

FEATURE

TRANSFORMING SINGAPORE'S AEROSPACE INDUSTRY

An aerial photograph of Gardens by the Bay in Singapore. The image shows several large, pink, spiky Supertree structures with circular glass canopies. A large green lawn is visible in the upper left, and a winding path or road cuts through the lush greenery. The overall scene is vibrant and modern.

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Singapore's strategic location, well-developed industrial base and supply chain, skilled talent pool and top-notch research institutes and universities have enabled it to emerge as one of the leading aviation and aerospace hubs in the Asia-Pacific region. To sustain its competitive advantage, the Singapore Aerospace community is repositioning itself in anticipation of changes to the landscape as a result of disruptive technologies and new business models. The recently launched Aerospace Industry Transformation Map encapsulates its strategies.

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Singapore is home to over 130 aerospace companies – one of the largest and most comprehensive concentrations of aerospace firms in the region. This includes home-grown giants, Singapore Technologies Aerospace (ST Aerospace) and SIA Engineering Company (SIAEC), and multinationals like Airbus, Boeing, Rolls-Royce, GE, Pratt & Whitney and UTAS.

These companies have significant operations in Singapore, engaged in engineering, manufacturing, maintenance, repair and overhaul (MRO), and research and development (R&D). Beyond MRO, Singapore is a prime location for advanced manufacturing, being already home to Asia-Pacific's only large commercial engine assembly and test facility and two major fan blade manufacturing facilities. The aerospace ecosystem has developed around this core to include a wide range of capabilities such as fleet management, asset management, component and spares distribution, special processes, NDT and laboratory services, aircraft leasing, pilot and crew training, and technical training, etc.

In 2016, Singapore's aerospace industry generated a total output worth S\$8.9 billion and accounted for 10 percent of global output. The nation is readying itself to ride the wave of growing demand for passenger aircraft in the next two decades. Global aircraft manufacturer, Airbus, projects that as many as 34,900 new aircraft – 34,170 passenger aircraft and 730 freighters – will be delivered by 2036. 40 percent will comprise replacements for ageing platforms and 60 percent will support the projected growth in global air travel. Over a third of worldwide aircraft



deliveries in the next 20 years is anticipated to be in the Asia-Pacific region, with fleet size expected to reach over 14,200 by 2036.

CHALLENGES AHEAD

Even as Asia-Pacific continues to present great growth opportunities across the value chain in manufacturing, MRO and aftermarket industry segments, Singapore's leading market position is constantly challenged by other countries. Neighbours Indonesia, Malaysia, Philippines, Thailand, and Vietnam aspire to be the next aerospace hub in the region, and have shown willingness to invest and offer incentives to attract foreign investments.

A Frost and Sullivan report

suggests that the Malaysian aerospace sector is expected to be the fastest growing in the region in the next 20 years, as it seeks its share of commercial MRO activities migrating to the region. The consultancy forecasts that the Malaysia's MRO sector is expected to grow at a compound annual growth rate of 8.45 percent with over 13,000 new technician and engineer jobs created by 2037.

"Aerospace MRO and manufacturing are highly global industries and migration of MRO services or manufacturing of parts can take place anywhere in the world where capacity is developed with adequate certifications and quality control in collaboration with global players," it stated. This is a



timely affirmation of Singapore's intent to effect a transformation of its capabilities and stay well ahead of the competition.

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According to the Singapore Economic Development Board (EDB), the aerospace industry is a key sector of growth for the country's economy, with a compounded annual growth rate of 7 percent in value-added over the past 20 years. The industry achieved a value-added of S\$3.35 billion, providing employment to 21,000 people in 2016, with locals accounting for 80 percent of this workforce.

Underscoring the importance of the sector, the Singapore government launched the Aerospace Industry Transformation Map (ITM) on 17 January 2018. This masterplan was developed in collaboration with industry partners, unions and trade associations. The Aerospace ITM provides directional guidance for development of the industry - articulating strategies to address emerging market opportunities. It also outlines a new basis for competitiveness, leveraging on technological developments such as digitalisation, data analytics, the industrial internet-of-things (IIoT), and additive manufacturing.

"The strong growth in Asia-Pacific presents opportunities

across the value chain in manufacturing, MRO and aftermarket industry segments," said Singapore's Minister for Trade and Industry (Industry), S. Iswaran at the launch.

"Aerospace companies will need to broaden their Asian footprint and innovate to address these new market needs," he added, "It is timely and essential that we plan and prepare for the way ahead. The Aerospace ITM aims to achieve an industry value-added of S\$4 billion and create about 1,000 new jobs by 2020."

To achieve these objectives, Singapore's Aerospace ITM has proposed three key thrusts that will guide efforts to transform the industry: operational excellence, technology innovation, and workforce development. Programmes and initiatives under these three strategies will be implemented with the aid of industry associations such as the Association of Aerospace Industries Singapore (AAIS) and Singapore Institute of Aerospace Engineers (SIAE), as well as unions, including those from the National Trades Union Congress (NTUC) Aerospace and Aviation Cluster.

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BOOSTING PRODUCTIVITY

As a small island state, Singapore has long recognised that its economic growth has to be sustained through improvements in productivity. It has continuously espoused the importance of skilled and multi-skilled labour, continuous learning, enhanced work practices and innovation to achieve greater output across all industries.

To enhance productivity in the aerospace industry, EDB encourages companies to invest in new equipment and infrastructure to drive improvements in output efficiency. For example, local aerospace company, Singapore Aerospace Manufacturing (SAM), is investing in advanced automation equipment, as well as, software and engineering capabilities to upgrade its existing production lines to manufacture next-generation aircraft components. The firm expects productivity gains of up to 30 percent through the efficiency and robustness brought about by the improved manufacturing processes. At the same time, SAM is also grooming a dedicated team to drive continuous improvement in future automation projects.

Companies are also developing new data-driven technologies to enable them to make better decisions in planning and operations. ST Aerospace, renowned for its depot level maintenance, aircraft upgrading, refurbishment, major structural repair and life extension programmes for wide range of general aviation and military aircraft, has initiated a digital and productivity transformation programme called Smart MRO. Through this initiative, the company will employ data analytics to optimise internal processes

and offer increased value to its customers through solutions like customised predictive maintenance. ST Aerospace will also adopt novel techniques such as drone-based aircraft inspection, and additive manufacturing for spare parts in a bid to improve cost efficiencies and turnaround time.

DRIVING INNOVATION

The Agency for Science, Technology and Research (A*STAR) is the leading public R&D agency in Singapore. A*STAR's mission-oriented and industry-specific research efforts support the innovation thrust of the Aerospace ITM. A*STAR's Aerospace Consortium has initiated over 120 aerospace research projects involving leading aerospace companies and OEMs since 2007. This has provided Singapore with a range of aerospace-related R&D capabilities in fields such as advanced materials, non-destructive inspection techniques, process automation, avionics and wireless communications.

With an eye on the future, Singapore's new focus areas for innovation could include industrial

internet-of-things, additive manufacturing, data analytics for predictive maintenance and asset optimisation.

The Advanced Remanufacturing and Technology Centre (ARTC) is a public-private collaboration between A*STAR, Nanyang Technological University (NTU) and industry. It was set up as the region's first centre for test-bedding and developing remanufacturing technologies. ARTC aims to leverage on the latest digital manufacturing processes to bridge technological gaps in the adoption of advanced remanufacturing processes that inject new life into worn or end-of-life components or products.

The ARTC, Rolls-Royce and Singapore Aero Engine Services Private Limited (SAESL) jointly launched the Smart Manufacturing Joint Lab in September 2017. The initiative is designed to develop next-generation aerospace manufacturing and MRO capabilities that are enabled by advanced processes, automation and digital technologies. The parties will invest up to S\$60 million over a five-year span to develop cutting-edge manufacturing technologies, such as



additive manufacturing of complex aero-engine components, and advanced robotic and automatic solutions.

WORKFORCE UPSKILLING/ RESKILLING

With automation and digitalisation rapidly transforming the global aerospace industry, Singapore has also launched the Skills Framework for Aerospace, an initiative that aims to equip its manpower with the necessary skills and knowledge to enable them to stay relevant in the digital era. The initiative is jointly developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG) and EDB, with participation from industry stakeholders, unions, and education and training institutions.

The Skills Framework provides important information about various aerospace sub-sectors, career pathways, occupations and job roles, as well as existing and emerging skills required to take on those opportunities. It is essentially also a career roadmap, designed to empower individuals to pursue career growth opportunities along or across four different tracks within the aerospace sector. Individuals who wish to join or progress within the Aerospace industry can use the Framework to assess their career interest, identify relevant training programmes to upgrade their skills and prepare for their desired jobs. The Skills Framework covers 86 job roles such as aircraft maintenance, fleet maintenance, aircraft engine and component maintenance, and manufacturing.

Singapore is also preparing its next generation to address the future challenges and requirements

of the aerospace industry as it continues to transform and adopt advanced manufacturing technologies. To meet this demand, the country's Institutes of Higher Learning (IHLs) will work closely with leading research institutes and private training providers – such as A*STAR's Singapore Institute of Manufacturing Technology (SIMTech) and TUM Asia – and industry to identify and develop industry-relevant training in emerging areas such as automation, data analytics, cyber security, and robotics. Temasek Polytechnic, for example, will be rolling out two

new SkillsFuture Earn and Learn Programmes (ELPs) in robotics and automation and the Industrial Internet of Things (IIoT).

The Aerospace ITM must be keenly attuned to industry trends, and its various initiatives must adapt and continually refined to help our enterprises respond quickly and effectively to changing economic conditions," Minister Iswaran reiterated, adding that with the strong support and active involvement of all stakeholders, he was confident that Singapore would succeed in this journey of economic transformation. ^{AS}

BELOW:
Singapore's
Minister for
Trade and
Industry, Mr S
Iswaran, at the
launch of the
Aerospace ITM

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AEROSPACE INDUSTRY TRANSFORMATION MAP

OUR VISION



SINGAPORE — Globally recognised aerospace nation, capable of design, engineering, production and aftermarket services for the world's major aircraft programmes.

TARGET BY 2020

Value add of **S\$4 billion**
an increase of >25% from 2015



Create **1,000**
new jobs



THE ROADMAP

PURSuing OPERATIONAL EXCELLENCE

- Adopting Automation and Industrial IoT
- Deepening of manufacturing engineering capabilities

DRIVING INNOVATION IN EMERGING TECHNOLOGIES

- Continued investment in developing public R&D infrastructure
- Developing industry-relevant technologies
- Providing regulatory support for new industry segments

EQUIPPING SINGAPOREANS WITH RELEVANT SKILLS

- Upskilling/reskilling existing and displaced workers
- Working with lead demand to train industry workforce
- Preparing the future workforce

DEEPENING TIES WITH INDUSTRY ASSOCIATIONS AS KEY PARTNERS

- Engaging industry through fostering greater collaboration with associations such as the Association of Aerospace Industries Singapore (AAIS) and Singapore Institute of Aerospace Engineers (SIAE)