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AEROSPACE

SINGAPORE

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Navigating the Post-Pandemic Landscape

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MESSAGE

LIGHT ON THE HORIZON

We look forward to 2023 with optimism for the recovery of aviation and aerospace. In Singapore, aerospace has recovered from the pandemic and grew 27.7% year-on-year in 2022. To cope with the growing demand for MRO services, the industry is seeking to recruit about 3,000 staff by the end of 2023.

Aviation on the other hand is still in recovery. The Asia-Pacific has lagged other regions in this respect, but with pandemic restrictions being rolled back in key markets, notably China and Japan, we can be optimistic. Passenger movements at Singapore Changi Airport are clearly moving in the right direction, with 4.62 million passenger movements in December 2022 compared to just 820,000 in December 2021.

While the International Monetary Fund (IMF) is predicting a slowdown in the global economy, it is hoped that China's re-opening will mean we avoid a global recession this year. "Barring new shocks, 2023 could be the year of turning points, with growth bottoming out and inflation decreasing", to quote the IMF's chief economist.

Emerging from the lows of the pandemic, we are certainly looking for positive news. The big story as I pen this message, is that Air India has placed orders for a record 470 aircraft, giving a huge boost to manufacturers' order books. That's certainly good news for the start of 2023, the year that our association celebrates its 20th anniversary.

P.S. This was not written with help from ChatGPT.

SIA KHENG YOK / Chief Executive, AAIS

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AIR INDIA MAKES ITS MARK WITH BUMPER ORDER OF 470 NEW AIRCRAFT

Air India selected Airbus' A320 Family and A350 family to both modernise and expand their fleet as part of the deal. Image: Airbus

In a jaw-dropping move, Air India, part of the Tata conglomerate, announced on 14 February 2023, a massive order for a total of 470 widebody and single-aisle aircraft from Airbus and Boeing. It is believed to be the largest aircraft deal by any single airline in history, and is set to reshape Air India's fleet and India's position in the global aviation industry.

The deal, which is believed to be valued minimally at US$68 billion, is split between Airbus and Boeing, and both companies are set to bolster their order books by at least US$34 billion based on current market values.

Air India's Airbus order will add 140 A320neo and 70 A321neo single-aisle for its short and medium-haul operations as well as 34 A350-1000 and six A350-900 wide-body jets. The Boeing element of the deal totals firm orders for 220 new aircraft, split between 190 Boeing 737 MAX, 20 Boeing 787s, and ten new 777X airplanes. Alongside the firm orders, Air India has secured options for an additional 70 aircraft, including 50 737 MAX and 20 787s.

The deal will also make Air India the largest operator of Rolls-Royce's Trent XWB-97 engines, with the engine manufacturer winning orders for 68 Trent XWB-97 engines, the powerplant of the A350-1000, plus options for 20 more. Rolls-Royce also secured an order for 12 Trent XWB-84 engines, the sole engine option for the A350-900.

CFM International, a joint venture between General Electric and France's Safran, is also a big winner as it will exclusively power all 210 Airbus A320s and 190 737 MAX aircraft. It confirmed Air India's firm order for 800 LEAP engines includes 420 LEAP-1A, 380 LEAP-1B, plus spares, as well as a CFM services contract.

Air India is carving out an ambitious renaissance under the Tata Group conglomerate. The airline, India's first, was formed by J.R.D Tata, the first Indian to receive a commercial pilot's license and chairman of the huge Tata Group of companies for decades. Nationalised in 1953, Air India faced financial troubles and a drop in reputation after years of losses under state control and the emergence of new players. In January 2022, the Tata conglomerate regained control of the airline after it was put up for bids by Prime Minister Narendra Modi's government in its push for privatisation. The company has since launched a slew of structural and strategic initiatives to drive the airline forward in the modern aviation landscape.

OEMs have touted Air India's massive aircraft order as a testament to India's growing aviation industry, which is being fuelled by various factors, including continued business growth, rising disposable incomes, and the travel aspirations of its young, affluent middle class.

The first of the new aircraft will enter service in late-2023, with the bulk to arrive from mid-2025 onwards. In the interim, Air India has already started taking delivery of 11 leased B777 and 25 A320 aircraft to accelerate its fleet and network expansion.

CONSORTIUM LED BY MTU EXPLORING NOVEL TURBOFAN TECHNOLOGIES

A group of leading aerospace companies including MTU Aero Engines AG, Pratt & Whitney, Collins Aerospace, GKN Aerospace and Airbus have partnered with research institutions to develop hybrid-electric and water-enhanced turbofan technology for future aircraft propulsion systems. Announced on 29 November 2022, the consortium is supported by the European Union Clean Aviation Joint Undertaking (Clean Aviation).

The Sustainable Water-Injecting Turbofan Comprising Hybrid-Electrics (SWITCH) project is focused on developing a novel propulsion concept built from two revolutionary and synergetic technologies: Water Enhanced Turbofan (WET) and hybrid-electric propulsion. By combining these technologies with Pratt & Whitney's GTF engine architecture, the SWITCH concept aims to significantly enhance efficiency and substantially reduce emissions across the full operational flight envelope.

Essentially, the WET concept recovers water vapor from the engine exhaust and re-injects it into the combustion chamber to significantly improve fuel efficiency, reduce NOx emissions, and lessen contrail forming emissions. Together with hybrid-electric propulsion, the group is targeting fuel efficiency improvement of up to 25% and reduced CO2 emissions compared to current propulsion systems on short- and medium-range aircraft.

SWITCH engine model. Image: MTU

Airbus will provide key expertise relating to the future integration of SWITCH technologies at the aircraft-level and will support the evaluation of its performance benefits. Collins will provide megawatt-class electric motor generators and power electronics, high-voltage DC distribution and protection, thermal management components, and nacelle architectures. GKN Aerospace will develop various engine structures with all-new functionalities, such as integrated electric machines and heat exchangers.

The project has received funding for Phase 1 through 2025, which will involve testing of a hybrid electric GTF engine, WET technology and sub-system laboratory testing.

Technologies under the SWITCH project will be designed to be fully compatible with cleaner alternative fuels – such as Sustainable Aviation Fuel (SAF) — and evaluated for future use with hydrogen.

ASIA-PACIFIC LEADS INTERNATIONAL AIR TRAFFIC GROWTH IN 2022

The global aviation industry has been progressing along on its path to recovery in 2022. According to its Air Passenger Market Analysis posted by IATA (International Air Transport Association) on 6 February 2023, global passenger traffic has increased substantially through the year as travel restrictions were lifted and pent-up demand released. In 2022, international passenger traffic more than doubled, recording 153% year-on-year growth and revenue passenger-kilometres (RPKs) at 68.5% of pre-pandemic levels.

The recovery has been particularly notable in Asia Pacific due to the reopening of many economies in the region and the return of passengers and airlines to the skies. Although performed RPKs were still some 54% below the levels of 2019, Asia-Pacific airlines have seen a significant uptick in traffic growth in both domestic and international markets, posting a 363% rise in full year international 2022 traffic compared to the previous year. Demonstrating steady growth momentum, international traffic within Asia in December 2022 reached 79% of December 2019 levels.

Overall, North American carriers are leading the industry in recovery, achieving close to pre-pandemic passenger traffic levels, with total RPKs in 2022 at only 11% under 2019 volumes. Latin American carriers were at only 14% below 2019 levels while European carriers were 22% below 2019 levels.

EMBRAER UNVEILS NEW AIRCRAFT CONCEPTS UNDER ENERGIA PROGRAMME

Embraer, the Brazilian aerospace manufacturer, has provided an update on Energia, the company's initiative to achieve net-zero emissions by 2050. In an online briefing to the media on 5 December 2022, Embraer revealed two new aircraft concepts powered by renewable energies and new technologies.

The first concept, Energia Hybrid, includes two variants, E19-HE and E30-HE. Powered by parallel hybrid-electric propulsion, Embraer claims that the aircraft will enable up to 90% reduction in carbon dioxide emissions when using sustainable aviation fuel (SAF). The company is exploring 19 and 30-seater variants with rear-mounted engines following an earlier nine-seater model revealed in 2021.

The second concept, Energia H2 Fuel Cell, includes two aircraft models powered by hydrogen electric propulsion and designed to produce zero carbon dioxide emissions. They were also presented in 19 and 30-seater variants with rear-mounted electric propellers. This is believed to not only not only reduce noise but also improve design efficiency by enabling close integration with electric motors, hydrogen fuel tanks, fuel cells, thermal management systems, and wire harnesses.

The two concepts are still in the evaluation phase and Embraer is assessing their technical and commercial viability. The company has made clear that while net-zero emissions are the main target, they are also focusing on operational economics in bringing these new concepts to market. Towards this end, the company had launched the Energia Advisory Group to gather inputs and collaboration from partner airlines, including defining requirements such as seat capacity range, takeoff performance, maintenance requirements etc. Air New Zealand was the latest airline to join the advisory group on 8 February 2023, and Chinese Ruili Airlines, had previously joined the group in December 2022.

Luis Carlos Affonso, Sr. VP of Engineering, Technology, and Corporate Strategy at Embraer, said, "As new propulsion technologies will be first applied on smaller aircraft, Embraer is in a unique position. The 19 and 30 seaters are sensible starting points for focused studies since they are likely to present earlier technical and economical readiness."

Energia Hybrid is expected to be ready by the early 2030s and the Energia H2 Fuel Cell by 2035.

	E19-HE	E30-HE	E19-H2FC	E30-H2FC
Propulsion type	Hybrid Electric	Hybrid Electric	Hydrogen Fuel Cell	Hydrogen Fuel Cell
Technology Readiness	2030+	2030+	2035	2035
Range (nm)	500	500	200+	200+
Seats	19	30	19	30
External Noise Reduction	60%	60%	70%	70%
Carbon Emissions	30% less with JetA1 90% less with SAF	30% less with JetA1 90% less with SAF	Zero	Zero

Image: Embraer

CHANGI AIRPORT RECOVERY IN FULL SWING

Singapore Changi Airport is well on its way to recovery. According to Changi Airport Group (CAG), there were a total of 32.2 million passenger movements handled in 2022, almost half of the traffic in 2019. Aircraft movements, which include landings and takeoffs, totalled 219,000, 57.2% of 2019 levels.

Passenger traffic at Changi started to surpass half of pre-pandemic levels in June 2022, with 2.93 million passengers handled. It surged to a high in December, with 4.62 million passenger movements recorded, representing 72% of Changi Airport's traffic in December 2019. The airport recorded over 1.07 million passengers passing through its terminals during its busiest week of the year (12 to 18 December), representing 82% of the weekly average in 2019. During the same month, aircraft movements registered 25,400, reaching 76% of pre-Covid levels.

Changi Airport's top five passenger markets were Australia, Malaysia, Indonesia, India, and Thailand, with the busiest routes being Kuala Lumpur, Bangkok, and Jakarta. The Singapore-Kuala Lumpur route is currently the world's busiest international route based on seat capacity.

Departure Gate at Changi Airport Terminal 3. Photo: Lip Jin Lee via Flickr

CAG has re-opened Changi Terminals 2 and 4 to restore airport capacity to cater to the strong travel demand. As at the first week of January 2023, 96 airlines operate over 5,600 weekly scheduled flights at Changi Airport, connecting Singapore to 143 cities in 48 countries and territories globally. This is 82% of Changi's pre-Covid connectivity.

CAAS LAUNCHES TENDER FOR SAF OFFTAKE MECHANISM IN SINGAPORE

The Civil Aviation Authority of Singapore (CAAS) has launched a tender in January 2023, calling for consultancy services to study and develop a structural off-take mechanism for Sustainable Aviation Fuels (SAF) in Singapore. The study will support the adoption of SAF at Changi Airport, with the aim of boosting Singapore's competitiveness as a sustainable air hub.

The study will commence in the first quarter of 2023 and will take about four months. Its key Terms of Reference will include assessing various models for driving structural off-takes and shortlisting preferred options for Singapore. The study involves the design of the structural off-take mechanism and economic impact, as well as coordination with key stakeholders to align on implementation.

Singapore has emerged as a leading proponent of SAFs in the region as the aviation industry continues to explore solutions to meet sustainability targets. In February 2022, CAAS partnered with Singapore Airlines, Temasek, ExxonMobil, and Neste in a SAF Pilot to advance the use of SAF in Singapore. In October 2022, Singapore signed an agreement with International Civil Aviation Organization (ICAO) to provide and receive assistance, capacity-building, and training (ACT) on SAF under the ICAO ACT-SAF program.

Mr Han Kok Juan, Director-General of CAAS, said, "SAF is the key pathway for the decarbonisation of the aviation sector. The setting up of a SAF off-take mechanism is an important next step in CAAS's effort to catalyse the development of a self-sustaining ecosystem and flow of funds for SAF in Singapore. It will encourage greater SAF adoption at Changi Airport and help create long-term, predictable demand to incentivise capital-intensive investments in SAF production and help drive down the price over time."

SINGAPORE AEROSPACE INDUSTRY SURGES AHEAD: ECONOMIC SURVEY 2022

The Singapore Aerospace industry has made a strong comeback, with output for 2022 reaching S$13.3 billion and a value-added of S$3.9 billion. This represents a 27.7% and 16.4% growth respectively from the previous year. The industry has surpassed pre-pandemic levels by 2.8%, indicating sustained growth beyond recovery. The industry is expected to continue its growth trajectory, with improvements in aviation- and tourism-related sectors although this may be affected by uncertainties and risks that remain in the global economy.

The release of the Economic Survey of Singapore 2022 by the Ministry of Trade and Industry on 13 February 2023 has shown encouraging statistics for the Singapore Aerospace industry. Preliminary data released by the ministry recorded aerospace industry output for 2022 at S$13.3 billion, and a value-added of S$3.9 billion. This represents a 27.7% and 16.4% growth respectively compared to the previous year (2021).

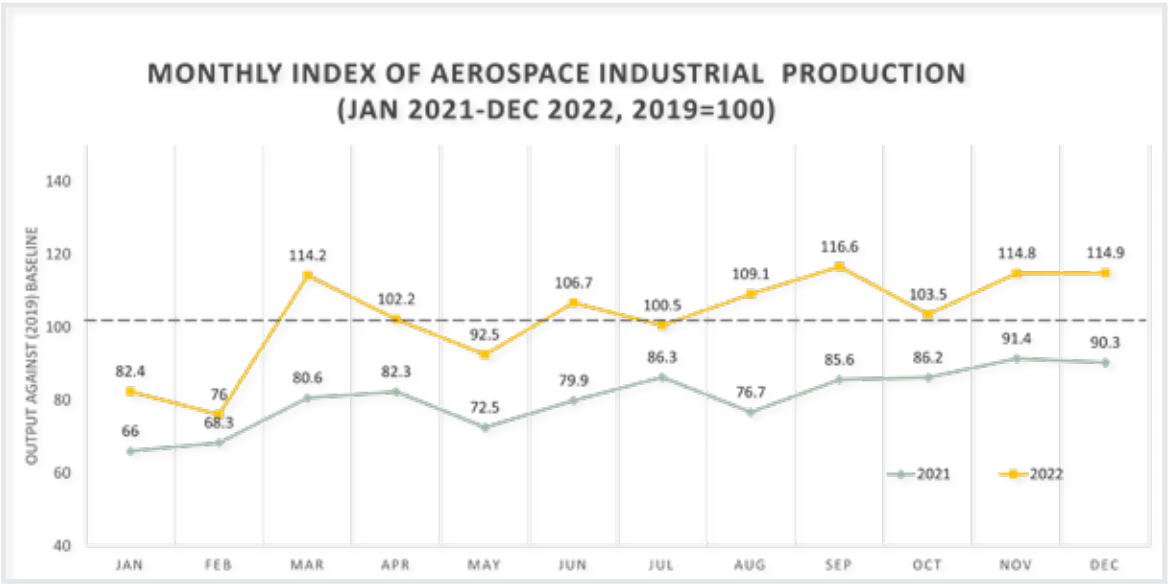
Impact And Recovery From COVID-19 Pandemic

The Singapore Aerospace industry has been making significant strides in recent decades, recording compound annual growth rate (CAGR) of 8.9% between 2000 and 2019. But like everywhere else around the globe, the COVID-19 pandemic had a profound impact on the industry in 2020, with the industry experiencing a contraction of 26% against the previous year.

However, the industry made a remarkable comeback in 2022, surpassing pre-pandemic (2019) output levels by 2.8%. This is a positive sign for the industry, indicating sustained growth beyond recovery. The achievement also speaks to the resilience of the industry and the effectiveness of the strategies and improvements implemented collectively and independently by Singapore aerospace companies during the pandemic.

The strong showing of the industry in 2022 can be attributed to the ramping up of air travel and aerospace activity with the lifting of travel restrictions in Singapore and around the world. The industry had seen early signs of growth since March 2022, when output exceeded 2019 levels for the first time, according to Monthly Manufacturing Performance reports by the Singapore Economic Development Board (EDB). Output in September 2022 was recorded at a high of 16.6% against the baseline.

Data source: Ministry of Trade and Industry, Economic Survey of Singapore reports
***2022 figures are drawn from preliminary data**



Data source: Singapore Economic Development Board, Monthly Manufacturing Performance reports

Aggregated data from MTI also showed steady increase in aerospace activity and output, surpassing pre-pandemic levels from the second quarter through to the last quarter of the year.

Optimism And Challenges on The Path Ahead

This growth trajectory is expected to continue. Analyses by MTI suggest a further improvement in the aviation and air travel related segments, bolstered by the improved outlook: "The growth outlook for aviation- and tourism-related sectors of the Singapore economy has improved as the ongoing recovery in international air travel and inbound tourism is expected to accelerate following the faster-than-expected relaxation of China's border restrictions. These sectors include air transport, accommodation, and arts, entertainment & recreation." Data and analyses from EDB's Business Expectations of the Manufacturing Sector survey supports this, with a net weighted balance of +43% of aerospace firms projecting a higher level of production in the first quarter of 2023, compared to the previous quarter, in anticipation of an increase in demand for aircraft engine repair work and MRO services from commercial airlines.

The optimism of the aerospace sector is a notable exception, however, as the overall sentiment of Singapore's manufacturing industry has turned negative due to uncertainties and risks that remain in the global economy. Tighter financial conditions in many advanced economies and continued interest rate hikes by major central banks could lead to disorderly market adjustments and reveal previously hidden vulnerabilities among heavily indebted corporations and households, thereby raising the risk of financial instability. Additionally, further escalation in the war in Ukraine and geopolitical tensions among major global powers could worsen supply disruptions, dampen confidence, and impact global trade.

Despite the challenges, Singapore's external demand outlook for 2023 has improved slightly. Growth in China is projected to pick up in tandem with the faster-than-expected easing of its COVID-19 restrictions, leading to improvements in the growth outlook of regional economies. Moreover, the global supply situation continues to stabilise amidst softening global demand conditions, resulting in eased global commodity prices from 2022 levels.

To sustain its growth momentum, it is crucial for the Singaporean aerospace sector to remain vigilant and adaptable in navigating the volatile economic landscape. It will also have to address and surmount challenges including manpower tightness in the domestic talent market and intensifying competition in the region. By focusing on innovation, enhancing productivity, developing talent, working collectively and leveraging the policy supports for the industry, aerospace stakeholders can stay ahead of the curve.

SATS INKS MOU WITH ALL FIVE POLYTECHNICS

Signatories from polytechnics and SATS with 2nd Minister for Education Dr Maliki Osman (third from left, standing). Photo: SATS

SATS has inked a collaborative agreement with all five polytechnics in Singapore with the aim of nurturing a larger pool of work-ready graduates and facilitating bilateral knowledge exchange between industry and academia.

Under this multi-year MOU, SATS aims to double its intake of interns and widen the breadth of available roles. Starting from academic year 2023/24, SATS will work with the polytechnics to place approximately 300 students from more than 20 Diploma courses on paid internships of up to six months. Students will experience industry-relevant, structured and hands-on learning with regular mentoring sessions in areas including airport operations, food nutrition, sustainability, digitalisation, data analytics and cybersecurity, among others.

According to SATS, interns can look forward to a pathway to full-time employment with the firm upon their graduation. To further spur and develop interest among youth, SATS and the polytechnics will engage students from Year 1 via learning journeys, career talks and work-study programmes that provide exposure to real-world experiences.

Another area of collaboration under the MOU is Staff and Faculty Development, through which SATS will establish a knowledge-exchange framework with the polytechnics to drive staff and faculty attachment programmes, ensuring the relevance of curriculum based on up-to-date industry practices and innovations. To this end, SATS will invite faculty to be part of on-ground operations, while nominated SATS representatives provide the polytechnics with views on coursework requirements to bridge the gap between theory and practice.

The MOU signing ceremony was held on 7 February at the SATS Global Innovation Centre. The MOU was signed by Kerry Mok, President and Chief Executive Officer of SATS together with Jeanne Liew, Principal and Chief Executive Officer (PCEO), Nanyang Polytechnic; Lim Kok Kiang, PCEO, Ngee Ann Polytechnic; Yeo Li Pheow, PCEO, Republic Polytechnic; Soh Wai Wah, PCEO, Singapore Polytechnic; and Aw Tuan Kee, Deputy Principal, Temasek Polytechnic. Witnessing the signing ceremony was Dr Mohamad Maliki Osman, Second Minister for Education.

INTER AIRPORT SOUTHEAST ASIA RETURNS: EXHIBITION SOLD OUT

After a four-year hiatus, inter airport Southeast Asia (IASEA) 2023, the premier airport exhibition and conference, will return from 1 to 3 March at Marina Bay Sands in Singapore. IASEA 2023 will set the stage as the first large-scale airport exhibition in Southeast Asia, with a completely sold-out exhibition space featuring 150 of the world's leading airport suppliers from 29 countries.

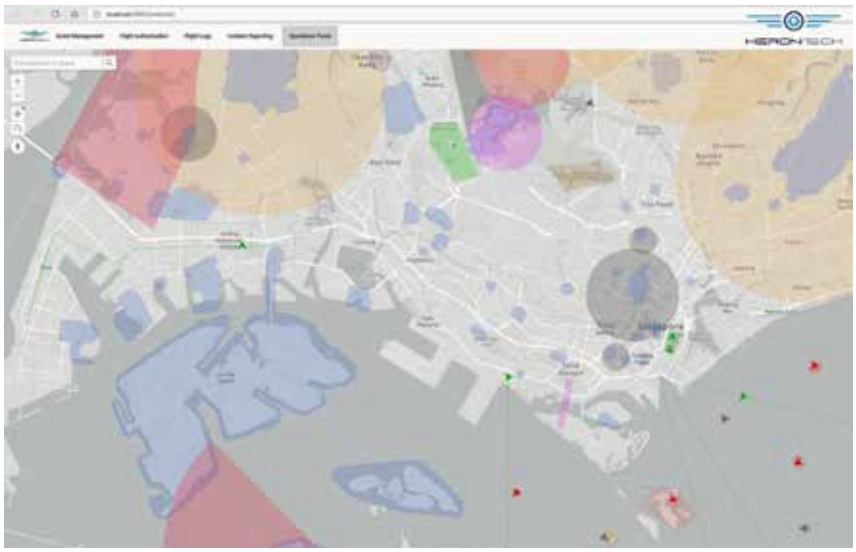
The exhibition will include three pavilions featuring airport innovations from Germany, Italy and Singapore. The German pavilion alone will bring 23 companies to IASEA. The Singapore pavilion, led by the Association of Aerospace Industries (Singapore) will showcase some innovative solutions, from automation and robotics, fuel management solutions, digitalisation and more.

At present, Asia Pacific has the largest concentration of airport development projects by number (228) and value (US$227 billion of investments).

IASEA 2023 will include a conference, themed "Reconditioning for Asia's Long-Haul Growth". Headlined by regional and international leaders from the airport, aviation, and aerospace industries, the conferences and panel discussions will address the Asia-Pacific airports outlook, challenges, and opportunities, and reveal exclusive statistics/data/trends by leading analysts and consultants.

The IASEA Conference is complimentary for all attendees.

HOMEGROWN HERON TECHNOLOGY TARGETS EXTENSION OF UNMANNED TRAFFIC MANAGEMENT SERVICES WITH INCORPORATION OF HERON AIRBRIDGE



AirBridge aims to enable the integration of AAM and drone operations for use by stakeholders. Photo: Heron AirBridge

Singapore-based Heron Technology, a digital aviation and cybersecurity solutions provider, has formed a new business unit, Heron AirBridge, to drive the commercialisation of its proprietary Unmanned Traffic Management (UTM) solution, AirBridge. The platform will serve the gap in the Advanced Air Mobility (AAM) market and offer drone mission and UTM platform services, vertiport digital infrastructure, and complex drone-enabled services.

Mr Ryan Lee, Co-Founder & Chief Executive Officer, remarked, "Given the enormous potential of AAM to address the growing challenges of population growth, urbanisation and sustainable development in the region, there is a critical need for a digital platform that can support the introduction of more unmanned aerial operations here. We must move ahead in tandem with continued collaboration between stakeholders to develop the systems required."

In a December 2022 report published by McKinsey, AAM software development was identified as a key missing piece of the industry, with a predicted spend of up to 30% of the industry's total value by 2030. The same report estimates that more than 50 functions need to be performed by AAM digital platforms, all of which need to be tailored for differing aircraft, evolving business models, geographies and regulatory frameworks.

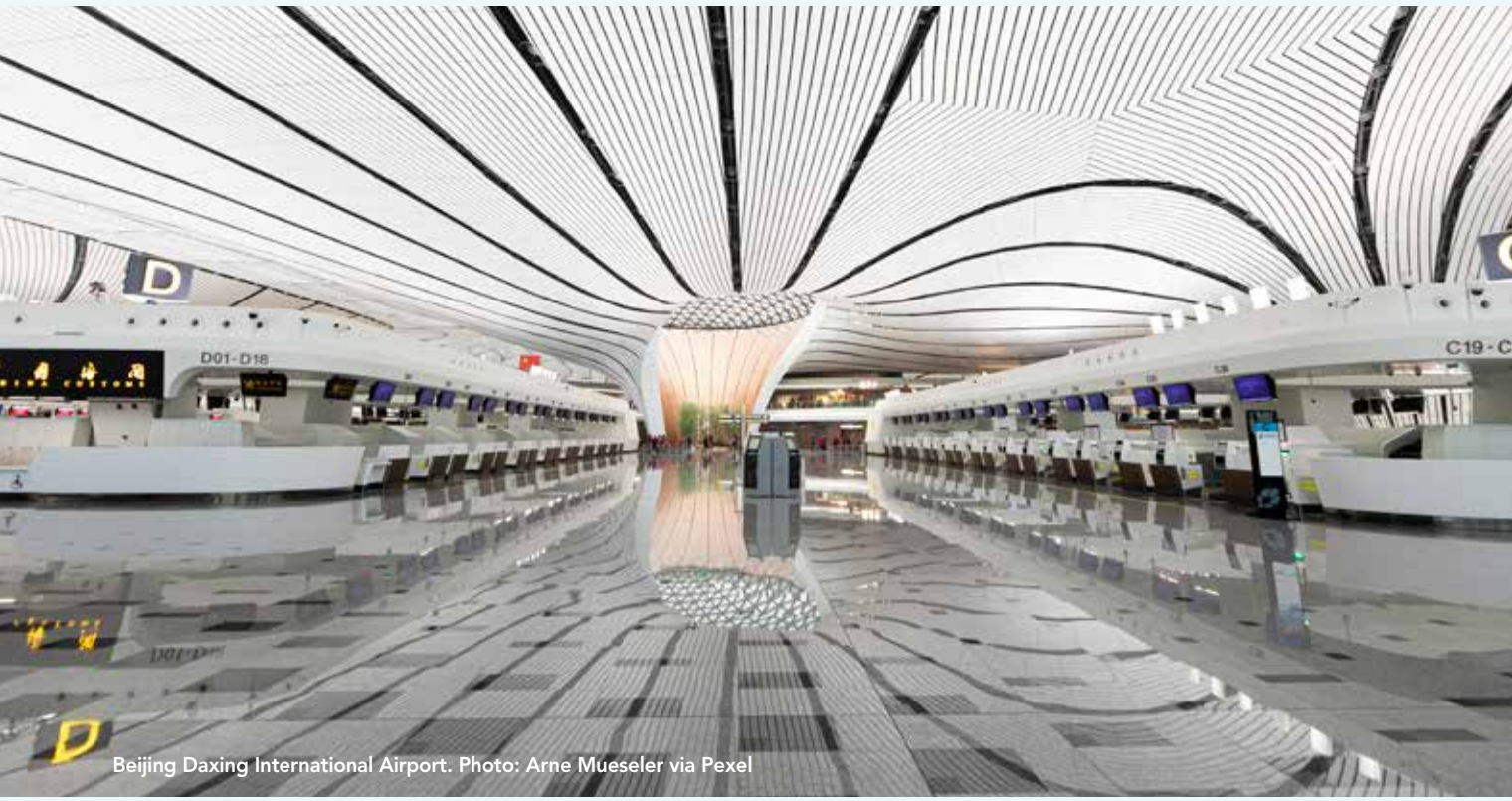
To serve the gap in the AAM market, Heron AirBridge's businesses comprises the AirBridge drone mission and UTM platform, as well as a full suite of technological support services for UTM integration and operations, vertiport digital infrastructure services and complex drone-enabled services. The platform's features will be continually expanded to meet the evolving needs of the AAM and drone services industries, with customisation based on customer requirements as well the capability to integrate third party applications for an all-in-one ready-to-deploy platform.

Heron AirBridge has received support from the Singapore Government through the Startup SG Tech grant which provides startups with early-stage funding to fast-track commercialisation of their propriety technology solutions. It is working closely with local authorities and regulatory bodies in Singapore to develop the technologies and regulatory frameworks necessary for safe and effective AAM deployment.

To raise the standards for global AAM technology solutions, Heron AirBridge has committed to gaining certification by EASA to provide U-Space2 services in Europe, after the U-Space regulation framework comes into force in January 2023.

Beyond the aviation sector, Heron AirBridge is also working with port authorities and shipping industry stakeholders in Southeast Asia to apply the AirBridge platform's digital infrastructure technologies to strengthen and scale maritime drone operations. The company is also working closely with public and private sector organisations to synchronise AAM and aviation regulatory developments to ensure the safe, secure, and seamless integration of these planned flights with traditional aircraft and vessel routes.

Heron Technology was established in 2021 after a management buyout of Nova Systems Asia, which played a key role in the development and testing of Singapore's first UTM system in 2021.



Beijing Daxing International Airport. Photo: Arne Mueseler via Pexel

FUTURE AIR HUB: NAVIGATING THE POST-PANDEMIC LANDSCAPE

Text by Joshua Ng, Alton Aviation Consultancy

Air hubs have been a vital component of the aviation industry for decades, serving as central points in the implementation of hub-and-spoke airline models. The COVID-19 pandemic, however, undermined the basis of this notion, as international travel demand plummeted and protocols favoured point-to-point travel for commercial air passengers.

As the aviation industry looks towards recovery and the future, air hubs will face new challenges and opportunities. In this *Aerospace Singapore* feature, Alton Aviation Consultancy explains and illustrates the continued importance of air hubs in the post-pandemic era. The fundamental drivers, emerging trends and future-proofing strategies that will shape successful air hubs will also be explored.

AIR HUBS - KEY TO FACILITATING AIR CONNECTIVITY

Connecting traffic, stimulating untapped demand

A key value proposition of air hubs is connectivity. Connecting flights offered by air hubs provide dual advantages for air travelers. First, they offer a more cost-effective alternative to non-stop long-haul travel, given the propensity for airlines to discount connecting itineraries. Secondly, they are often the only link between two city pairs which lack sufficient demand for direct flights.

COVID-19 had severely disrupted connecting traffic as border restrictions reduced international travel demand and limited air hubs from serving foreign connecting traffic. Airlines also reduced service levels significantly, which in turn, diminished available itineraries for the average traveler.

With the lifting of border and other COVID-19 related restrictions and the restoration of routes and destinations, we can expect that the fundamental benefits of lower costs and more efficient routings will remain tangible savings and important considerations for air travelers, putting air hubs on firm footing in the post-pandemic era.

A passenger using the touchless e-security gate at Hong Kong International Airport. Photo: HKIA

Retaining local traffic, driving volume

Historically, strong air hubs have captured a larger share of local traffic, anchored by their hub carrier(s). Changi Airport in Singapore and Hong Kong International Airports are two examples of such hubs, capturing a significant share of international connecting traffic in the Southeast Asian region. These airport hubs tend to retain a much higher level of local non-stop traffic, as indicated by a lower percentage of "origin and destination" (O&D) spillover to other airports.

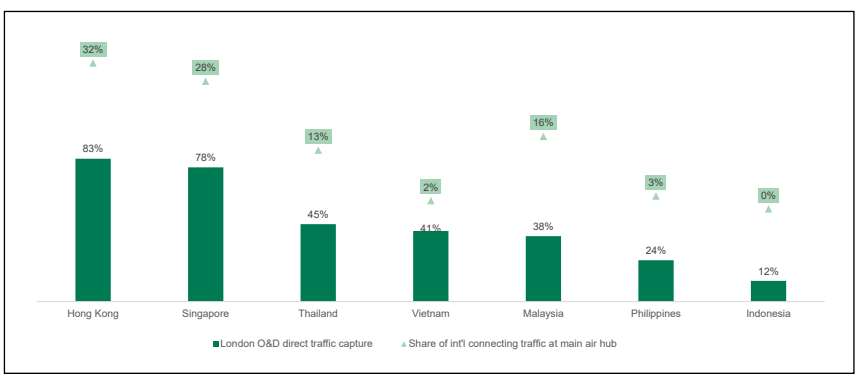
The London route provides a clear illustration of this. Hong Kong and Singapore, powered by their hub carriers Cathay Pacific and Singapore Airlines, respectively, have shown to be able to retain over 75% of O&D traffic on this route. This is not the case for passengers originating from countries such as Thailand, Vietnam, and Malaysia, as more than 50% of them opt to transit at a different airport.

Accommodating Next-Generation Aircraft

In recent years, the introduction of smaller widebody aircraft like the Boeing 787 and Airbus A350 has offered airlines the potential to fly longer, thinner routes at unit costs similar to those of "traditional" large widebodies like the A380, 747 and 777. New-generation long-range narrowbody aircraft like the A321XLR – due to enter service within the next few years – may further disrupt the market as they offer airlines the ability to operate medium-haul routes with lower demand and still maintain profitability, enabled by much lower trip costs.

Despite the introduction of such new generation "hub-busting" aircraft, the air hub is expected to remain functionally relevant as a key node in the air transportation network. The 787 and A350, for example, have enabled the inauguration of several previously un-served intercontinental routes. Yet, the majority of these routes are still operated between major air hubs or from air hubs to major end markets, as evidenced in the accompanying chart (Exhibit 2).

Exhibit 1. Southeast Asian Hubs: O&D Traffic Capture of Direct London Traffic, 2019



Source: Alton analysis, Cirium

In many cases, this new generation of aircraft has enabled hub airlines to operate trunk route services between hubs at higher frequencies to provide more attractive schedules, for example, replacing a single A380 service with two 787 services to meet the demands of business travelers. In the same manner, the A321XLR will also present new opportunities for hub carriers to start services to previously unviable medium-haul destinations or optimize capacity on existing routes. We can anticipate that air hubs and their airline partners will continue to adapt their networks to leverage new aircraft technologies for improved efficiency and better offerings for consumers.

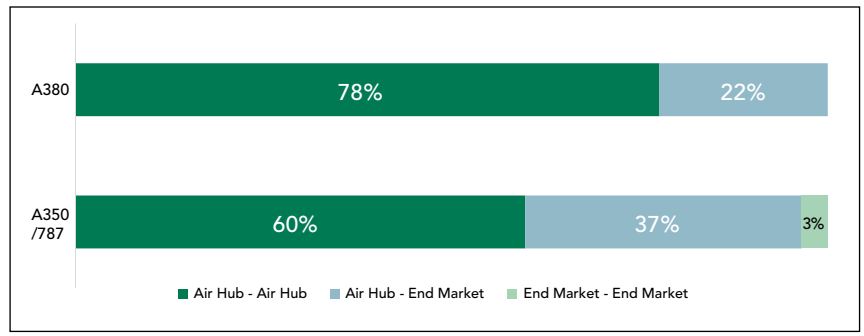
COVID-19: IMPACT, SILVER LININGS AND OPPORTUNITIES FOR AIR HUBS

Planning & positioning for competitiveness

COVID-19 had a devastating impact on long-haul international travel and by extension, connecting passenger volumes. In addition to restrictions which curtailed local O&D traffic, many air hubs were forced to suspend transit passenger operations as governments put in place transit bans on foreign travelers. As the number of services at air hubs fell, so did the number of possible connections and thus their overall connectivity levels.

During this time, several air hubs, most notably in the Middle East, strived to maintain their levels of connectivity. By implementing favourable government policies and leveraging their central location, these air hubs were able to provide much-needed connection to travelers, especially those traveling between secondary and tertiary markets. These airports became the de-facto gateways to countries whose national carriers had suspended most services. Consequently, these air hubs have found it easier to restore service levels to pre-COVID levels once air travel activity ramped up.

Exhibit 2. A380 vs. A350/787 Available Seat Kilometres (ASKs)[1] by Route Type



Source: Alton analysis, Cirium, OAG
Note: [1] Based on schedules filed for IATA S22 season

Focus on cargo and logistics infrastructure

In the absence of passenger traffic, air hubs, including both airlines and airports, shifted their focus towards developing their cargo businesses, which remained largely robust.

This was driven by multiple external factors, including consumers' heightened demand for goods over services during the lockdowns, driving the already high growth segment of cross-border e-commerce. Pandemic-induced supply chain issues also boosted air cargo demand with the spillover from other affected modes of transport such as sea freight. Combined with a sharp reduction in supply of air freight capacity due to a loss of passenger aircraft belly hold capacity, cargo airlines began to record new highs in yields and profits.

Exhibit 3. Passenger Network Development of Select Major Air Hubs

No. of destinations	Dubai (DXB)	Doha (DOH)	Frankfurt (FRA)	London (LHR)	Hong Kong (HKG)	Singa-pore (SIN)
Pre Covid (Dec 2019)	224	167	254	188	165	153
During Covid (Dec 2020)	174	149	186	162	83	77
Present (Dec 2022[1])	218	169	231	182	114	121
Net Gain/Loss over 3 years	**-6**	**+2**	**-23**	**-6**	**-51**	**-32**

Source: Alton analysis, Cirium
Note: [1] Filed airline schedules for Dec 2022 as of July 2022

In pivoting to cargo, major air hubs such as Brussels, Frankfurt, Chicago O'Hare and Singapore capitalised on the global rush to distribute vaccines. While many of these air hubs had cold-chain capabilities pre-COVID, the stringent temperature and shock tolerance constraints of COVID-19 vaccines required further investments and improvements to their existing capabilities. Such investments will provide these hubs with a competitive edge in cold chain logistics in the post-pandemic era.

Automation and digitalisation of processes

During the pandemic, airports had to contend with lockdowns and safe distancing measures, which reduced workforce on site. Such developments were a catalyst for air hubs to accelerate digitalisation and innovation efforts to improve manpower efficiency while maintaining a safe and sanitary environment. Air hubs rolled out automated check-in and baggage drop kiosks, as well as automated security lines, which reduced human-to-human interactions. Touchless technologies, such as facial recognition during the immigration process, also saw increased adoption at air hubs.

Additionally, due to the highly sensitive nature of COVID-19 vaccines, many vaccine manufacturers requested for increased visibility on vaccine shipment status. This led several air hubs to explore the implementation of new technology such as air cargo community systems (ACCS), which provide air cargo stakeholders and shippers with real-time end-to-end visibility on shipments across the entire value chain – using cloud-based applications to optimise operations and fully digitise the supply chain. All in all, air hubs that have been spurred to implement automated and digitalised processes are better equipped for post-pandemic challenges such as higher costs and manpower shortages.

KEY TRENDS SHAPING THE FUTURE OF AIR HUBS

Sustainability-driven air hub

Decarbonisation will be a core theme in the ongoing transformation of air hubs as countries and regulators around the world commit to net zero emissions.

Air hubs must begin to explore environmental sustainability by considering transitioning their energy requirements to carbon-free sources of energy, such as renewables. Solar energy arrays, for example, are well-suited to the wide swathes of land and terminal roof areas of airports. Air hubs situated in areas of high solar irradiance are particularly suited for these applications, an example being Delhi Indira Gandhi International Airport (DEL), which transitioned to solar and hydro power for 100% of its energy needs in June 2022, achieving the highest ACI airport carbon accreditation level in the process.

There are several other ways through which air hubs can improve sustainability standings, from water consumption reduction initiatives to the use of environmentally friendly asphalt and concrete produced using low-carbon processes, to encouraging the electrification of ground support and ground handling equipment. Air hubs can also consider leveraging local geographic and climactic features to facilitate net zero air hub emissions. Stockholm Arlanda Airport, for example, utilises water from a nearby underground aquifer to heat and cool terminal operations throughout the seasons to provide significant reductions in heating and cooling energy consumption.

Support infrastructure for decarbonisation

Increasing scrutiny and focus on carbon emissions from the air travel industry will drive demand for cleaner modes of transportation both in the air and on the ground. For air hubs, this entails planning for the infrastructure to support these energy transitions. The table at Exhibit 4 outlines the latest industry expectations around entry-into-service (EIS) dates for new propulsion technologies by aircraft category. Air hubs should be at the forefront of planning for adoption of these technologies.

Finnair Cargo's cutting-edge Cool terminal at Helsinki–Vantaa Airport. Photo: Finnair

Exhibit 4. Timeline of Adoption for New Propulsion Technologies

	2025	2030	2040	2050
Commuter 9-50 seats <60 minute flights <1% of industry CO2	SAF	Electric and/ or SAF	Electric and/ or SAF	Electric and/or SAF
Regional 50-100 seats 30-90 minute flights ~3% of industry CO2	SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF
Short-haul 100-200 seats 45-120 minute flights ~24% of industry CO2	SAF	SAF	Hydrogen combustion and/or SAF	Hydrogen combustion and/or SAF
Medium-haul 200-250 seats 60-150 minute flights ~43% of industry CO2	SAF	SAF	SAF	SAF and potentially Hydrogen
Long-haul 250+ seats 150+ minute flights ~30% of industry CO2	SAF	SAF	SAF	SAF

Source: Alton analysis

In the near-term, sustainable aviation fuel (SAF) has shown considerable promise as a "drop-in" solution to tangible reductions in carbon emissions. SAF requires little to no modification of existing fueling systems at airports, including aircraft propulsion and fuel delivery systems. Nevertheless, significant investments are still required in the production and supply chain infrastructure to support this shift. Several major air hubs worldwide have begun initiatives to make SAF available for use.

In the long-term, hydrogen remains one of the industry's promising propulsion energy sources to drive decarbonisation of the industry. OEMs such as Airbus and Embraer are currently working on development of aircraft powered by hydrogen. Given that hydrogen, whether in gaseous or liquid form, requires a complete new set of infrastructure as opposed to conventional jet fuel and SAF, it is crucial that air hubs begin to evaluate the implementation of such systems in long-term planning to ensure supporting infrastructure is in place should the technology reach maturity.

With the gradual introduction of new technology such as electric and hydrogen aircraft, air hubs are poised to be the initial proving ground and lead industry's pivot towards greener energy. The low fuel weight of electricity and hydrogen allows for efficient refueling without adding significant weight to the aircraft's operation, enabling full-load fuel capacity to be carried on board for both legs of the journey (subject to the aircraft's range capabilities). Therefore, even if the destination airport may not yet have the necessary infrastructure in place to refuel these types of aircraft, air hubs equipped with the necessary fuel infrastructure will allow for the seamless operation of these greener aircraft.

Multi-modal transport initiatives

Airlines have long sought cost-effective means to expand the reach and effective catchment at their main hubs. This trend has been most evident in Europe, with airlines placing their codes on regional train services connecting the main air hubs to surrounding suburbs or cities. The recent focus on reducing carbon emissions from air travel has prompted European carriers to reduce domestic and regional flying, leading to increased collaboration in multi-modal partnerships such as rail-to-air and sea-to-air connections (less prevalent). These partnerships offer similar benefits to air hubs by expanding their catchment area.

Multi-modal transport partnerships provide a seamless travel experience for passengers by offering unified access to ancillary products, loyalty program benefits, and efficient service recovery options in case of disruptions. This integration not only benefits passengers, but also offers potential for growth in air cargo development. In logistics, road-to-air and sea-to-air transfers are commonly used to balance cost and speed of delivery. To effectively position themselves as multi-modal transport hubs, air hubs must undertake strategic operational and infrastructural planning.

Integrating Advanced Air Mobility (AAM)

Air taxis can potentially add another layer to the multi modal and green infrastructure of airports. There are several considerations when it comes to an air hub's strategy for AAM. Hub airports with strong local O&D demand may require both intercity and intracity AAM routes to enhance their traditional airline network and multi-modal transport networks. On the other hand, smaller airports may leverage AAM as feeder services to existing flights, or pitch AAM to enlarge the addressable market for potential new services.

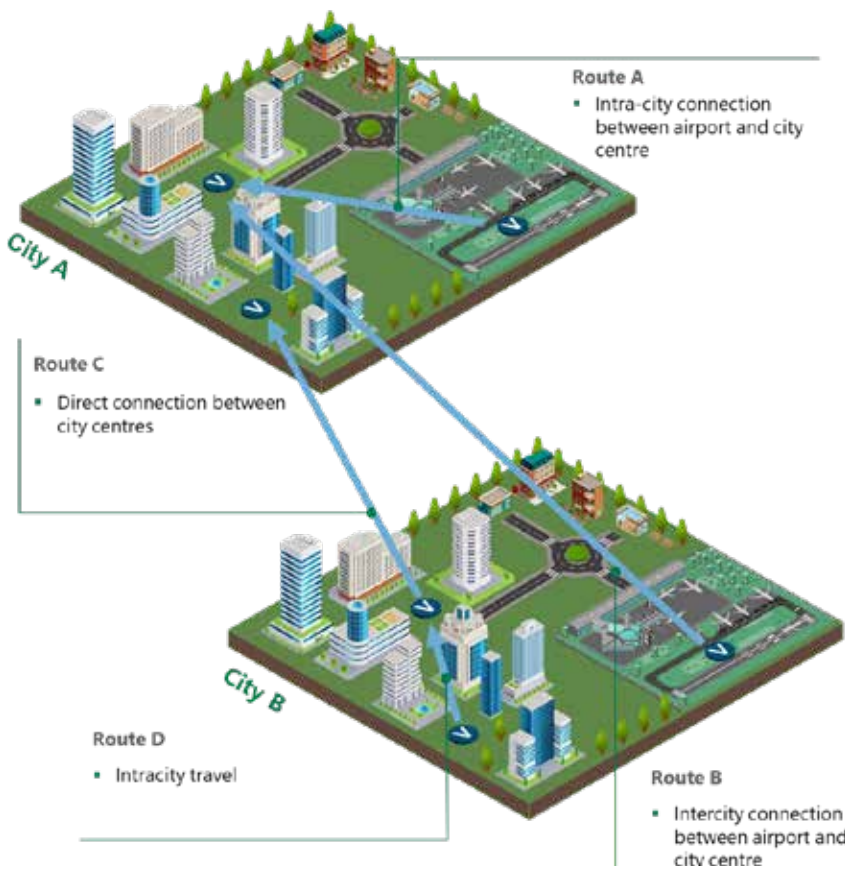
Air hubs will need to evaluate overall network strategy in considering the future role of AAM in their respective ecosystems. A balance should be struck between integration and operational costs, while ensuring that traffic stimulation will outweigh any potential cannibalisation of existing routes. Hubs should also consider the affluence of its core catchments in evaluating AAM services, given that initial unit costs of AAM is expected to be much higher than existing commercial air services, making it more suited for corporate and premium travelers who are able to afford a premium for shorter journey times.

As of today, airspace management systems and flight planning are largely focused on single-aircraft optimisation, with the outcome focusing on the best available flight plan optimised for cost and network considerations. As AAM will require a quantum shift in airspace management, regulator support for reform of air traffic management protocols will be key to ensuring operational success.

With the potential for future airspace to be further populated by smaller aircraft such as AAM systems, community-based traffic systems in which users have flexibility to manage operations within set constraints may become the norm. Air hubs should be prepared to embrace collaborative tools to support the optimisation of airspace, especially as it becomes increasingly congested. Such systems would be predicated on layers of automated information sharing and data exchange between operators, vehicles, and ANSPs.

SAF being loaded directly onto departing Singapore Airlines aircraft in July 2022. Photo: ExxonMobil Asia Pacific

Exhibit 5. Potential AAM Service at Air Hubs



Source: Alton analysis

CONCLUSION

Despite recent challenges, air hubs will be key players in the commercial air transport value chain moving forward, as connecting traffic will continue to be a major component of intercontinental and long-haul travel. Nevertheless, achieving success as an air hub in the future will require more than just a strong commercial flight network. Rapidly developing trends such as the drive to sustainability, a new generation of air vehicles that offer a step-change in mobility within an airport's catchment, as well as the advent of multi-modal transport hubs will shape the development of existing and aspiring hubs. With increasing digitalisation of processes and the continued relevance of pandemic-related health and safety concerns, air hubs must adapt to stay ahead. The persistence of de-globalisation may also impact the role of air hubs in regional trade and connectivity, making it crucial to have a well thought out strategy.

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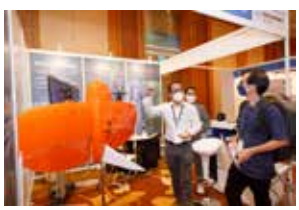

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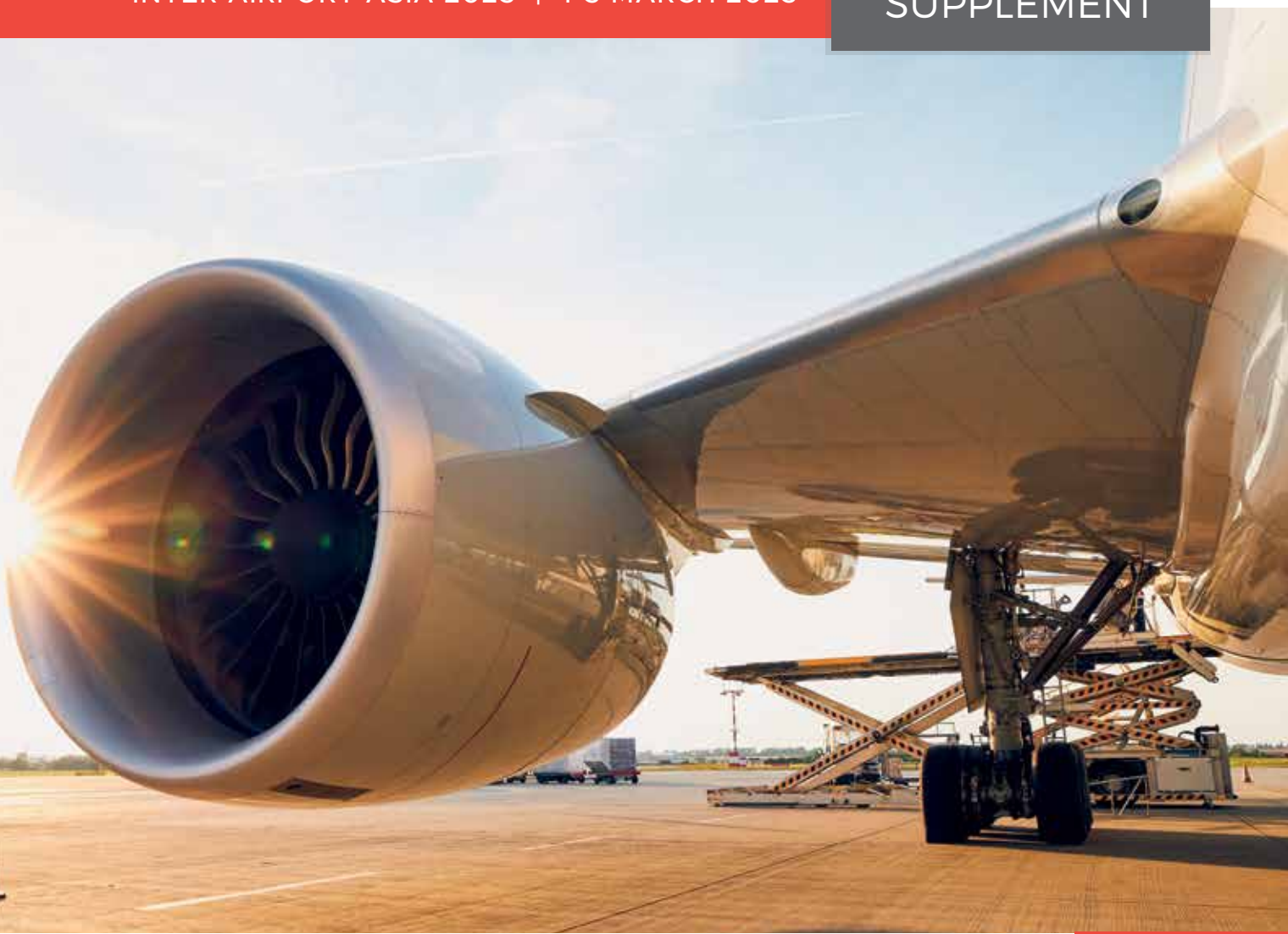

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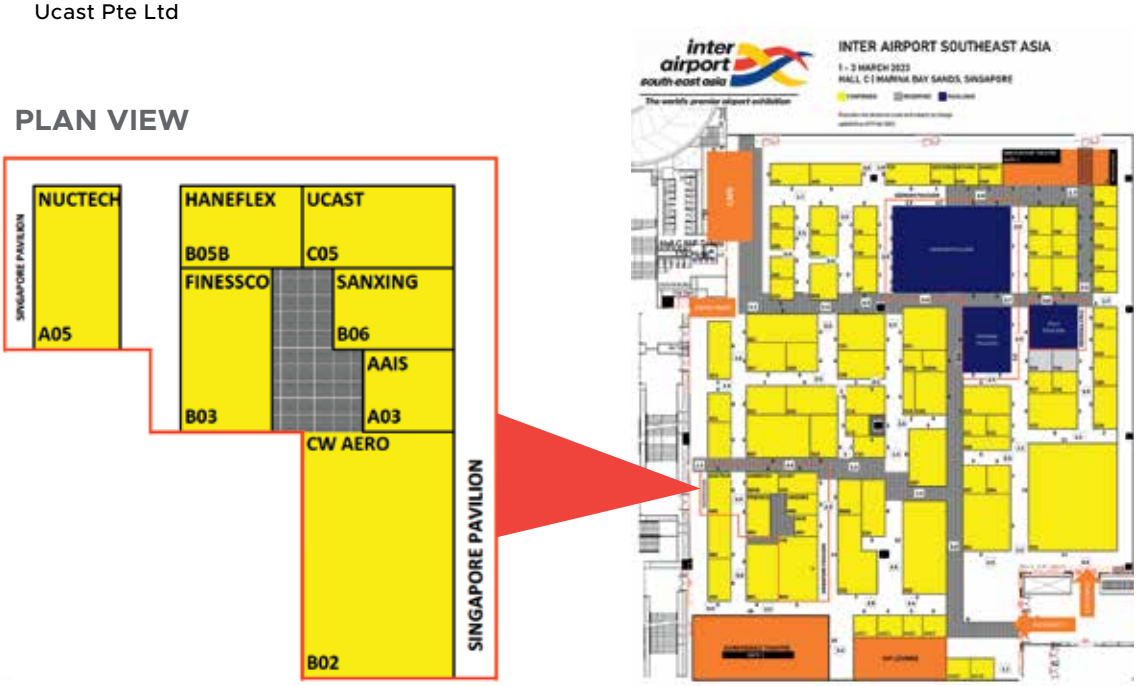

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A WIDER VISION FOR THE FUTURE

An interview with Hadley Bowling, VP Sales, Asia Pacific Global Sales & Marketing at GE Aerospace on the company's developments and plans

In November 2021, the General Electric Company (GE), a global multi-industry powerhouse with over 130-year history, announced plans to become three independent and publicly traded businesses focusing on healthcare, energy, and aviation. As of 3 January 2023, GE had already spun off its healthcare division and shared its plans to divest its energy business by early 2024. When this happens, the company that is now GE would change the name of its last remaining division to GE Aerospace to become "an aviation-focused company shaping the future of flight".

Aerospace Singapore speaks with Hadley Bowling, who is based in Singapore, to find out more about the developments in the company's aero engine division and plans for GE Aerospace.

Please tell us more about yourself, your responsibilities and how you came into this role at GE.

As the Vice-President of Sales for the Asia Pacific region for GE Aerospace, I'm responsible for growing partnerships with airlines, lessors, and MROs in the region. Having spent my entire career in Commercial Engines, I have more than 20 years of experience in the global aviation and aerospace industry with a focus on understanding customer needs and building high-performing teams.

I enjoy building relationships and partnerships with customers in the broad Asia Pacific region as the market recovers and returns to pre-pandemic levels of flight with significant growth anticipated over the next decade.

Hadley Bowling, VP Sales for Asia Pacific at GE Aerospace, at Singapore Airshow 2022

With the eventual formation of GE Aerospace as a pure-play aviation company, can we expect there to be a significant change in the company's business strategies and directions, or would it retain its current focus and trajectory?

We're on track and confident in our plans for GE Aerospace as a separate company in early 2024. We will benefit from greater focus, tailored capital allocation and strategic flexibility to drive long-term growth and value. With an installed base of 39,400 commercial and 26,200 military aircraft engines, including engines made by joint ventures, the company will continue to play a vital role in supporting the industry through a historic recovery while shaping the future of flight. We are an exceptional business in the commercial and military sectors, we're embracing lean and technology to drive operational performance and services growth, and we're investing in technologies to enable a more sustainable future of flight.

On this note, what are some of the technologies/applications being developed at GE Aerospace to support the aviation industry's sustainability goals?

GE Aerospace is already at work today to develop breakthrough technologies for the benefit of us all tomorrow, such as advanced new engine architectures like open fan, hybrid electric propulsion and hydrogen fuel combustion. The aviation industry's ambition, which GE supports, is to reach net-zero CO2 emissions from commercial flights by 2050.

GE Aerospace projects include:

- The CFM RISE Program, or Revolutionary Innovation for Sustainable Engines. CFM is a 50-50 joint company between GE and Safran Aircraft Engines. Through the RISE program, we're maturing multiple technologies to achieve at least 20% better fuel efficiency compared to our most efficient engines today. This includes the development of new advanced engine architectures, such as the open fan, and compact engine core designs.
- As part of the Electrified Powertrain Flight Demonstration (EPFD) project, we're collaborating with NASA and Boeing to develop a megawatt-class hybrid electric powertrain for commercial aviation.
- We've also announced plans to develop a hydrogen combustion engine and flight test it with Airbus. This will lead to the development of new cryogenic fuel storage and delivery systems and a combustor capable of burning hydrogen.

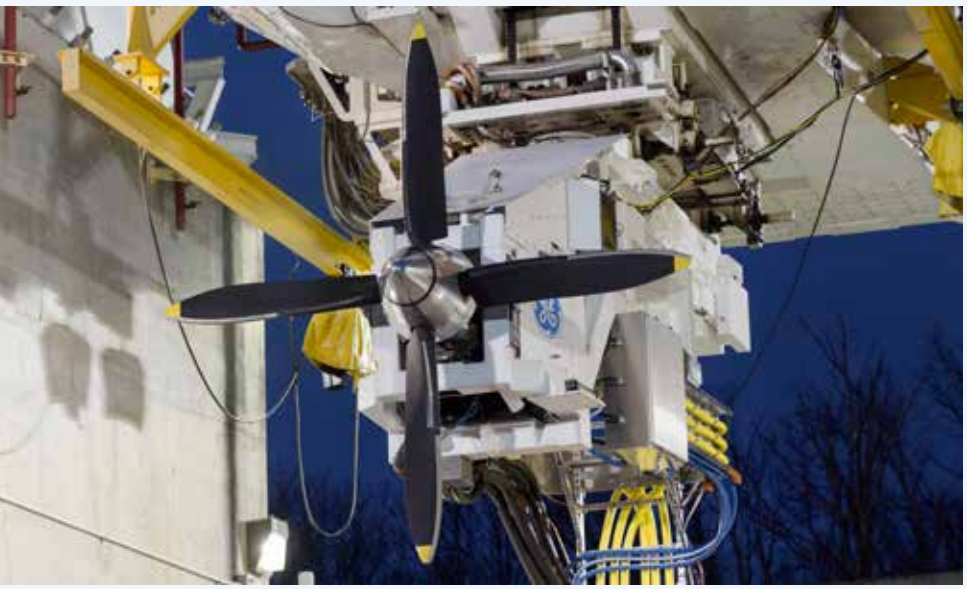
We'll see open fan, hybrid electric and hydrogen technologies go through ground and flight tests this decade. What we learn could lead to the development of new engine products for entry-into-service in the mid-2030s.

Growing adoption and availability of Sustainable Aviation Fuel (SAF) is also significant to reaching net-zero. All GE and CFM International engines can operate on approved SAF today.

How, in your view, can Singapore and its aerospace ecosystem best support the sustainability efforts being driven in the aviation sector?

Commercial aviation won't be able to reach its collective goals to reduce carbon emissions without wider adoption and availability of SAF and engines that are compatible with 100% SAF. As new, disruptive technologies such as hybrid electric are more likely to be applied to single-aisle aircraft before widebodies, SAF also plays an important role in making international long-haul travel more sustainable now and into the future.

Incentives that help increase the availability of SAF at affordable prices are key to greater adoption. All of GE Aerospace's and its partners' engines today can operate on approved SAF. However, there is currently not enough supply of SAF globally to meet the needs of our customers if more were to begin using SAF.



GE Aerospace and NASA recently completed the world's first test of a megawatt (MW)-class and multi-kilovolt (kV) hybrid electric propulsion system. Photo: GE Aerospace

As demand and aviation activity ramps up in most places in Asia-Pacific, what is your sense of the market? What are the changes to your clients' needs and requirements in the post-pandemic environment?

We are seeing a continued recovery of the aviation sector, with almost all the Asian country borders reopening in 2022. With the latest reopening announcement by China, we should see continued momentum going into 2023. We expect narrowbody traffic to recover in later 2023 and widebody passenger by late 2023. Business and international travel are in-line with expectations.

Asia Pacific will be a growth region in the next decade, with this region making up 20% of global commercial aircraft orders. This region will see close to 2,500 new aircraft deliveries over the next 10 years. Specifically, India and ASEAN countries like Indonesia and Vietnam will form the bulk of regional growth. These will spur MRO services demand.

These growth opportunities are enabling us to further our progress in additive manufacturing, digitalisation, automation and robotics, advanced technology research, and carbon emissions reduction for aviation.

Through its Aerospace Industry Transformation Map 2025, Singapore aspires to strengthen its leadership position in engine MRO. How does GE Aerospace in Singapore contribute to this aspiration?

At GE Aerospace in Singapore, we are pursuing Operational Excellence. Lean is at the heart of everything we do in GE Aerospace Singapore, with good productivity improvements resulting from our Lean activities.

We are also driving innovation in emerging technologies. In 2018, GE Aerospace partnered with Singapore's Economic Development Board (EDB) to invest in the state-of-the-art

The Loyang facility in Singapore was the first MRO facility worldwide approved to use metal additive manufacturing for commercial jet engine component repairs. Photo: GE Aerospace

Additive Manufacturing Centre to fuel innovations in the application of additive manufacturing technology in the Maintenance, Repair and Overhaul (MRO) of commercial jet engines. This investment has already resulted in a breakthrough in 3D Printing for additive repair of commercial jet engine airfoil components, which led GE Aerospace Engine Services Singapore to becoming the first in the world to implement an approved additive repair for High Pressure Compressor Airfoils. Co-developed by GE's local engineers and GE's Additive Manufacturing Technology Centers in the US, this innovation allows twice as many jet engine parts to be repaired daily, enabling customers' aircraft to take to the skies again in a shorter period of time. We continue to partner across the company and locally with EDB to continue to develop innovative repair technologies and methods.

The growth opportunities in additive manufacturing, digitalization, automation & robotics, advanced technology research, and improved sustainability for aviation drove the creation of more than 300 new jobs in 2022. We continue to train and develop local engineering talent in current and future aviation technologies, including in automation, robotics and additive manufacturing that will empower new levels of productivity and efficiency.

We are also deepening ties with key partners such as the AAIS, EDB, academia, A*STAR/SIMTech.

Finally, are there aspirations for GE Aerospace to grow more broadly, beyond the commercial, aftermarket and defense segments?

The new name signals a new era of growth in aerospace and defense, building upon our established expertise and commitment to our customers. While it's too soon to offer specifics about any one sector, we will look for opportunities to use our technology and expertise to make a difference for our customers, while also contributing to our long-term success as a business.

MAKING SAFETY A TOP PRIORITY

Singapore aerospace companies refresh commitment to safety through inaugural AAIS industry safety week

With the recovery of air travel, the Singapore aviation sector has recovered about 90% of its pre-COVID workforce at the end of 2022. Aerospace activities have also turned the corner with domestic aerospace production exceeding pre-pandemic levels by March 2022 and output growth recorded as high as 16% over 2019 (baseline) levels in September. This positive sentiment is expected to continue in the coming months, with most Singapore-based aerospace companies foreseeing growth to improve in terms of output, new orders, exports, and employment. Manpower demand is also expected to increase in 2023 as air travel further improves.

As the tempo of operations continues to pick up, an influx of fresh talents is expected who will need to be familiarised with safety practices and considerations. At the same time, experienced aerospace personnel will benefit from consistent refreshers to remain up-to-date and keep safety protocols top-of-mind. There are also new considerations in the post-pandemic landscape such as the upkeep of aircraft, especially those that were kept in storage, the introduction of new technologies as well as changes to the operating environment.

In alignment with growing interest and emphasis on safety, the Association of Aerospace Industries (Singapore) organised its first AAIS Industry Safety Week from 14 to 18 November 2022, calling upon members of the industry to renew and reiterate the commitment to safety at all levels. A series of events conducted in conjunction with the campaign saw over 70 aerospace and aviation organisations participating in various activities, including seminars, webinars, and site visits for cross-learning of best practices.

Aviation Safety: In conversation with CAAS and Aerospace Leaders

Kicking off Safety Week, AAIS held a hybrid seminar on 14 November to discuss aviation safety in aerospace MRO and manufacturing. The event featured industry leaders including Mr Oliver Chamberlain, Manufacturing Executive, Rolls-Royce Singapore, and Mr Mark Loh, General Manager, Bell Textron Asia, as well as a representative from the Civil Aviation Authority of Singapore (CAAS), Mr Leong Chin Sing, Senior Manager (Maintenance Organisation).

The speakers shared valuable insights on safety policies and best practices for MRO and aerospace organisations. Their personal anecdotes added a unique perspective on the importance of safety and the differences in safety cultures across organisations and countries. The experts emphasised the need for continual improvement in safety management and called for collaborative efforts to improve aviation safety awareness. During the panel discussion, participants were engaged in topics such as integrating safety into aerospace curricula, increasing safety training, and the role of regulators in safety management.

Visit to SIAEC's Aviation and Workplace Safety Promotion Centres

Members of the AAIS Management Committee and their safety officers were invited to visit SIA Engineering Company's (SIAEC) safety promotion centres on 15th November for cross-learning. The visit included interactive tours of the Aviation Safety Promotion Centre and the Workplace Safety Promotion Centre, which were established by SIAEC to enhance safety training programmes for its staff and foster a safety culture and mindset in the workplace.

From left: Mr Chamberlain, Mr Leong, and Mr Loh engaging with participants at a discussion on aviation safety in aerospace MRO and manufacturing organisations

Participants of the site visit organised by AAIS to the SIAEC Safety Promotion centres on 15 November 2022

Participants were impressed with the comprehensive and engaging set-up of the Aviation Safety Centre, which included immersive media, informational displays and interactive activities. The Workplace Safety Promotion Centre provided an integrated learning environment that combined classroom-based lessons with experiential and visual learning.

WSH New Code of Practice + Data-Driven Risk-Based Approach

A webinar held on 17 November, switched gears to workplace safety and health (WSH) practices. The keynote speaker, Mr Christopher Koh, General Manager of the Singapore WSH Council, provided a briefing on a new code of practice (COP) that details the duties of company CEOs and directors on WSH. This new COP, which was gazetted in October 2022, underlines the workplace health and safety responsibilities of leaders in companies in Singapore across all industries. This includes the mental well-being of workers in addition to their physical health.

The audience was also treated to an insightful presentation by Mr Lim Sui Soon, Executive Committee Member at the Singapore Institution of Safety Officers (SISO). Mr Lim presented 'A Data-Driven Risk-Based Approach to WSH Management' which encouraged organizations to analyse key causal factors of incidents based on WSH data and develop mitigating methods in managing these high-risk factors. This approach provided a fresh perspective on WSH management and offered the audience new ways of tackling workplace safety and health issues.

Speakers of the WSH webinar on 17 Nov. From left: Mr Christopher Koh and Mr Lim Sui Soon

Launch of AAIS Safety Microsite

A key element of AAIS Industry Safety Week was the opportunity for cross-learning and sharing of best practices. To facilitate this, AAIS launched a curated Safety Microsite (https://aais.org.sg/safety) aimed at promoting knowledge/resource sharing between members of the industry ecosystem. The Safety Microsite serves as a repository of safety resources, including messages from industry leaders, as well as safety-related posters, articles, guidance documents, activities, and other collaterals. In addition, the AAIS Safety Microsite is a platform for industry members to contribute their own safety-related materials such as checklists, safety week activities, videos and others.

The microsite will be available beyond Safety Week, making it a valuable long-term resource for organisations to enhance their safety practices. Safety officers and industry professionals alike will be able to access a comprehensive collection of materials safety-related resources to augment their own internal safety promotion efforts.

As the aerospace industry continues to evolve, it is crucial to maintain a strong focus on safety practices and technology. The success of the inaugural AAIS Industry Safety Week sends a strong signal of the our community's commitment to promoting and enhancing aviation safety for the benefit of all stakeholders.

Scan the QR code to visit the AAIS Safety microsite

aais.org.sg/safety

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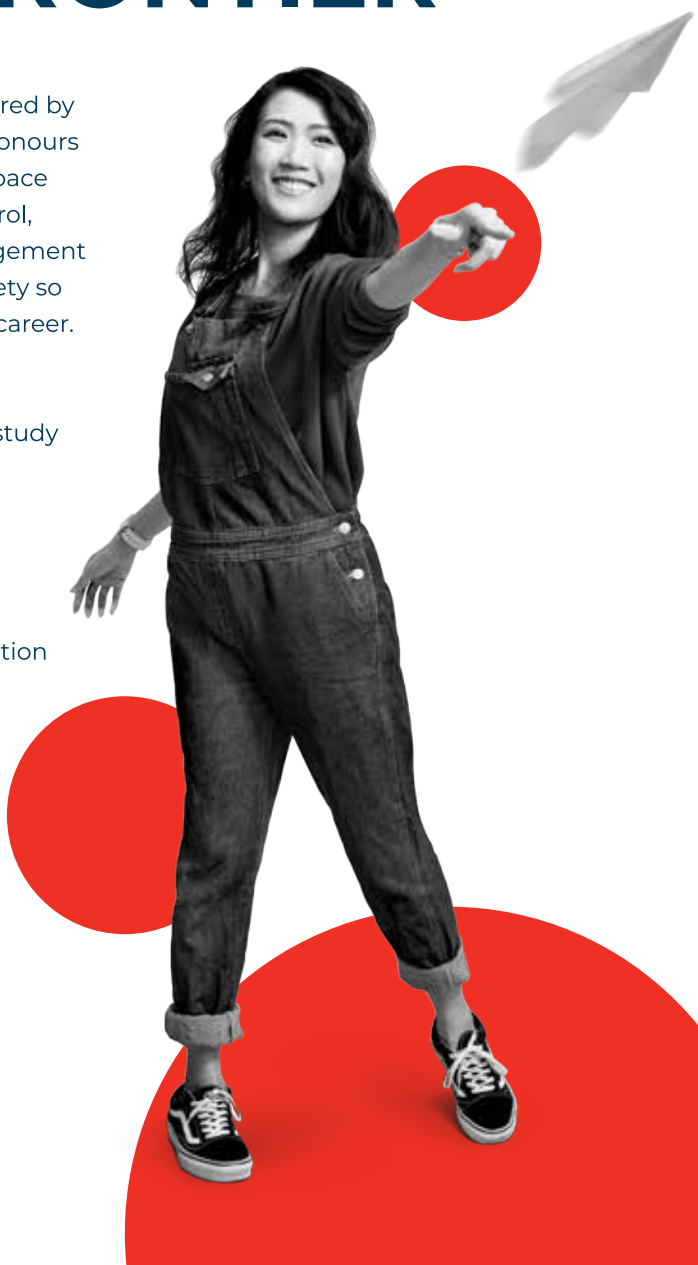

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INDUSTRIAL TRANSFORMATION ASIA-PACIFIC 2022

Fifth edition of ITAP draws over 15,000 attendees in-person and online across three days

Industrial Transformation ASIA-PACIFIC (ITAP), an event of Constellar with international partner Deutsche Messe, returned for its 5th edition from 18 to 20 October 2022 at Singapore EXPO.

With the theme 'Industry 4.0 for Business Sustainability', ITAP 2022 covered three key dimensions: Digitalisation to accelerate productivity and quality control with lower costs; Talent and Workforce Development initiatives to equip personnel with the right skillsets for transformation; and Environmental Sustainability measures to help businesses reduce their carbon footprint and CO2 emissions. Attendees included delegates from the World Economic Forum and representatives from Europe, the US and Asia.

Deputy Prime Minister and Coordinating Minister for Economic Policies Heng Swee Keat delivered opening remarks as the Guest-of-Honour at the ITAP 2022 opening ceremony. In his speech, Minister Heng highlighted the importance of strong connectivity which would enable economies to tap on one another's strength, leverage on complementarities to strengthen competitiveness and better capture new opportunities in manufacturing and trade. He also launched a refreshed set of Industry Transformation Maps (ITMs) for five sectors of Singapore's Advanced Manufacturing & Trade cluster – Electronics, Precision Engineering, Energy & Chemicals, Aerospace and Logistics.

Some 276 exhibitors from over 20 countries presented their latest innovations in industrial automation, intralogistics, digital factories and additive manufacturing on the exhibition floor at Singapore EXPO's Hall 2 and 3.

2,500 visitors participated in over 120 content sessions by more than 150 speakers across five conferences:

- Industrial Transformation Forum on 18 October featuring global industry leaders from HP, Microsoft, the World Economic Forum and others

Visitors and media personnel learning about robots that perform intelligent spray painting and construction quality inspection. Photo: Constellar Exhibitions

Hustle and bustle across Halls 2 & 3 at ITAP 2022. Photo: Constellar Exhibitions

- Future of Manufacturing CXO Summit on 19 October, co-organised with the Agency for Science, Technology and Research (A*STAR)
- NAMIC Global Additive Manufacturing Summit from 19 to 20 October with global additive manufacturing thought leaders and application experts
- LogiSYM Platinum series on 19 October - a unique, industry first invite-only roundtable for senior supply chain professionals
- Standards Forum on 20 October organised by the Singapore Standards Council and Enterprise Singapore

Overall, ITAP 2022 attracted more than 15,000 attendees across three event days and facilitated over 1,000 business matchings. The event hosted 8 national pavilions including Singapore, France, Germany, Indonesia, Malaysia, US, among others.

The next edition of ITAP is set to be held from 18 to 20 October 2023.

THE CHANGI STORY

Pride of Singapore, Changi is an award-winning airport for quality services, passenger-friendly infrastructure and efficiency. In 2019, before the global aviation industry was derailed by the Covid-19 pandemic, the passenger traffic through Changi Airport hit 68.3 million, serving more than 100 airlines flying to 400 cities in over 100 countries. The airport has won over 620 awards since its opening, including 28 "Best Airport" awards in 2019 alone. From one passenger terminal and one runway when it opened in July 1981, Changi now boasts four passenger terminals with a total capacity of 85 million passengers and three runways. At its heart is the Jewel, an integrated retail and entertainment hub and global icon. Goh Yong Kiat traces the beginnings and development of Changi in this heritage series for *Aerospace Singapore*.

Unintentional Airfield

The beginnings of Changi is a unique story. While the rest of the airfields in Singapore were built by the British Royal Air Force (RAF) or the colonial civil administration, Changi started off as an army artillery camp for the protection of Singapore against naval invasion.

During the Japanese occupation between 1942 to 1945, the Japanese Army cleared the vegetation in the east of Singapore and constructed two intersecting landing strips for its fighters to defend Singapore. Completed in 1945, the airfield saw little service before the war ended.

A satellite image of RAF Changi taken during the US DoD Corona KH-4 reconnaissance satellite programme on 2 April 1963. Image: United States Department of Defense, Public domain via Wikimedia Commons

The selection of Changi for an airfield by the Japanese was a good choice. Despite the marshy ground that it was built on, its location near the sea with excellent all-round approaches became the choice by the RAF to later develop as its main transport base and its Far East Air Force (FEAF) Headquarters. Officially opened as RAF Changi on 8th April 1946, it was the largest RAF airfield in the region with a runway 1,800m long and 46m wide, capable of taking the heaviest four-engine aircraft of that time.

The RAF made Changi available to both military and civil aircraft movements and with its opening, BOAC and Qantas resumed their London-Sydney air service through Singapore.

On 15th October 1952, Singapore moved into jet age travel with the arrival a BOAC Comet jet at RAF Changi, inaugurating the London-Singapore Comet service. (The Comets had to operate from Changi owing to the runway length and limited facilities at Kallang.)

Through the 1950s, Changi's role continued to be the RAF FEAF's main terminus for its Transport Command's flights to UK and Australia. The opening of Paya Lebar Airport in 1955 to take over Kallang as Singapore's international airport relieved RAF Changi of all commercial flights.

Birthplace of the RSAF

Singapore's independence in 1965 and the subsequent withdrawal of British forces east of Suez saw the rapid handover of RAF air bases to the Singapore Air Defence Command (SADC). RAF Changi was the last to close with a simple farewell parade on 9th December 1971.

Renamed Changi Air Base, the SADC moved in its Flying Training School (FTS) with its training aircraft and 120 Squadron with its Alouette III helicopters to take up residency. In 1974, the Skyhawks arrived to form 142 Squadron. By 1975, Changi Air Base was the home to the FTS, 120 Squadron with Alouette helicopters, 121 Squadron with Skyvan transport aircraft and two squadrons of Skyhawk fighters. The SADC, which was then renamed the Republic of Singapore Air Force (RSAF), was not to stay long at Changi.

On 3rd June 1975, the Government announced that decision was made to develop the airfield at Changi into Singapore's new international airport to replace Paya Lebar. To make way for the initial developments, the two Skyhawk squadrons were moved to Tengah in August 1975. The remaining RSAF units were to stay until Changi was fully developed for the airport.

The Changi Plan

Building Changi Airport from a blank sheet was a mammoth task undertaken by the young Singapore civil service. The plan comprised of two parallel runways with the passenger terminal complex, aircraft parking aprons and the control tower located in between. North of the passenger terminal complex were a 60ha cargo complex and a hangar which could accommodate up to three Boeing 747 aircraft. South of the passenger terminal complex were two flight kitchens.

To achieve this quantum leap in capacity, the total airport land area devoted to Changi was 1,663ha, five times the size of Paya Lebar Airport. Much of the land required was reclaimed through the biggest contract in Southeast Asia at the time totaling $239.1 million.

The basic philosophy in the planning of the new Changi Airport was one of flexibility, functional simplicity, time-tested and proven concepts, and systems. Considerable attention was also given to landscaping and interior décor to provide a relaxing, peaceful and pleasant atmosphere. This included exterior landscaping that begins well before the airport boundary.

Construction was subdivided into two phases. Under Phase 1 was one runway, a 220,000sqm passenger terminal with a handling capacity of 10 million passengers a year or 5,000 passengers at peak hours, 45 jumbo aircraft parking bays and associated ancillary facilities. Phase 1, targeted for completion by 1981, was projected to meet requirements up to the mid-80s when Phase 2 of the development project, with the second runway, another passenger terminal and other supporting facilities would be completed.

The Mylar cord fountain which became synonymous with Terminal 1. It was later replaced with the Kinetic Rain Installation.

Model of Changi Airport.

A New Gateway to Singapore and the Region

Changi Airport was opened for on 1st July 1981, a significant milestone for Singapore civil aviation. Singapore Airlines' Flight SQ101, was the first scheduled commercial flight to land at Changi Airport. The Boeing 727 flight from Kuala Lumpur, touched down at Changi Airport at 7.10 am with 140 passengers.

First commercial flight to land at Changi Airport in 1981: a Boeing 727 with flight number SQ101 arrived from Kuala Lumpur. Photo: Unknown

Thirty-four airlines used Changi when it opened. There were 1,200 scheduled flights each week connecting Singapore to 67 cities in 43 Countries.

Costing $1.3 billion, Changi Airport then operated with one passenger terminal and a cargo complex which was gazetted as a free trade zone. In the first year of service, it handled 8.1 million passengers, 193,000 tonnes of airfreight and 65,054 aircraft movements.

With Phase I barely completed in 1981, Phase II was launched which included a second runway, adjoining taxiways, 23 aircraft parking bays, a second fire station and a third cargo agent building. With two independent runways, Changi Airport would have the capacity to handle up to 80 aircraft movements per hour.

Passenger traffic at Changi Airport hit the 10 million mark by end of 1986. In the same year, construction of Terminal 2 to meet the increase in demand began.

By 1988, Singapore had its 100th air destination in the global airline network when a new service began between Singapore and Langkawi in north-west Peninsula Malaysia on 7th August. The new connection boosted the image of Changi Airport as the international air hub with the largest number of international air links in the Asia-Pacific region. That same year, Changi Airport received its first Best Airport In The World Award given by Business Traveller (UK). It would go on to clinch this award for the next consecutive 10 years. This was a precursor of many more awards to come.

Terminal 2 was opened in 1990 with a capacity of 23 million passengers per annum (mmpa). The new 285,000sqm terminal was 30% bigger than Terminal 1. Six storeys high, Terminal 2 had two four-level finger piers at each end. A people-mover system shuttles passengers between the two adjoining terminals.

Improvements never stop at Changi Airport. Even as new terminals are built, older terminals are continually upgraded and expanded to meet the growing demands and expectations of the travellers. The capacity of Terminal 1 was expanded to 21 mmpa by 1993.

A Global Air Hub

A decade later, in 2004, Changi's Terminal 1 and Terminal 2 was serving 30 million passengers, about 68% of the total airport capacity.

On 11th November 2005 Changi Airport became the first airport outside Europe to welcome the Airbus A380 when the super jumbo double-decker aircraft arrived for airport compatibility verification tests. Changi was also the first airport in the world to have a completed third Passenger Loading Bridge ready for simulation tests with the A380 aircraft. This was part of the $60 million upgrade to make Changi Airport A380 ready.

Changes to the aviation landscape saw a growing presence of low-cost carriers (LCCs). To meet the burgeoning demand for LCC flights, a Budget Terminal (BT) became operational on 26th March 2006. The $45 million BT served more than 3,000 passengers during its first day on 16 regional flights.

Terminal 3, spanning 350,000 sq metres of floor space and with 28 aerobridges was opened in 2008 with a capacity of 22 mppa. The new $1.54 billion terminal was also designed to have the capability to handle the super jumbos of the 21st century. The total passenger number at Changi Airport hit 58.7 million in 2016, about 90% of the total airport capacity.

Though never in the mind of the pioneers who embarked on the design of Changi Airport to create an award-winning airport, Changi did not achieve its status by chance. Right from the design stage, it was to create a pleasant experience for the travellers and visitors. The story of Changi would continue with episodes of troubles, tenacity and triumph.

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EU-ASIA SYMPOSIUM ON UAS/UAM: KEY TAKEAWAYS AND HIGHLIGHTS

More than 180 participants from the UAS/UAM industry, academia, and regulators gather to exchange ideas and discuss the future of drones and air mobility

Members of the Singapore UAS Community participated in and presented at the inaugural European Union–Asia Symposium on Unmanned Aircraft Systems (UAS) and Urban Air Mobility (UAM) held at the Goodwood Park Hotel from 18 to 21 October 2022.

Organised by the Civil Aviation Authority of Singapore (CAAS) and the European Union Aviation Safety Agency (EASA), the event marked the first time that regulators from Europe and Asia-Pacific were gathered to discuss UAS and UAM regulations alongside leading industry players and researchers. With over 20 civil aviation authorities participating in the four-day symposium, there was a great engagement among participants, leading to important discussions on UAS and vertical take-off and landing (VTOL) development and regulations.

Some 140 participants attended the event in-person in Singapore and with others joining in online. Photo: NTU International

Key Discussion Points

Industry players provided regulators with valuable feedback on the future of the industry on day 1 of the symposium. One of the key points made was the expectation that in the next 10 years, demand for UAM and BVLOS (Beyond Visual Line of Sight) operations over populated areas would increase exponentially. As such, it is crucial for regulators to drive the development of appropriate regulations that can support the growth of the industry while ensuring safety and security.

The cost per mile of air taxis was another significant factor that was discussed, with industry players predicting that the cost per mile of air taxis would eventually become similar to ground transportation, making UAM more accessible to a wider range of consumers. However, the reduction of cost and battery weight would be a major driver of commercial viability, as these factors can significantly impact the economics of operations.

Public acceptance of UAM operations was also identified as a critical factor in the success of the industry. Industry players emphasised the need to gain public acceptance, among others by iterating respect for privacy and the natural environment. Industry players agreed that there would need to be coordination and cooperation with regulators to ensure that the necessary safeguards are in place to protect the privacy of individuals while also minimizing the impact of UAM operations on the environment.

In relation to this, research on UAS traffic management and airspace integration was also identified as key to enabling scalable operations. Industry players underscored the importance of continued research in this area to

develop effective systems that can manage the increasing number of UAS and UAM operations. Global harmonization of standards for UAS, UAM, UTM-U-Space and vertiports were also seen as key to ensuring that regulations and standards are consistent across different regions and countries. This would enable the seamless integration of UAM operations into aviation systems and for cross-border operations.

A Common Goal of Promoting Urban Air Mobility

The symposium was also marked by the signing of a Memorandum of Understanding between CAAS and EASA on 18 October 2022 with CAAS Director-General Mr Han Kok Juan and EASA Strategy and Safety Management Director Mr Luc Tytgat as signatories. Through the MOU, the regulators signalled their commitment to collaborate on regulatory standards and safety requirements for VTOL aircraft, including the competencies of personnel involved in the operation of such aircraft, the certification requirements for operations in hot and humid environments and the requirements for training organisations. The MOU also covered collaboration on strategies for outreach to relevant stakeholders on urban air mobility and analysis on public attitudes towards urban air mobility and VTOL, as well as conferences, workshops and other joint activities on the industrys.

Describing the CAAS-EASA MOU as a 'pathfinder', Mr Han said, "In the last few years, we have seen quantum leaps in UAS and UAM development. The potential benefits are tremendous. Realising them will require concomitant development in regulation and regulators need to keep pace with technology and business developments to assure safety and security and build public confidence and acceptance. As the technology is novel, we cannot do this alone but need to work together to share knowledge and pool regulatory resources."

As part of the programme, a field visit to the Maritime Drone Estate was held to provide attendees with an opportunity to learn how Singapore facilitates the development of novel technology in a regulatory test-bed environment. The visit allowed participants to witness first-hand how unmanned systems and autonomous vehicles were being tested and deployed in maritime logistics and surveillance. The symposium concluded with a networking evening hosted by CAAS at the National Gallery.

Overall, the EU-Asia Symposium on UAS/UAM and the CAAS-EASA MOU highlight the proactive approach towards regulatory development and demonstrates the regulators' commitment to keeping pace with advancements in the industry. This is well summed up by Mr Tytgat, "We know that traditionally regulators lag behind industry developments and innovations. Both this MOU and the wider symposium will contribute to regulators getting ahead of the technology curve in support of our future safety oversight responsibilities."

(From left) Mr Luc Tytgat and Mr Han Kok Juan, representing EASA and CAAS respectively at the signing of the MOU. Photo: NTU International

Mr Ryan Lee, CEO & Co-Founder of Heron AirBridge, providing a briefing and demo at the Maritime Drone Estate. Photo: NTU International

AAIS 20TH ANNUAL GENERAL MEETING

The Association of Aerospace Industries (Singapore) held its 20th Annual General Meeting on 27 October 2022 at the InterContinental Singapore, marking the first physical AGM since the pandemic.

In his opening address to members, AAIS President Mr Wong Yue Jeen noted that the aerospace industry had turned a corner in tandem with aviation's recovery, with the sector operating at near or above pre-pandemic (2019) output since March 2022. Even as the outlook for the coming months remained buoyant, the industry was very mindful of the challenges looming due to the instability of the geopolitical and macroeconomic environment.

AAIS President Wong Yue Jeen, addressing members at the top of the AGM

From left: Hon. Secretary Lim Hee Joo, President Wong Yue Jeen, and Asst. Treasurer Yap Siok Leng

Mr Wong emphasised the important role of the Association in galvanising the community for collective action and elaborated on the focus areas in the coming year encompassing Safety, Sustainability and Supplier Development.

Following the opening address, Honorary Secretary, Ms Lim Hee Joo, presented highlights of the past year's activities. Assistant Honorary Treasurer, Ms Yap Siok Leng, then provided an overview of the Association's financial performance for the past fiscal year.

The AGM endorsed the FY2021/22 Annual Report and audited Financial Report, reappointed Ernst & Young as the Honorary External Auditor, and reappointed Mr Paul Sandosham of Clifford Chance as the Honorary Legal Advisor.

At the AGM, Mr Mark Loh, General Manager of Bell Textron Asia Pte Ltd was elected as a member of the Management Committee FY2021/23. This was to fill a vacancy left by Mr Kevin Chow of Thales Solutions Asia who had stepped down from the MC in August 2022 to take up a new role overseas.

Members recorded their appreciation to Mr Chow and congratulated Mr Loh on the appointment.

The AGM formalities concluded with closing remarks from President, who provided a glimpse of the exciting activities planned for the coming year in conjunction with the Association's 20th anniversary in 2023. Mr Wong called on members for support, contributions and participation in the events and projects.

Members were glad to be back meeting face-to-face at the first physical AGM since the pandemic

In the next part of the programme, members heard informative presentations on the topics of Sustainability, Supplier Development and Manpower. Mr Chan Mun Wei, Programme Director of Sustainability, provided an overview of the AAIS Sustainability Roadmap. This was followed by Mr Loh Wai Cheong, Senior Industry Transformation Advisor who shared about the Jobs Development Partner (JDP) Programme of which AAIS is a TAC partner. Rounding off the presentations, Ms Marlia Isnin and Ms Mathia Lee from Workforce Singapore shared about WSG's manpower findings, initiatives and programmes for the aerospace and aviation sectors.

The event ended with a networking session among the guests. AAIS thanks the event sponsor, Workforce Singapore, for their forthcoming and generous support, and all members for actively participating.

NEW FACES ON AAIS MC/ PANEL OF EXPERTS

Mr Mark Loh
General Manager, Asia
Bell Textron Asia (Pte) Ltd
Elected to AAIS Management Committee - October 2022

Mark was appointed General Manager of Bell Asia in 2022. In this role he is responsible for directing the Bell Asia Pacific business strategies for maintenance repair and overhaul (MRO). Mark joined Bell in 2019 and was tasked to set up Bell's MRO facility in Zhenjiang, China.

Before joining Bell, Mark was Vice President, MRO Operations for Airbus Southeast Asia in Singapore. He joined Airbus after serving as Head, Military Sales in ST Engineering. He had also served in the Republic of Singapore Air Force (RSAF) for 27 years, before retiring as Head, Helicopter Branch.

Mr Tan Lye Teck
Executive Vice President, Safety & Security
Changi Airport Group (CAG) Singapore
Appointed to AAIS Panel of Experts - January 2023

Lye Teck currently oversees safety, security, emergency services and cyber-security at CAG. He was previously EVP Airport Management, overseeing airport management functions at Singapore's Changi and Seletar Airports. Prior to CAG, Lye Teck held various management roles in the Civil Aviation Authority of Singapore (CAAS), including as Deputy Director-General, before crossing over to CAG in 2009.

In managing the airport, Lye Teck has overseen capacity management and continuing development of Changi Airport's facilities, including opening the Budget Terminal in 2006, Terminal 3 in 2008, Terminal 4 in 2017 and Runway 3 in 2020. He is currently overseeing the redevelopment of Terminal 2.

DEVELOPING A SUSTAINABLE AIR HUB IN SINGAPORE

Mr Daniel Ng highlighting key recommendations from the IAP report

As Singapore steps up its green ambition towards achieving net-zero emissions by 2050, the aviation industry has also been shaping strategies to ensure sustainability in recovery and growth.

AAIS was pleased to hold a briefing on 2 November on Developing a Sustainable Air Hub in Singapore, sponsored by inter airport Southeast Asia. The keynote was delivered by Mr Daniel Ng, Chief Sustainability Officer and Director (Air Transport) at the Civil Aviation Authority of Singapore, covering the 15 initiatives and recommendations from the International Advisory Panel (IAP) to decarbonise the aviation sector across three key domains of airport, airline and air traffic management. Participants then heard another enlightening presentation by Ms Tan Yen Ling, Head of Sustainability and Strategic Projects at SATS who shared on the sustainability practices and initiatives being rolled out internally at SATS and for clients of its ground handling and in-flight services.

The presentations were followed by an engaging panel discussion moderated by AAIS Programme Director for Sustainability Mr Chan Mun Wei. The discussions were enlivened by questions and comments from the attendees, covering a wide range of topics such as embedding ESG awareness across an organisation, positioning to capture the growing market for green air travel, greening of airside vehicles in the airport, and strengthening of infrastructure to adapt to climate-related risks.

Ms Tan Yen Ling engaging with participants during her presentation

INDUSTRY PREVIEW OF AEROSPACE ITM 2025 BY EDB

The Singapore aerospace industry is turning a corner. In March 2022, aerospace production levels exceeded pre-pandemic levels for the first time on a monthly basis. Growth has continued at a steady pace, with preliminary data showing total aerospace output expanding by 27.7% on a year-to-date basis from January to December 2022, over the previous year.

As the industry positions to capture more opportunities, the Singapore Economic Development Board (EDB) has launched the Industry Transformation Map (ITM) 2025 which aims to cement Singapore's position as a global node for aerospace manufacturing and Maintenance, Repair, and Overhaul (MRO) activities, with leadership in engine MRO. It also aims to pave the way for participation in future aircraft development programmes in emerging areas. An update from the previous iteration (ITM 2020), Aerospace ITM 2025 addresses the systemic shifts arising from the COVID-19 pandemic, highlighting key strategies and initiatives to support the industry in recovery and beyond.

AAIS was pleased to organise an industry preview of the refreshed Aerospace ITM on 10 October 2022. Held at Seletar Aerospace Park, the preview was attended by representatives from across the industry, government agencies and academia. Mr Abiel Neo, Assistant Vice President, Capital Goods at EDB delivered a comprehensive briefing on the ITM, sharing its target for the aerospace industry to achieve S$4.6 billion in Value-Add (VA) by 2025, and restoring total employment of the industry to pre-pandemic levels of 22,000 by adding 3,000 jobs. This would be driven by capability and capacity building for manufacturing and MRO, with a focus on strengthening our leadership position in engine MRO.

Under the ITM, agencies will partner with aerospace companies, AAIS and relevant organisation in the following key areas:

- Driving transformation through technology
- Helping SMEs fly high on the global stage
- Investing in talent
- Gearing up for sustainability and Advanced Air Mobility (AAM)
- Emerging stronger through tripartism and partnerships with Industry Associations

Following the ITM briefing, participants engaged with a panel consisting of Mr Neo, Mr Wilin Ng, Chief Commercial Officer at SIA Engineering Company Ltd and moderator Dr Kenneth Low, Deputy Cluster Director of Singapore Institute of Technology. The panel took questions from the audience and had robust discussions on the new strategies, initiatives and shaping the future of the Singapore aerospace industry. Participants also heard from AAIS President, Wong Yue Jeen, who shared on the role of the Association in supporting priority areas for members.

All present took the opportunity to network during the coffee break and reception. AAIS thanks all speakers and industry representatives for a very engaging session.

Panel discussion with (from left) Mr Wilin Ng of SIAEC, Mr Abiel Neo of EDB and Dr Kenneth Low of SIT and AAIS MC as moderator

Briefing attendees included many senior executives from OEMs, suppliers, solution providers from across the sector

AAIS ANNUAL FUTSAL TOURNAMENT 2022

Even before the World Cup fever grips football fans globally, AAIS saw dramatic and nail-biting moments on the pitch at our very own AAIS Annual Futsal Tournament 2022. Held in the afternoon on Saturday, 19 November at the FutsalArena@Yishun, the event saw teams from organisations across the aerospace industries vying for the Championship trophy and bragging rights as the top Futsal team in the sector.

After a two-year pause on the popular tournament, participants were ready and raring to go, enlivened by strong support from colleagues and family members on-site. The tournament saw spirited competition between teams right from the very first whistle.

Ultimately, Singapore Aero Engine Services Private Limited (SAESL) emerged as champions, with Rolls-Royce Singapore and Advance Remanufacturing and Technology Centre as runners-up. Fourth place went to Pratt & Whitney Component Solutions. Our heartiest congratulations to all players, especially Mohammed Imran bin Ismail, the 2022 Tournament's Most Valuable Player!

We thank all players and members for their keen support, as well as everyone who attended for creating an electric atmosphere. See you at our next sporting tournament!

Tournament Champions: Team SAESL

First runner-up: Team Rolls-Royce

Second runner-up: Team ARTC

Fourth place: Team P&W Component Solutions

AEROSPACE COMMUNITY DAY 2023

AAIS organised Aerospace Community Day 2023 in conjunction with the Chinese New Year as a platform for the industry and aerospace professionals to give back to the community. The event, which took place at two elderly care homes on 30 January and 1 February lifted the spirits of volunteers as well as some 470 elderly residents, including 70 seniors at St. John's Home and 400 residents at Bright Hill Evergreen Home.

Volunteers from the industry came together, spending heart-warming afternoons with the residents of the two homes. No effort was spared as they prepared fun-filled programmes including 'Lohei', interactive games (e.g Bingo, Passing the Parcel etc), and crowd-favourite sing-along sessions, creating a festive atmosphere in celebration of the CNY festivities. The residents thoroughly enjoyed the activities and showed their appreciation by participating with enthusiasm. In addition, the volunteers distributed oranges, red packets, and lunch/tea-time snacks to the elderly.

This event was made possible thanks to the positive energy, compassion and collaboration of the volunteers in attendance. We received great feedback on the event and were delighted to have been able to make a positive impact on the lives of the elderly residents.

AAIS would like to record our appreciation to the following groups, companies and individuals for their contributions, voluntarism and support for Aerospace Community Day 2023:

- AAIS Management Committee members
- Alton Aviation Consultancy Singapore Pte Ltd
- Singapore Aero Engine Services Pte Ltd
- Pratt & Whitney Turbine Overhaul Services Pte Ltd
- Wencor, LLC
- Mr Michael Daniel
- Embry-Riddle Aeronautical University (ASIA)
- NUS Aviation Club

We look forward to the continued support of members to enable us to bring more of such engaging and fulfilling events to the community.

Volunteers and residents enjoyed the festive mood at the St John's Home

Students from aviation clubs joined industry volunteers at the Bright Hill Evergreen Home

CNY HOST NETWORKING EVENING

The Singapore aerospace and UAS community came together for the first HOST Networking session of the year held on 2nd February 2023 at the Grand Mercure Roxy. With over 80 aerospace professionals in attendance, the event, held in conjunction with the Lunar New Year, was a fantastic opportunity for networking and discussions.

AAIS Chief Executive Sia Kheng Yok kicked off the evening by addressing members in attendance and highlighting exciting events and projects in 2023. He also took the opportunity to introduce new members of AAIS and the UAS community, as well as government agency representatives who were present at the event.

A highlight of the evening was the customary "tossing of the salad" or Lo-Hei which added to the festive atmosphere. The evening came to a close on a high with a lucky draw which saw 5 lucky winners.

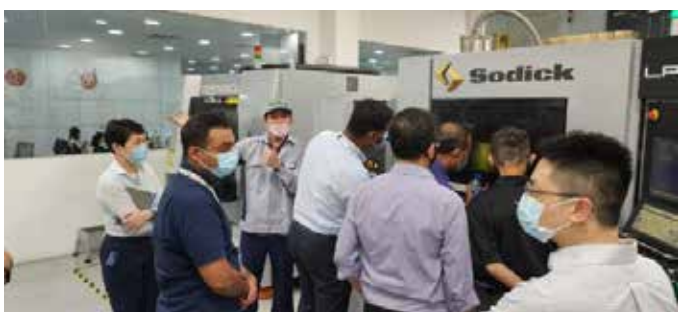
We thank Workforce Singapore for co-sponsoring this event and urge members to find out more about the manpower support programmes for the industry, including the Career Conversion Programme for New Hires, Job Redesign, and Capability Transfer.

LEARNING JOURNEY TO SODICK SINGAPORE TECHNO CENTRE (SSTC)

AAIS and Sodick Singapore Techno Centre (SSTC) organised a learning journey on 12 January 2023 for members and industry participants to learn more about advanced manufacturing capabilities for business transformation. The event received a lot of interest with over 30 participants on site.

Before the tour, presentations on Additive Manufacturing (AM) and design freedom case studies were shared by speakers from the Singapore Institute of Technology (SIT), illustrating the potential of AM in future manufacturing. Then, participants were brought around SSTC's Manufacturing Centre and its Additive Manufacturing Lab, which showcased Sodick's latest 3D printers and machines that integrate IoT for data collection and analysis. The state-of-the-art machines and integrated systems allow SSTC to serve as a one-stop shop for solutions to increase productivity and efficiency.

On behalf of members and participants, we thank our hosts, SSTC and SIT, for an enriching afternoon.



SINGAPORE PAVILION AT MRO EUROPE 2022

AAIS coordinated the Singapore Pavilion at MRO Europe 2022, held from 18 to 20 October in London, UK. The event featured a three-day senior-level conference with over 30 expert speakers sharing insights and knowledge about the latest trends and innovations in the aviation industry. In addition to the conference, MRO Europe also featured a two-day international exhibition.

Singapore Pavilion exhibitors attracted a lot of interest at MRO Europe 2022

MRO Europe brought together over 7,000 attendees and 400 exhibitors from across the aviation industry. Seven Singapore companies joined us to pursue opportunities in the commercial aviation aftermarket.

Overall, the Singapore pavilion exhibitors found MRO Europe to be a highly valuable event that provided excellent opportunities for business development and networking, as well as a chance to showcase their products and services to a global audience including airline operators, MRO providers, and OEMs. They were also able to engage in conversations about industry trends and emerging technologies, and to learn about the latest developments in the aviation industry.

Singapore Pavilion @ MRO Europe 2022 (Booth 1611)

Exhibiting Companies

- AMS Decision Pte Ltd
- Aviation Partner And Consulting Pte Ltd
- Coway Engineering & Marketing Pte Ltd
- CW Aero Services Pte Ltd
- KBG Contract Machining Pte Ltd
- Prime Aerospace Pte Ltd
- RexAdvance Technology Pte Ltd

Coordinated by: Association of Aerospace Industries (Singapore)

Supported by: Enterprise Singapore

AAIS YEAR-END NETWORKING EVENING

AAIS warmly welcomed members of the aerospace and UAS communities as well as partners to our Year-End HOST Networking evening on Thursday, 1 December 2022. The event brought out the festive spirit and marked the return of in-person HOST networking evenings for members since going virtual during the circuit breaker in 2020.

AAIS President Wong Yue Jeen kicked off the evening with an update on industry and AAIS activities, highlighting upcoming projects in conjunction with the Association's 20th anniversary in 2023. Simon Wayne, GM for Asia Pacific at Bombardier Singapore Service Centre – co-host of the evening – then gave a brief overview of the facility and its capabilities. Guests were invited on an exclusive tour of the centre, which boasts the first business jet paint facility in Asia-Pacific, an integrated parts depot with US$15 million in parts inventory, office and lounge facilities for Bombardier customers and full-service interiors workshop, among others.

Attendees relished the opportunity to reconnect face-to-face with industry friends and get to know new faces. Some gamely participated in a special quiz, identifying and singing familiar Christmas tunes. The lovely evening came to a close with a lucky draw, which saw 3 lucky guests winning prizes, including a Bombardier aircraft model.

Guests agreed that it was a fruitful, yet relaxed and fun evening. We thank everyone for joining us, Simon and his team at Bombardier Singapore Service Centre for their warm hospitality and excellent support for the event.

AAIS GUEST BOOK

The Association of Aerospace Industries (Singapore) is delighted to receive international delegations at Seletar Aerospace Park. The visits provide opportunities for us to share the developments of the Singapore aviation and aerospace industries find out about aerospace industry developments in the visitors' countries and regions, as well as discuss opportunities for international business collaboration. Here are some recent highlights:

Incheon Metropolitan City Maritime Affairs and Aviation Bureau (Republic of Korea)

26 September 2022

Led by Director General Hyun-Mo Yoon and facilitated by Starburst, the visiting delegation included the Incheon Industry-Academy Collaboration Institute. The meeting saw a useful exchange on the latest industry developments in aerospace and the emerging UAM/AAM sector. As Incheon and Singapore share similarities as maritime and aviation hubs, the discussion considered possibilities for benchmarking, information exchange and cooperation.

Delegation from Can Tho City (Socialist Republic of Vietnam)

13 October 2022

AAIS was pleased to welcome a delegation from Can Tho City, Vietnam, to Seletar Aerospace Park. The delegation was led by the Chairman of the Can Tho People's Committee, Mr Tran Viet Truong and facilitated by Ingrid International. Following an exchange of presentations and discussion on the promotion of Can Tho City, an MOU was signed between Mrs Nguyen Thi Kieu Duyen, Director of Can Tho Promotion Agency and Mr Tan Chye Kin, Chairman of Ingrid International.

European Parliament Transport Committee (European Union)

2 November 2022

The delegation was visiting Singapore to explore innovative solutions in the transport sector. Led by Committee Chair MEP Jens Gieseke, the delegation visited AAIS and Skyports Drone Services. Chief Executive AAIS, and Sanjay Suresh and Koh Jia Le of Skyports briefed the delegation on the aviation and aerospace recovery, and development of drone services in Singapore.

University of St Gallen's Aviation Management Course (Switzerland)

3 November 2022

Seletar Aerospace Park's industry ecosystem continues to be a draw – this time for students of the Aviation Management Compact Course. AAIS selectively provides guest lectures to visiting students enrolled in Masters and Executive Education courses. These provide collaborating institutions with insights into one of the world-leading Aerospace clusters and the success of Seletar Aerospace Park in attracting global investors.

OUR NEW MEMBERS

ORDINARY MEMBERSHIP
Field International Pte Ltd

Incorporated in 1995, Field International is a privately owned independent group of global engineering companies serving a customer base across the aerospace, transport, energy and medical industries. Backed up by deep engineering capabilities, we provide high-quality products and intelligent solutions to meet the rapidly evolving needs of our customers.

ORDINARY MEMBERSHIP
IAI Asia Pte Ltd

A leader in defense, aerospace, and commercial markets, IAI leverages state-ofthe-art technology in delivering large turnkey projects. IAI covers the full spectrum of technologies and capabilities for design, integration, testing, certification, manufacturing, marketing, and product support of manned and unmanned aircraft. The group also provides comprehensive maintenance services (MRO) for aircraft, engines, and components.

ORDINARY MEMBERSHIP
Inmarsat Solutions Pte Ltd

Inmarsat is a leader in global mobile satellite communications, with wholly owned and operated networks and satellites which provide safety and operational communications to thousands of aircraft globally. We are trusted by airlines, ANSPs, OEMs, business aviation and international regulatory authorities to keep the cockpit and cabin securely connected at 35,000 feet.

ASSOCIATE MEMBERSHIP
CF Global Technologies Pte Ltd

CF Global Technologies established since 2010 provides industrial products under our group of companies with a special focus in turbine industries. We specialize in supplying capital equipment like Adaptive machining systems, Automated/ manual Precision TIG welding machines, Heat Treatment Solutions, Coating Solutions APS/HVOF, Micro Resistance Welding machines, Drilling Technology for cooling holes as well as Cleaning, FPI & MPI Automated equipment.

ASSOCIATE MEMBERSHIP
Hexagon Metrology Asia Pacific Pte Ltd

Hexagon is a global leader in sensor, software, and digital information technology solutions. We put data to work to boost quality, efficiency, and productivity across industrial, manufacturing, infrastructure, safety, and mobility applications. Our technologies are shaping the two ecosystems of smart manufacturing and smart cities, making them increasingly connected and autonomous

ASSOCIATE MEMBERSHIP
JAC Recruitment Pte Ltd

We are an international recruitment consultancy dedicated to connecting companies with high-level talent across Asia, the US and Europe. Our approach to business is firmly underpinned by our core values, championing freedom, discipline and fairness in delivering exceptional standards of service to our clients with speed and sincerity.

Scan to find out more about our members and membership benefits!

AAIS TRAINING CALENDAR

The Professional Development arm of AAIS offers a spectrum of training and development programmes throughout the year. These range from general or soft-skill courses to industry-specific certification courses.

AEROSPACE STANDARDS/ CERTIFICATION

Understanding & Implementing AS 9100:2016 QMS*
16 March 2023
13 April 2023
25 May 2023
22 June 2023

AS 9100:2016 Internal Auditor Course*
16 & 17 March 2023
13 & 14 April 2023
25 & 26 May 2023
22 & 23 June 2023

Understanding & Implementing AS 9120:2016 QMS*
16 March 2023
13 April 2023
25 May 2023
22 June 2023

AS 9120:2016 Internal Auditor Course*
16 & 17 March 2023
13 & 14 April 2023
25 & 26 May 2023
22 & 23 June 2023

PROBITAS AS/EN/JISQ 9100:2016 Rev D Lead Auditor
13 to 17 March 2023

AS 9110C / EN 9110:2016 Foundation Course
3 & 4 April 2023
12 & 13 June 2023

AS 9110C / EN 9110:2016 Internal Auditor Course
20 & 21 April 2023
15 & 16 June 2023

Fundamentals to Aerospace Quality Management System (AQMS)*
26 & 27 June 2023

INTERNATIONAL STANDARDS/ CERTIFICATION

ISO 9001:2015 Internal Auditor Training*
7 & 8 March 2023
4 & 5 April 2023
9 & 10 May 2023
13 & 14 June 2023

IRCA ISO 9001:2015 Lead Auditor Training*
13 to 17 March 2023
10 to 14 April 2023
15 to 19 May 2023
5 to 9 June 2023

ISO 14001:2015 Internal Auditor Training*
4 & 5 April 2023
13 & 14 June 2023

IRCA ISO 14001:2015 Lead Auditor Training*
10 to 14 April 2023
5 to 9 June 2023

ISO 45001:2018 Internal Auditor Training*
7 & 8 March 2023
9 & 10 May 2023

IRCA ISO 45001:2018 Lead Auditor Training*
10 to 14 April 2023
5 to 9 June 2023

Integrated Management System Internal Auditor Training (ISO 9001:2015, ISO 14001:2015, ISO 45001:2018)*
6 to 8 March 2023
8 to 10 May 2023

ISO 22301:2019 Internal Auditor Training#
28 & 29 March 2023

IRCA/CQI Certified ISO 22301:2019 Lead Auditor Training#
17 to 21 April 2023

ISO 27001:2013 Internal Auditor Training#
7 & 8 March 2023

IRCA/CQI Certified ISO/IEC 27001:2013 Lead Auditor Training#
13 to 17 March 2023

ISO 27001:2022 Internal Auditor Training#
21 & 22 March 2023
13 & 14 June 2023

IRCA/CQI Certified ISO/IEC 27001:2022 Lead Auditor Training#
19 to 23 June 2023

IRCA/CQI Certified ISO 50001:2018 Lead Auditor Training#
27 to 31 March 2023

INDUSTRY INTRODUCTION & FAMILIARISATION

Intro to Aerospace Industry
11 & 12 May 2023

INDUSTRY PRACTICES

Human Factors and Error Management
31 March 2023

EASA REGULATIONS

EASA Part 145 One Day Refresher Course – Introduction of SMS Requirement#
27 April 2023

EASA Part 21 Subpart J - Design Organisation Approvals (DOA)#
24 to 27 April 2023 (4 half weekdays)

FAA REGULATIONS

FAR 145 Approved Training Programs – Train the Trainer*
24 March 2023

FAA Part 145 Safety Assurance Systems (SAS) Repair Stations including EASA differences, PMA/TSOA & Approved Parts, FAA Form 8130-3 Usage, and SMS Updates*
27 & 28 March 2023

FAA Part 145 Safety Assurance Systems - Accountable Manager Training#
19 & 20 June 2023 (2 half weekdays)

NADCAP

Advanced Pyrometry
18 & 19 May 2023

QUALITY TOOLS & TECHNIQUES

Root Cause Analysis (RCA)
9 & 10 March 2023
4 & 5 May 2023

Measurement System Assessment (MSA)
27 & 28 March 2023
7 & 8 June 2023

Failure Mode & Effect Analysis (FMEA)
24 & 25 April 2023
26 & 27 June 2023

Six Sigma – Green Belt#
20 to 24 March 2023
17 to 21 April 2023
15 to 19 May 2023
19 to 23 June 2023

SAR REGULATIONS

Singapore Airworthiness Requirements (SAR) Part 21
29 May to 1 June 2023
(4 half week days)

SPECIAL PROCESSES (NEW)

Pyrometry Heat Treat Applications for Aerospace Qualification*
25 to 27 April 2023

Welding Applications for Aerospace Qualification*
8 to 10 May 2023

NDT Level II - Penetrant Inspection Applications for Aerospace Manufacturing Qualification
22 to 25 May 2023

NDT Level II - Magnetic Particle Inspection Applications for Aerospace Manufacturing Qualification
29 May to 1 June 2023

Shot Peening Applications for Aerospace Qualification*
7 to 9 June 2023

Flap Peening Applications for Aerospace Qualification*
12 to 14 June 2023

*Information is accurate at time of printing. AAIS reserves the right to re-schedule or cancel any course due to unforseen circumstance.

See all training courses.

AAIS Training

Legend:

#Virtual Instructor Led Training (VILT)
*Hybrid Classroom Training

For enquiries, contact Jen Ng at +65 6922 1788 or email us at training@aais.org.sg

Association of Aerospace Industries (Singapore)

Association of Aerospace Industries (Singapore)

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