Hypersonics vehicles and technologies



10%

Avionics, Air Traffic Management, Mission Systems and Aviation Ops

- Future ATM and avionics systems (CNS+A)
- Civil, military and sustainable aviation mission systems
- Human-Machine Interface and Interactions
- Sensors, multi sensor systems and data fusion
- Air Logistics and Aviation Economics

AEA Learning and Teaching Programs

Aerospace engineering programs

Undergraduate

- Bachelor of Engineering (Aerospace Engineering) (Honours)
- Bachelor of Engineering (Aerospace Engineering) (Honours) / Bachelor of Business (Management)

Postgraduate (coursework)

- Master of Engineering (Aerospace)
- Master of Engineering (Airworthiness)

Research

- Master of Engineering (Aerospace Engineering)
- PhD (Aerospace Engineering)

Aviation programs

Undergraduate

- Bachelor of Applied Science (Aviation)
  - Management/Operation
  - Pilot
- Bachelor of Applied Science (Aviation) / Bachelor of Business (Management)
- Hong Kong, Singapore, China

Postgraduate (coursework)

- Master of Science (Aviation)
- Grad Certificate Transport Safety Investigation

NEW **New Bachelor Applied Science (Aviation) in Vietnam (Trim 3 2020)**

RMIT UNIVERSITY

Deliver a remarkable, contemporary, relevant learning experience

AEA High impact, translational research

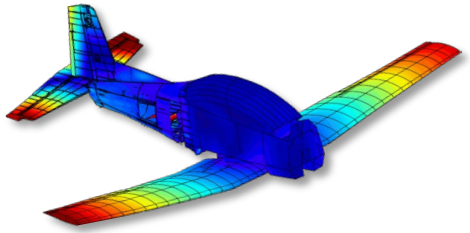
- Defence Science and Technology Group (Aerospace, Maritime, Land Divisions)
  - Aircraft performance & survivability, Aerospace systems effectiveness, Aircraft health & sustainment, Aircraft structures, Maritime autonomy, Maritime platform performance
- Defence Materials Technology Centre (DMTC)
- Defence CRC – Trusted Autonomy Systems
- Three Federally funded DefendTex led CRC-Ps:
  - Hypersonics, Rapid Access to Space and Energetics
- US Office of Naval Research and NRL
- DASA, CASG, CASA, ATSB, etc
- iMOVE CRC, RAIL CRC, Food Agility CRC, SmartSat CRC

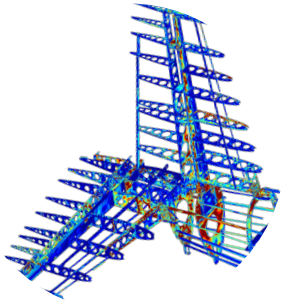
- Boeing Aerostructures Australia partnerships
- Ford Motor Company lead ARC-ITTH ATLAS
- Thales collaborative projects in ATM and Hybrid Composites
- Northrop Grumman partnership in Cognitive HMI
- Lockheed Martin, Elbit Systems, Textron Systems, RAUG Aviation
- RMIT Incubator developing UAS technologies

Embed industry in our way of working

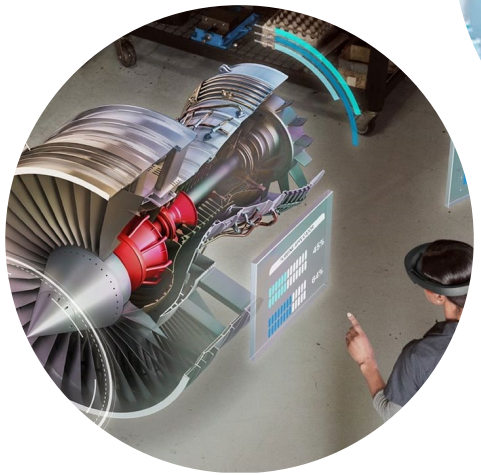
Digital Technologies in Aviation and Aerospace

Data-Driven Digital-Twin Platform for Airframe Diagnostics and Prognostics and Flight Simulation





R&D and L&T – Digital Transformation in Research and Education

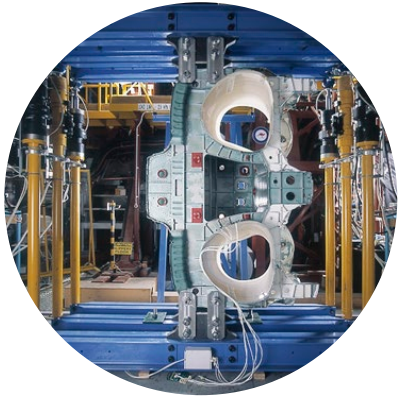


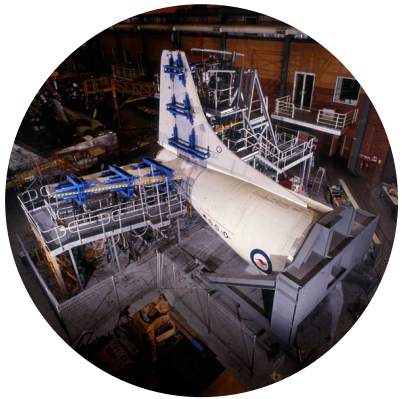
VR/AR/MR Solutions

IoT / Industry 4.0

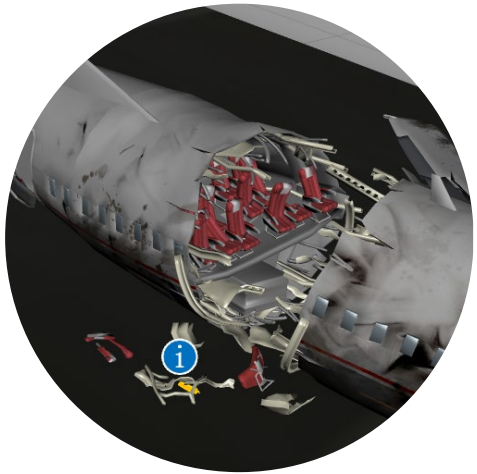
Haptic Gloves

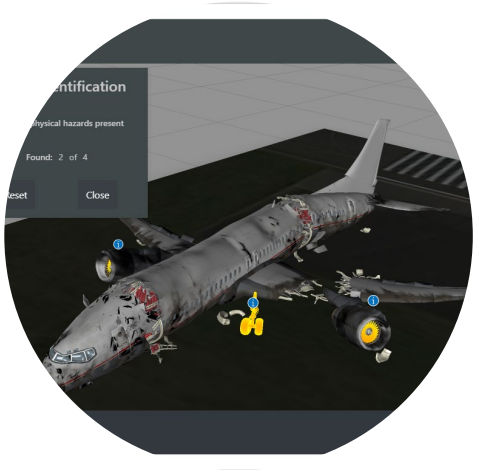
DST / RMIT Materials and Structures Partnership



Cyber-Physical Crash Lab





Physical Crash Lab

Virtual Crash Lab to simulate hands on experience in applying investigative techniques and to facilitate online learning.

Under development with ATSB

Cyber-Physical Simulation at RMIT

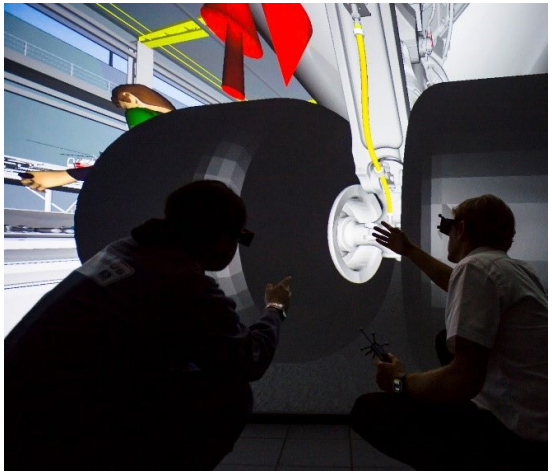
Human Factor Engineering and Simulation

Human-Machine Interactions

Air Traffic Control and Management Simulation

Digital Technologies and Role-playing game (RPG) on Airport Ops and Management

Airport Ops Simulator at VTC SHAPE



VR Lab at VTC SHAPE

Flight Simulation

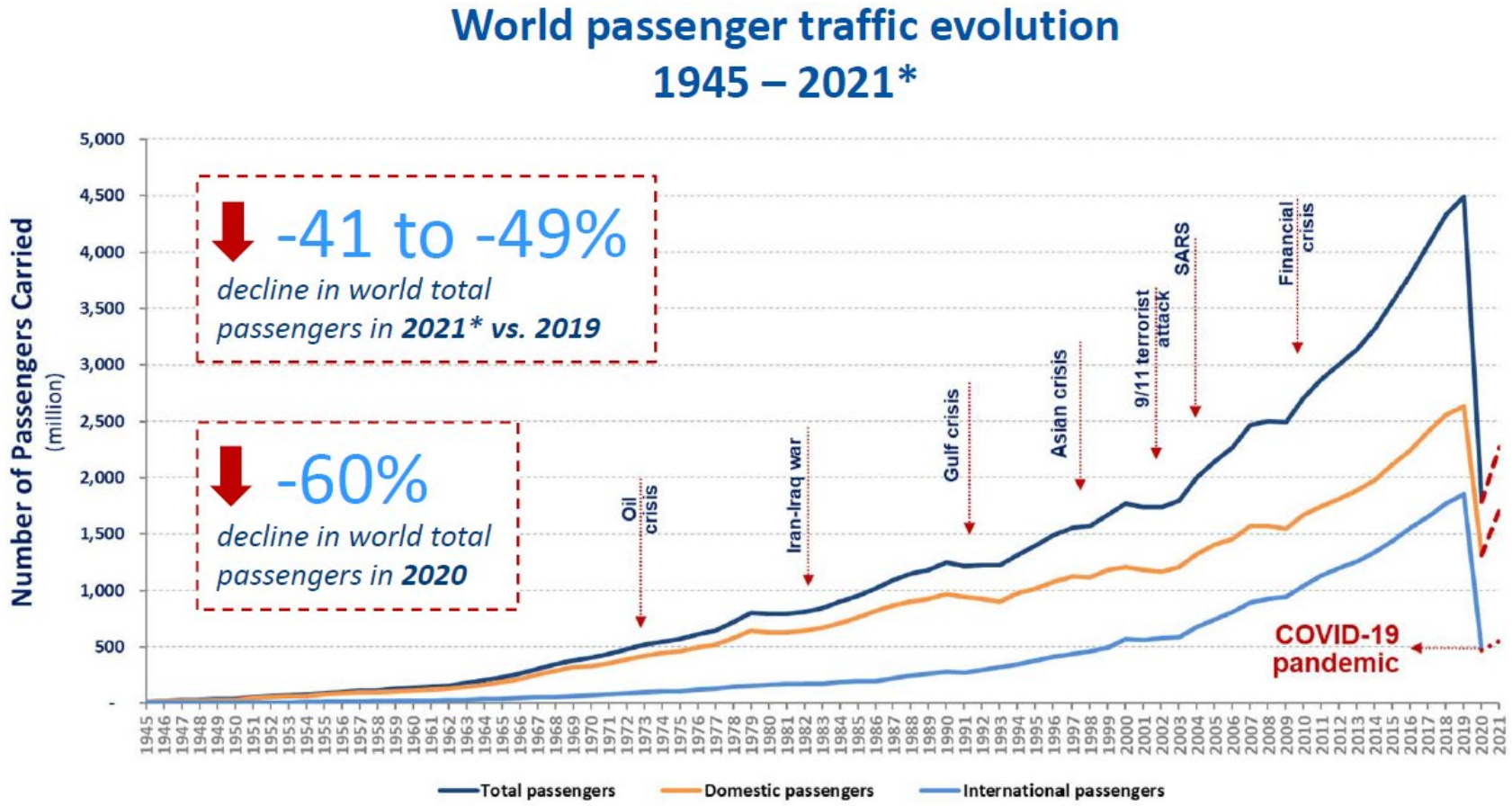
COVID and aviation

What's next...

Impacts of COVID-19 across industries

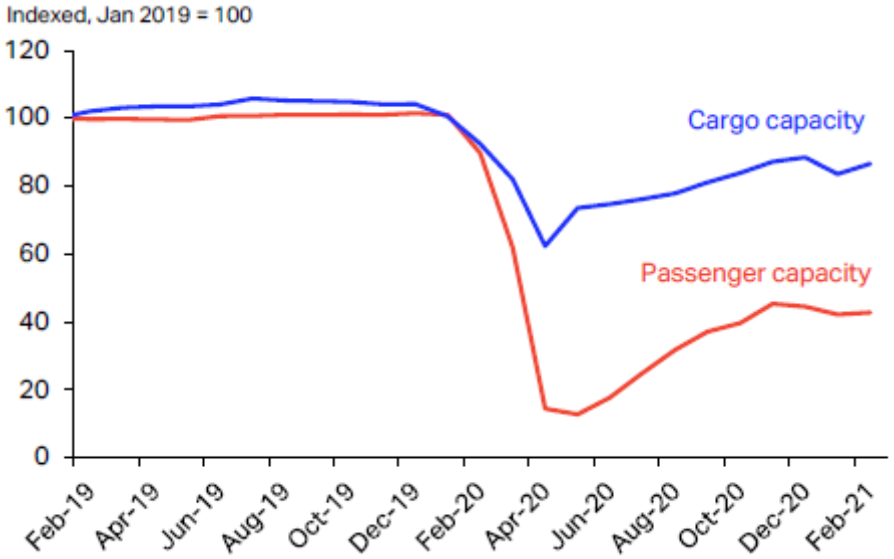
Source: ICAO, 2021

World passenger traffic evolution, 1945-2021



Source: ICAO, 2021

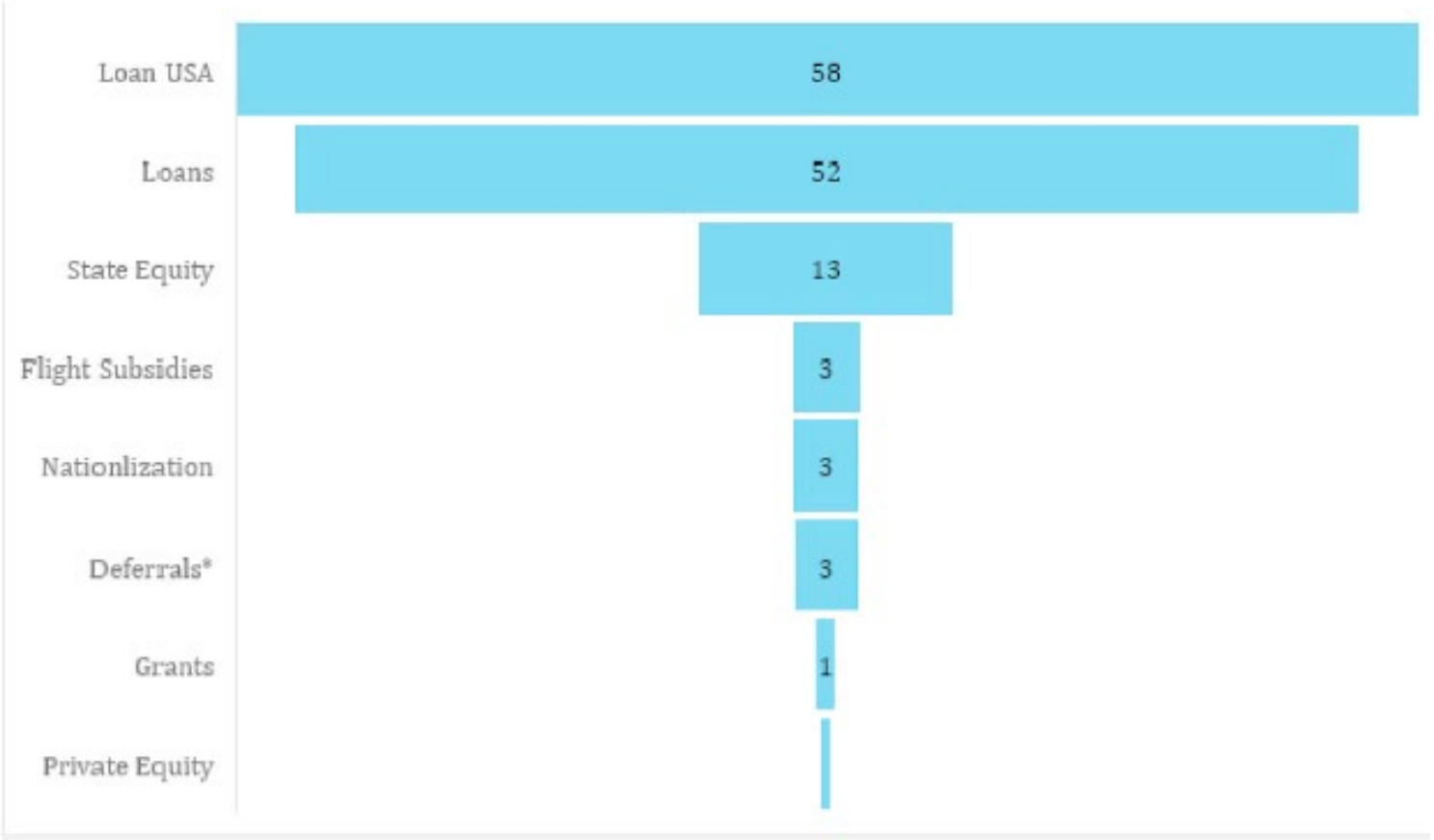
Surge in cargo flights since March 2020



Source: IATA, 2021

7 types of government support to airlines during COVID

(in billion USD), (a total of US$159 billion) by 57 countries



Source: Abate et at, 2020

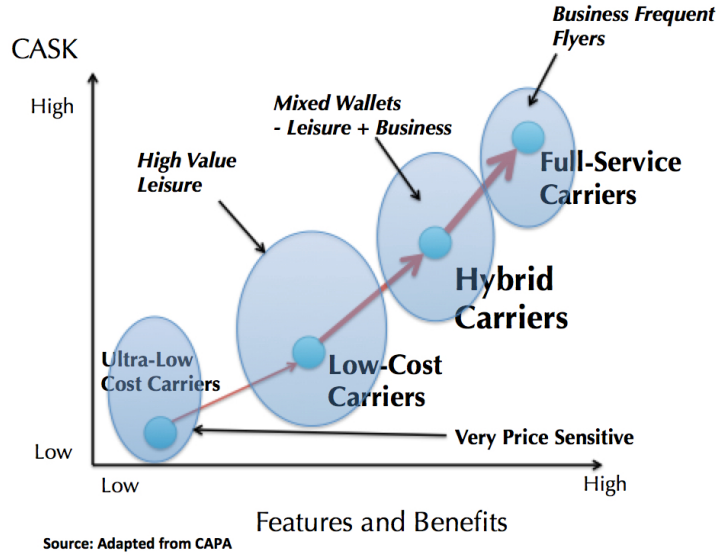
Prospective Changes in aviation post COVID

What's next...

Airline industry structural changes

- Airline restructuring and consolidation
- Airline fleet restructuring:
  - B787 to replace A380

- Airline business models:
  - focus on cost reduction



Changes in consumer behaviour

Continued use of virtual meeting technology: reducing business travel demand

Perplex confidence in air travel:

Some positive results, strong desire for air travel

Some negative results: reluctant, less confidence, concern of the spread throughout the flight journey

Source: Various sources

What travellers need post COVID?

Personal space: comfort and social distancing

Timely processing, NO queues

Cleanliness: hygiene

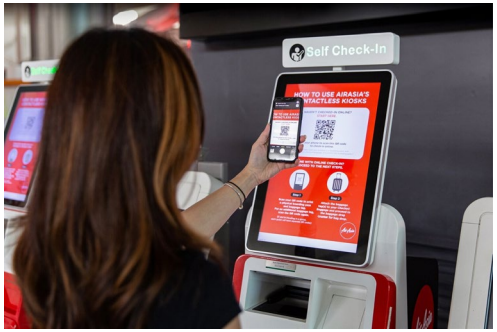
Current self-service is still physical touch.

- Is technology the solution?

Source: Delloite, 2020

Airport efficiency and travellers' experience

- Touchless operation, to minimise the risk of spreading disease



- Airport employee health and safety concerns

Travellers' desire for a smooth journey,

- Minimize screening hassles
- less time to spend at airport: challenges for airport's non-aeronautical revenues

Source: Various sources

Environmental impacts

- Continue to focus on carbon-neutral commitments
- Short term improvement, due to early retirements of older aircraft
- Challenging to justify airport expansion with reduced demand

Source: Mott MacDonald, 2020

Technology to revolutionise the industry

- new technology application to aircraft design and operation:
  - Artificial Intelligence
  - Blockchain
  - Biometrics

- New mode of transportation: Urban air mobility as a service

Aviation in Vietnam

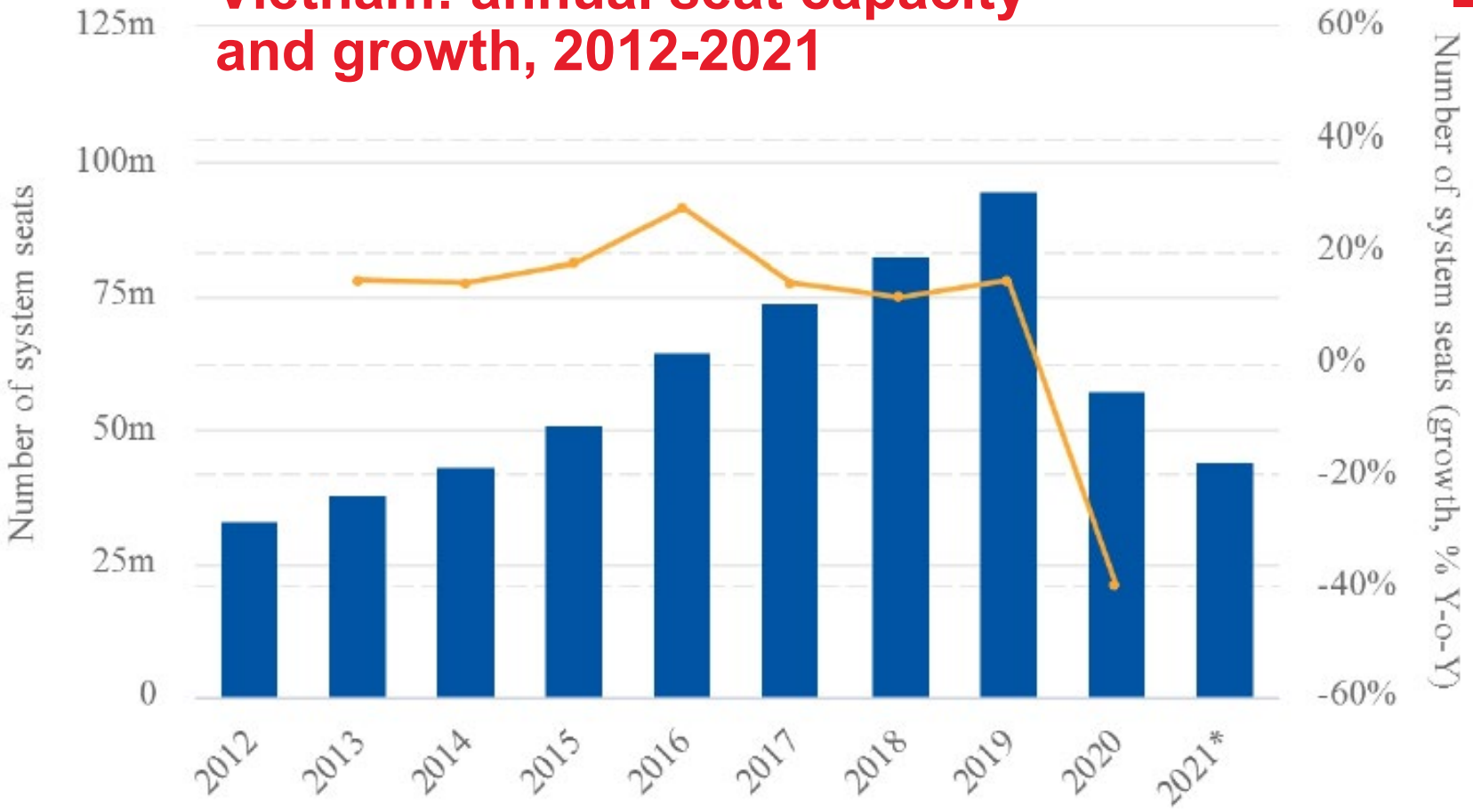
What's next...

Overview of aviation in Vietnam: the world's seventh fastest-growing aviation market

- 71 airlines, among them, 6 Vietnamese carriers
- 11 international airports, and 11 domestic airports
- 116 millions passengers carried in 2019
- 1.5 million tonnes of cargo carried
- 740,000 aircraft movements in 2019
- 72 international destinations served
- Supporting 2.2 million jobs
- Contributing to USD12.5 billion to GDP
- 5.2 % of GDP

Source: IATA, 2018, CAAV,

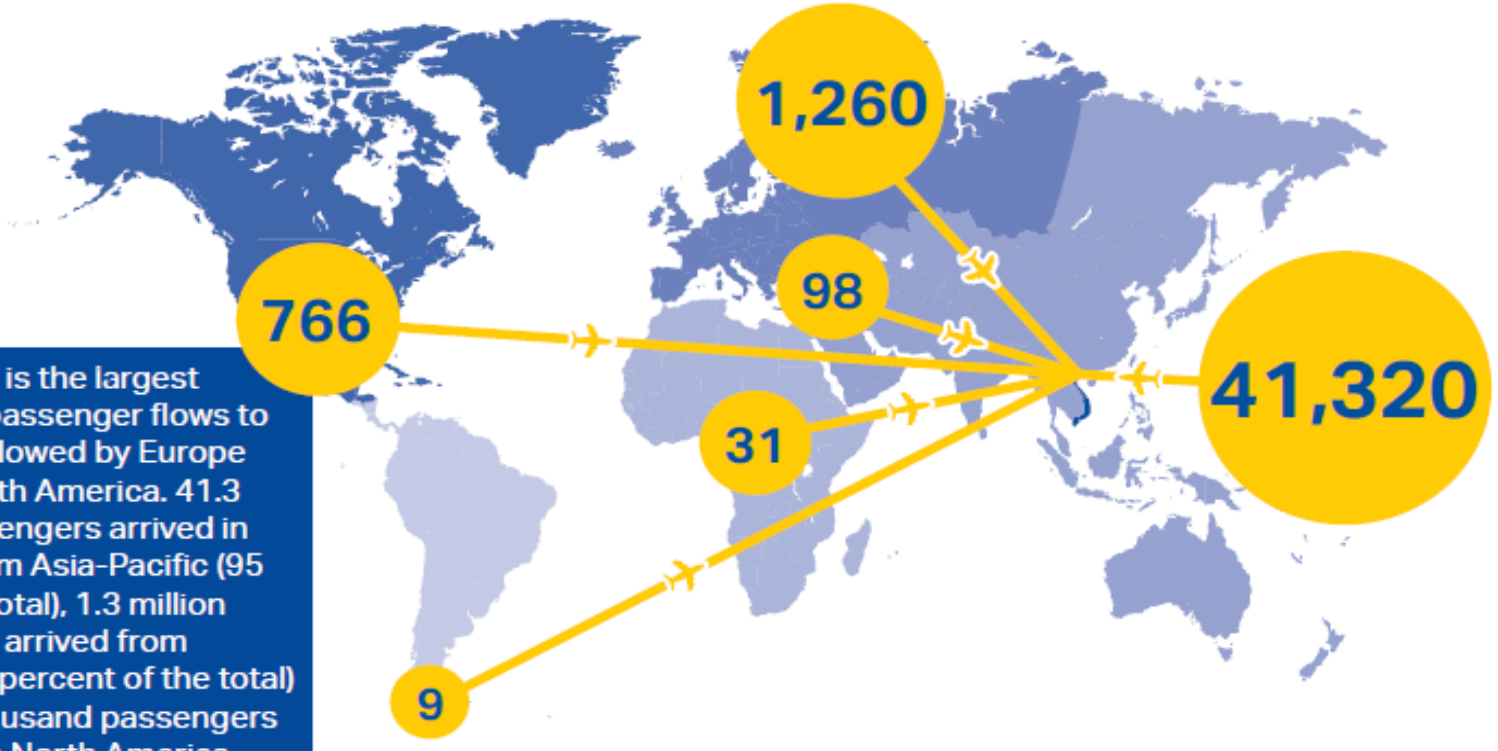
Vietnam: annual seat capacity and growth, 2012-2021



Source: CAPA, 2021

Vietnam market, international arrivals to Vietnam

Annual passenger flows by region (origin-destination, '000s)



Asia-Pacific is the largest market for passenger flows to Vietnam, followed by Europe and the North America. 41.3 million passengers arrived in Vietnam from Asia-Pacific (95 percent of total), 1.3 million passengers arrived from Europe (2.9 percent of the total) and 766 thousand passengers arrived from North America (1.8 percent).

Air trade facilitation index (ATFI) and eFreight Friendliness Index (EFFI)

Measures of air cargo trade facilitation

Vietnam's facilitation of air cargo through its regulations ranks 73rd out of 124 countries in terms of the Air Trade Facilitation Index (ATFI) and 67th out of 135 countries in terms of the eFreight Friendliness Index (EFFI) globally [8].

Passenger facilitation and visa openness

Vietnam's passenger facilitation (3/10) scores below the average of Asia-Pacific (4.4/10). On the World Economic Forum's Travel & Tourism Competitiveness Index, the country ranks 53rd out of 140 countries for visa openness. In all these scores, higher is better.

Air Trade Facilitation Index (ATFI) score
6.6/10

Passenger Facilitation Score [6]
3/10

eFreight Friendliness Index (EFFI)
1.5/10

Visa Requirements score [7]
4.1/10

Source: IATA, 2019

Where Vietnam stands according to the Bloomberg resilience score

to show how a country/economy handles the COVID most effectively, with the least social and economic disruptions—from mortality and testing rates to vaccine access and freedom of movement.

COVID STATUS

QUALITY OF LIFE

RANK	CHANGE	ECONOMY	BLOOMBERG RESILIENCE SCORE	1-MONTH CASES PER 100,000	1-MONTH FATALITY RATE	TOTAL DEATHS PER 1 MILLION	POSITIVE TEST RATE	PEOPLE COVERED BY VACCINES
1	▲1	Singapore	79.7	12	0%	5	0.1%	19.4%
2	▼1	New Zealand	79.6	3	0%	5	0%	1.9%
3	–	Australia	76.2	2	0.2%	36	0.1%	3.7%
4	▲1	Israel	74.9	82	2.6%	734	0.4%	57.4%
5	▼1	Taiwan	74.7	0	2.4%	1	0.4%	0.1%
6	–	South Korea	72.7	35	0.5%	35	1.8%	2.2%
7	▲1	Japan	70.9	80	0.9%	78	6.2%	1%
8	▲3	U.A.E.	69.7	610	0.2%	159	0.8%	47.4%
9	▲4	Finland	68.9	205	0.8%	163	1.8%	14.8%
10	▲2	Hong Kong	68.2	4	1.7%	28	0.1%	8.3%
11	▲4	Vietnam	67.2	0	0%	0	0.1%	0.1%
12	▼5	China	67	0	0%	3	0.1%	7.7%
13	▼4	Thailand	66.7	35	0.2%	2	0.7%	0.8%
14	–	Denmark	66.6	330	0.4%	427	0.4%	15.1%
15	▼5	Norway	66.6	359	0.4%	136	2.8%	14%
16	▲1	Saudi Arabia	66.6	70	1%	198	1.7%	11.8%
17	▲4	U.S.	65.3	595	1.3%	1,728	6.8%	35.2%
18	▲7	U.K.	64.3	126	1.1%	1,881	0.2%	34.1%
19	▼3	Canada	62.5	592	0.5%	634	6.6%	15.4%
20	▼2	Malaysia	62.4	161	0.3%	44	3.7%	2%

Source: Bloomberg.com

Recovery

- Vietnam government provided US$520 million worth of support to Vietnam Airline's rescue plan
- The state Bank of Vietnam refinanced Vietnam Airline's credit and extend its deadline
- The airline issued US$346 million in shares for existing stakeholders to boost its recovery
- Projected return to profit in 2023

Source: various sources

Education’s role in the recovery endeavour

What's next...

RMIT UNIVERSITY

Many factors will contribute to the recovery:

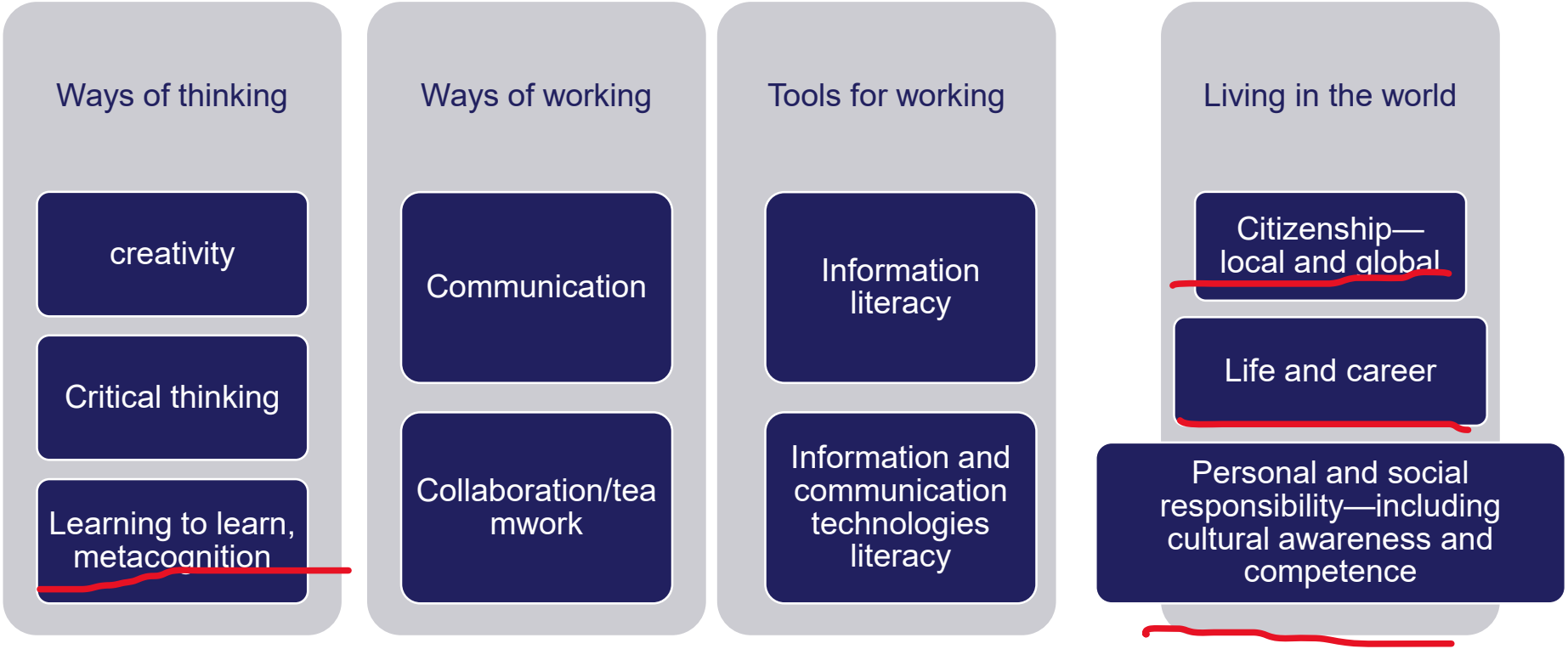
Universities and other training organisations should play a more strategic role to upskill the workforce

The future jobs are unknown!

- 85% of the jobs in 2030 that Generation Z and Alpha will enter into have not been invented yet (Dell Technologies report)
- 65% of primary-school children today will be working in job types that do not exist yet (World Economic Forum report)

But the key skills are essential: 4 groupings of skillset

(source: Griffin et al, 2012)



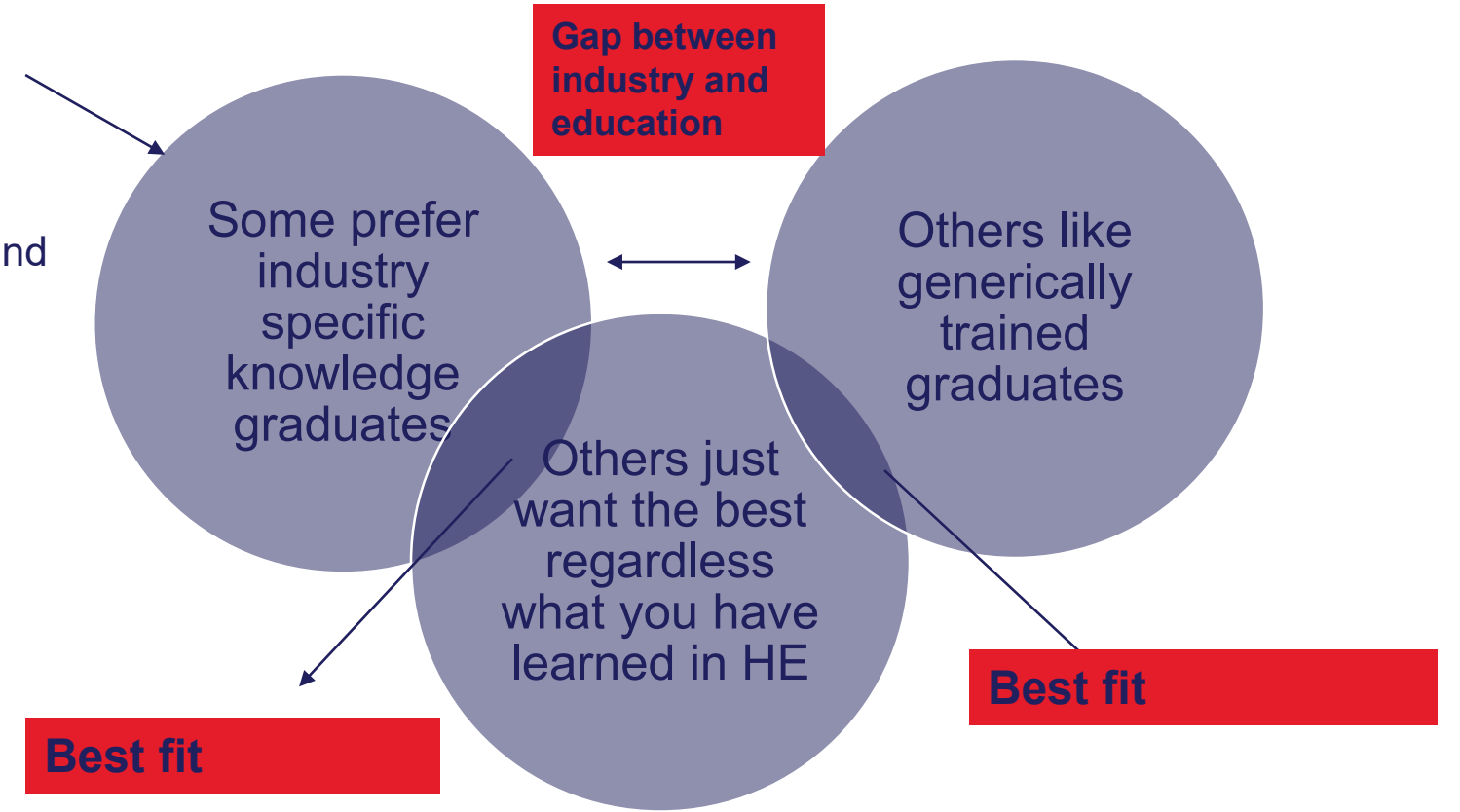
Underlined in red: skill set is missing in current education system (Source: Lappas and Kourousis, 2016)

Somewhat mismatch of skillset and knowledge

(source: Peksatici and Ergun, 2019)

Can be broad:

- Safety and security
- Scheduling and forecasting
- Flight and airport operation
- Data driven



RMIT has embarked on a journey to transform our (aviation) program

What's next...

RMIT UNIVERSITY

AEA Learning and Teaching Programs

Aerospace engineering programs

Undergraduate

- Bachelor of Engineering (Aerospace Engineering) (Honours)
- Bachelor of Engineering (Aerospace Engineering) (Honours) / Bachelor of Business (Management)

Postgraduate (coursework)

- Master of Engineering (Aerospace)
- Master of Engineering (Airworthiness)

Research

- Master of Engineering (Aerospace Engineering)
- PhD (Aerospace Engineering)

Aviation programs

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  - Pilot
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- Grad Certificate Transport Safety Investigation

NEW **New Bachelor Applied Science (Aviation) in Vietnam (Trim 3 2020)**

Deliver a remarkable, contemporary, relevant learning experience

RMIT Vision

We exist to prepare our students for workplaces that are rapidly evolving and we play a part in shaping a changing world.

---Prof Martin Bean, RMIT Vice Chancellor and president

Thank you

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Associate Prof Chrystal Zhang,
chrystal.zhang@rmit.edu.au