

FACTSHEET ON THE AIR TRANSPORT INDUSTRY TRANSFORMATION MAP

The Air Transport Industry Transformation Map (ITM) provides a roadmap for the future of Singapore aviation through: 1) Innovation, 2) Productivity, 3) Jobs and Skills, and 4) Enterprise. Under each thrust are strategies that will allow us to achieve our vision of growing our value-add per worker, improving the quality of jobs, and increasing our productivity.

The Air Transport ITM was developed by the Air Transport Industry Tripartite Committee (ITC), comprising 16 key representatives¹ from industry, unions and government.

The ITC formulates and drives the overall strategy to improve productivity and develop manpower in the air transport sector. In this regard, the ITC will also oversee the implementation of initiatives under the ITM.

Thrust 1: Innovation


An important objective of the ITM is to encourage businesses to pioneer more novel solutions and stay in the lead. To do this, we will set up test beds and support companies to experiment with using new technology and processes to solve the pressing issues facing aviation today. We want to tap on the expertise of aviation companies, as well as research institutions from outside the sector.

Strategy 1.1: Pioneer novel solutions

Example 1.1.1: Automated Passenger Loading Bridge (PLB) [New]

To enhance safety and alleviate manpower constraints for docking operations, ST Dynamics, the advanced engineering centre of ST Engineering, is developing an automated docking system. This new system will use precision lasers and cameras, with smart algorithms, to guide the docking process safely and autonomously. This is the first-in-the-world automated docking system designed for robust operations

¹ The ITC members are from the Civil Aviation Authority of Singapore, the Ministry of Transport, the Ministry of Manpower, Workforce Singapore, the National Trades Union Congress, Aviation and Aerospace Cluster Unions, Changi Airport Group, Singapore Airlines, SilkAir, Budget Aviation Holdings, Jetstar Asia, Singapore Airlines Cargo, SIA Engineering Company, SATS, and dnata.



under harsh weather conditions like heavy rain. ST will be testing out this technology on the aerobridges this year. If successful, we can extend the same technology to other airport equipment, like catering trucks, paving the way towards a seamless, efficient and autonomous apron.

Example 1.1.2: Aviation Challenges

The Aviation Challenges were launched to automate manpower-intensive processes, for which no commercial solutions exist today.

The Aviation Challenge 1 aims to automate the narrow-body aircraft baggage handling process, while the Aviation Challenge 2 aims to automate the build-up and breakdown of cargo pallets and containers. The automation of the labour-intensive processes aims to reduce the physical strain on workers.

Currently, seven teams are developing prototype systems to transform baggage and cargo handling.

This year will see the completion of prototypes by the teams. Some exciting solutions are in the works, such as automatic baggage scanning stations, robotic arms, exoskeleton suits to support baggage lifting, and automated conveyor belt systems. Some of these proposed solutions can be further developed and prepared for implementation, commercialisation and even export.

Example 1.1.3: SATS Technology Group

SATS Technology Group was set up in Aug 2014 to embed innovation into the organisation to transform the business. Working collaboratively with the various business units on their transformation initiatives, the technology team at SATS enables greater efficiency, smart planning, and the development of innovative products and services to fulfil the purpose of SATS to Feed and Connect Asia.

Example 1.1.4: CAG Living Lab Programme

To accelerate its innovation efforts, Changi Airport Group (CAG) launched a \$50-million Living Lab Programme in January 2017 – a platform to collaborate with innovation-driven companies and startups, to develop and demonstrate new technology solutions, in a live airport environment. To stay ahead of the challenges in an increasingly complex operating environment, CAG continues to invest in driving productivity and innovation at Changi Airport. Some of its recent projects include the Fast and Seamless Travel (FAST) initiative for automated self-service passenger processing and taxi queue analytics to provide passengers with better advice on ground transport options.

Example 1.1.5: SIAEC Innovation Group

In February 2016, SIA Engineering Company (SIAEC) announced investment of up to \$50M to develop new innovations and solutions to serve the future maintenance, repair and overhaul (MRO) needs of airline customers. To deliver these efforts, the SIAEC Innovation Group was established in April 2016. The Group will focus on projects in key areas of technologies including additive manufacturing, automation & robotics, data analytics and digitalisation, which will help to improve productivity and deliver new capabilities

Strategy 1.2: Leverage national research community

Example 1.2.1: Aviation Transformation Programme Office [New]

CAAS will be establishing an Aviation Transformation Programme Office to facilitate collaboration between the industry and the research community in developing innovative solutions to resolve challenges faced by the sector. Within the industry, CAG, SIAEC, and SATS have established their own innovation/technology offices to tap on technology to enhance processes and build new capabilities. The new office will synergise these existing efforts with companies, research institutes (RIs) and Institutes of Higher Learning (IHLs).

Strategy 1.3: Build core capabilities

Example 1.3.1: Smart Tower [New]

CAAS has issued an invitation to tender for the development and trial of a Smart Tower prototype for remote air traffic control operations. Through this project, CAAS aims to evaluate how state-of-the-art technology can transform air traffic control operations. The Smart Tower will provide a completely digitised real-time view of the aerodrome from state-of-the-art digital camera systems. This allows air traffic controllers access to advanced surveillance and information tools to manage live air traffic, which can augment operations.

Through the use of technology, a Smart Tower will transform the provision of air traffic control services and bring about the following benefits:

- i. **Enhanced Operational Efficiency**

A Smart Tower is capable of integrating two or more control tower operations into a single integrated facility, if necessary. This will enhance the coordination between multiple control towers, reduce the complexity of operations and improve safety.



ii. Increased Visibility

The use of night vision or infra-red technology increases visibility such as during hazy, low light or night conditions.

iii. Improved Line of Sight

The flexible and multiple camera placements will allow visual surveillance of aerodrome areas that may be located far away or blocked by buildings when viewed from a physical control tower.

iv. Enhanced Situational Awareness

The large monitors in a Smart Tower will enable the tagging and labelling of aircraft call signs and flight information for easy flight identification and greater situation awareness.

Example 1.3.2: Space-based VHF Technology [New]

VHF communications is also an important component in Air Traffic Management. Today, ground-based VHF does not comprehensively cover the whole Singapore Flight Information Region (FIR), due to geographical limitations. Therefore, controllers have to resort to HF, the availability of which is subject to atmospheric conditions and susceptible to interference.

Space-based VHF is a concept where VHF equipment is mounted onto low-earth-orbit satellites. With space-based VHF, we will be able to overcome geographical limitations and use VHF to communicate with aircraft anywhere in the FIR.

We are exploring the possibility of implementing space-based VHF, which is currently unavailable, with potential partners.

Thrust 2: Productivity

With the industry facing manpower and resource constraints, the ITM will drive higher productivity by accelerating the use of technology, redesigning work processes, and encouraging new ways of doing business. With higher productivity, we will be able to do more with less, allowing us to overcome our constraints to achieve better outcomes.

Strategy 2.1: Accelerate use of technology

Example 2.1.1: Autonomous Guided Vehicles/Autonomous Vehicles (AGV/AVs)

SATS has successfully completed AGV trials at its inflight catering centre to transport food items between food stores and meal tray assembly lines. Previously, staff working on the assembly lines had to make multiple trips to the chiller store for replenishments. Now, the same staff can call for supplies to be delivered by AGVs. This reduces preparation time by almost 40%.

Airport companies are now exploring the use of AGV/AVs in other airport processes, both within the terminals and on the apron. If successful, we can free up workers from routine driving to focus on other tasks, such as ensuring timely and accurate preparations for aircraft departure and managing these unmanned vehicles.

Example 2.1.2: One-Man Pushback Operations [New]

SIAEC has deployed a one-man remote-controlled aircraft pushback air tug, to enable a pushback operation by a single person on narrow body aircraft, instead of the current requirement of two. SIAEC has successfully implemented two units of the equipment so far, and is developing plans for scaling up the implementation.

Strategy 2.2: Redesign work processes


Example 2.2.1: Fast and Seamless Travel (FAST)

With the implementation of FAST at Changi, self-service processes are offered at key passenger touch points. Automated check-in and bag drop facilities can already be found at Terminals 1, 2 and 3, and a full suite of automated options with biometric integration for check-in, bag-drop, immigration clearance and boarding will be deployed at Terminal 4. This will greatly reduce the need for manual processing.

Increased adoption of FAST will transform the job scope of Passenger Service agents. While PSAs traditionally undertook repetitive mundane administrative processes behind the counter, automation will enable PSAs to handle more complex service requests with greater autonomy to interact with passengers. After some PSAs was reappointed as FAST Ambassadors, they reported higher job satisfaction.

Example 2.2.2: dnata GPS Fleet Management System [New]

dnata Singapore will be embarking on an initiative to further enhance the overall management and reliability of its ground support equipment (GSE) at Changi Airport.



GPS Fleet Management System (GFMS) is an integrated GSE monitoring system employing Global Positioning System (GPS), WiFi/3G interface with programmed control modules to provide real-time equipment monitoring and operators' driving behaviour analytics. The data will be transmitted to the dnata operations command centre through a local wireless Global System Mobile (GSM) network and the smart apron WiFi network. These data will further assist dnata's fleet controllers to track and monitor the GSE deployment effectively, provide GSE performance parameters for advanced preventive maintenance planning, and help verify that equipment operators' individual performance information are in compliance with the company's training policy.

The implementation of the GFMS will help improve the overall operational performance and efficiency of dnata's operations. In addition, it will also help improve the overall cost management and reliability of the entire GSE fleet, leading to safe and reliable operations here in Changi.

Strategy 2.3: Encourage new way of doing business

Example 2.3.1: 3D Printed Cabin Parts [New]

3D printing will transform aircraft maintenance. 3D printing saves on time needed for parts to be transported, as well as storage space for spares. It allows quicker turnaround of aircraft servicing and lowers logistics cost.

SIAEC is the first MRO to obtain CAAS's approval for design and production of Additive Manufactured (AM) cabin interior parts. This new capability offers an opportunity to provide 3D printed cabin parts for installation on airlines. In January 2017, SIAEC installed the first batch of 3D printed parts onto an A380 aircraft.

Example 2.3.2: Max Airport Programme for PSAs [New]

Under Jetstar Asia's upcoming Max Airport programme which offers a suite of customer-centric initiatives, frontline Passenger Service Agents (PSAs) will be equipped with tablets and portable printers to assist passengers in their check-in processes and any payment needs. This would allow faster transactions, and a hassle-free check-in experience, especially during busy periods.

Example 2.3.3: Centralised Dishwashing for Changi Airport [New]

A centralised dishwashing facility is currently being built at Terminal 3, to serve Terminals 1 to 4, as well as Jewel. When this is up and running, food and beverage (F&B) businesses would not need to heavily rely on dishwashing manpower to handle their dishwashing needs. A typical restaurant at Changi currently hires at least two staff just for dishwashing. The new facility will have capacity to provide dishwashing services to over 150 businesses.



Thrust 3: Jobs & Skills

For us to keep pace with aviation growth, we must not only build capacity and technology, but also improve jobs and deepen skills. Due to the strong growth of the sector, even with high productivity gains, we will still need to expand our workforce. We take a comprehensive approach to manpower development, offering opportunities for all.

Strategy 3.1: Share productivity gains

Example 3.1.1: eCommerce AirHub

The SATS eCommerce AirHub allows SATS to handle over 1,800 mail bags per hour through intelligent processing capabilities for scanning and data processing of mail bags. This project has resulted not only in a 30% improvement in productivity but also the creation of higher level jobs.

An “e-Hub Specialist” role has been created. Equipped with these intelligent processing capabilities to process mail bags more efficiently, as well as assisted loading devices to assist in the lifting of mail bags, e-Hub Specialists benefit from a broader job role, less strenuous work and higher pay (5-10% increase).

Example 3.1.2: Smart Watch and Bluetooth Bone Conductor Headsets

SATS has integrated Internet of Things (IoT) technology into daily ramp operations in the form of Smart Watches and Bluetooth bone conductor headsets.

These technologies allow ramp staff to receive real-time operational information, enabling them to make better decisions and respond faster to operational changes. The deployment of these technologies has cut down the time needed to service flights by 10% so far.

The smart watches are paired with bone-conductor headsets via Bluetooth, allowing ramp staff to also benefit from hands-free operations, as they can receive operational information and communicate with colleagues through the smart wearables. This allows them to carry out their tasks in a timely yet safe manner.

The bone-conductor headset also allows staff to communicate even with their ear-defenders on in an extremely high-noise work environment.



Strategy 3.2: Support professional growth

Example 3.2.1: Skills Framework for Air Transport

The Skills Framework for Air Transport provides key information on the sector's career pathways, occupations/job roles, as well as existing and emerging skills required for the occupations/job roles. It also provides a list of training programmes for skills upgrading and mastery. This aids Singaporeans to identify suitable roles for themselves as well as understand how to augment their skillsets based on their preferred roles.

CAAS is working with SkillsFuture Singapore (SSG) on the Skills Framework for Air Transport, covering the airport and airline sub-sectors. The Skills Framework for Air Transport is targeted for completion by end 2017.

Example 3.2.2: SkillsFuture Study Awards for the Air Transport Sector

CAAS administers the SkillsFuture Study Awards for the Air Transport Sector. The SkillsFuture Study Awards encourage Singaporeans to develop and deepen career-related specialist skills, enhancing their employability in an evolving economy and receiving greater opportunities to maximise their potential.

CAAS has awarded 49 SkillsFuture Study Awards for the Air Transport Sector since they were introduced in late 2015. Successful recipients receive a \$5,000 monetary award which can be used to defray expenses associated with the courses they will be taking. It can also be used on top of existing Government course fee subsidies without a bond.


Strategy 3.3: Expand education options for students

Example 3.3.1: Aviation in Schools

The Aviation in Schools Initiative (ASI) was established to help schools develop aviation-infused environments for their students to entrench their interest in aviation. The ASI supports schools in exposing students to aviation and aviation careers through hands-on and experiential activities, and aviation-themed curricula. There are currently six schools on board this programme, namely Changkat Changi Secondary School, Hillgrove Secondary School, Hwa Chong Institution, Northbrooks Secondary School, Ping Yi Secondary School and St Gabriel's Secondary School.

Example 3.3.2: Air Scouts

CAAS has partnered the Singapore Scout Association since 2012 to set up Air Scout Co-Curricular Activities (CCAs) in schools to expose students to aviation. Currently, the Air Scout units are the only dedicated CCAs in schools that focus on



civil aviation, in which they complete various aviation-related activities such as flight experiences, aeromodelling, and air navigation proficiency workshops to attain specialised Air Scout badges. The Air Scout activities have provided students with sustained industry exposure as they learn about the contributions of industry professionals, and the various elements that constitute Singapore's dynamic aviation sector.

Air Scouts are part of the global scouting movement, which also includes the more familiar land and sea scouts. There are presently four Air Scout units in Singapore, with over 100 members. Three out of the four units are based in schools, namely Hillgrove Secondary School, The School of Science and Technology Singapore, and ITE College Central.

Example 3.3.3: Aviation-related Courses in ITE [New]

ITE currently offers the Higher Nitec in Passenger Services course which prepares students to take on front-line service-oriented careers in the aviation industry. CAAS is working with ITE to explore expanding the range of aviation offerings to prepare students for technical ground operations roles in the sector, including in areas such as apron and ramp operations, baggage operations and in-flight catering.

Example 3.3.4: Air Transport Degree [New]

At the undergraduate level, CAAS is exploring a degree in air transport. The programme will prepare graduates with industry-relevant skills such that they can be highly adaptable and employable to meet the air transport sector's manpower needs.

CAAS intends to partner a suitable university and industry partners to develop the curriculum and implement the programme. This will enable the training to best suit the industry's and students' developmental needs, attract the right talent, as well as offer substantial opportunities for internships and/or work-study training to ensure a seamless transition into employment in the sector.

Strategy 3.4: Ease entry into aviation

Example 3.4.1: Professional Conversion Programme [New]

The Professional Conversion Programme (PCP) under the Adapt and Grow initiative, helps to jumpstart the careers of mid-career entrants into the air transport sector. In partnership with Workforce Singapore (WSG), CAAS has introduced the PCP for Air Transport (Ground Operations Officer). More PCPs for other roles such as Station Managers and Airline Officer and Executive will be rolled out progressively.



Example 3.4.2: SkillsFuture Earn and Learn Programme (ELP)

The SkillsFuture Earn and Learn Programme (ELP) for Air Transport has been jointly developed by CAAS, tripartite partners, SkillsFuture Singapore (SSG) and Temasek Polytechnic. This is a work-learn programme designed to give fresh ITE graduates a head-start in the air transport sector for two job roles - as Passenger Services Agents and Ground Operations Specialist (Equipment Operator). CAAS will also be exploring similar ELPs for other job roles.

For the first 12 months, trainees will be placed with an employer to learn through structured on-the-job training and an institution-based training. Two industry-recognised modular certificates will be awarded upon completion of the 12-month programme. Trainees may further develop their competencies by embarking on three more industry-recognised modular certificates which will lead to a part-time Diploma in Engineering (Aviation Management) by Temasek Polytechnic.

Thrust 4: Enterprise

The final thrust involves growing our local businesses and encouraging them to expand abroad.

Strategy 4.1: Develop new businesses together

Example 4.1.1: Drones [New]

CAAS is planning a Call for Proposal (CFP) to collaborate with end-users and drone companies to test out innovative use cases for drones. Such collaborative efforts will help catalyse new technology development and allow CAAS to develop new regulatory frameworks with industry. The use of drones are currently limited by regulation and technology. The CFP will enable drones use and capabilities to be expanded through technology co-creation and regulatory facilitation. Singapore will benefit through using drones to enhance productivity and improve processes.