



## PRESS RELEASE

### NEW INDUSTRY MEMBERS JOIN A\*STAR'S AEROSPACE R&D PROGRAMME DESPITE ECONOMIC DOWNTURN

*Membership grows to 16 since launch of Programme*

**Singapore, 20 February 2009:** Despite the current dismal global economic environment, aerospace-related multi-national companies and local enterprises are investing in R&D by collaborating with the Agency for Science, Technology and Research (A\*STAR) in Singapore. Recently, eight more companies took the bold step to join the Science and Engineering Research Council (SERC) Aerospace Programme, now in its second cycle, affirming their strong confidence in R&D in A\*STAR and Singapore.

Membership has increased to 16 since the launch of the SERC Aerospace Programme in 2007, and the new members of the Programme are: BASF, Coherix, MAG Industrial Automation Systems, GT Industrial, IPG Photonics, Resem Technologies, Sunny Instruments Singapore and Tru-Marine.

The members of the consortium firmly believe that technological advances through R&D hold the key to redefining air travel and creating the aerospace industry of the future. The members also believe that the current economic climate is not a reason to curtail

research spending since it presents an opportunity for companies to reconnoiter and plan for their future with investment in R&D. More poignantly, the industry understands that capability building is essential to hone the agility to respond to technological challenges that will remain after resolution of the current crisis.

The SERC Aerospace Programme offers an integrated R&D network members can effectively and strategically leverage on for the best resources and brain power to achieve their business objectives. With the breadth of industry experience and depth of technical expertise available in the consortium, members are also able to access R&D results to get first-mover advantage and seize new business opportunities. The alliance will also provide an economically viable option for members to address technological challenges and will help companies emerge stronger and faster from the economic downturn.

Commented Professor Chong Tow Chong, Executive Director of Science and Engineering Research Council, A\*STAR: “The increased membership despite the economic downturn confirms the relevance of the A\*STAR SERC Aerospace Programme to the industry. The companies realize the benefits of technology consortium which enable a group of like-minded members to participate in the development of innovative emerging technologies and overcome existing technological challenges for industry application cost effectively.”

Six new projects mark the commencement of the second cycle of the SERC Aerospace Programme. The technologies or outcomes developed can be applied to the entire aircraft, spanning from the body, wing, belly to the tail. These projects will work on the development of advanced materials for aircraft bodies, improvements for MRO and manufacturing processes as well as intelligent sensors for structural health monitoring and diagnostics (see FactSheet in Annex 2).

Bringing the total to 16 members are the eight members who joined the consortium earlier: The Boeing Company, EADS, Pratt & Whitney, Rolls-Royce, SIA Engineering Company, Sonatest Ltd, Rofin-Bassel Singapore and IDI Laser Services.

These members have started on the four first cycle projects of the SERC Aerospace Programme a year ago and are positive about their experience thus far. Encompassing research areas in Laser Processing, Advanced Robotics as well as Non Destructive Testing Techniques and Inspection, progress is underway and the technologies developed may be applied on the aircraft after suitable customization. (See FactSheet in Annex 2).

Singapore's aerospace industry has been growing strongly since it started in the 1970s. It has consistently achieved high compounded annual growth rate over the last 20 years, with a turnover of S\$6.89 billion in 2007, employing over 19,000 workers. The SERC Aerospace Programme is positioned to help companies in the value chain seed and grow R&D activities to build technical capabilities for the future and consequently contribute to growth statistics.

## FactSheet

### **About the Agency for Science, Technology and Research (A\*STAR)**

A\*STAR is Singapore's lead agency for fostering world-class scientific research and talent for a vibrant knowledge-based Singapore. A\*STAR actively nurtures public sector research and development in Biomedical Sciences, Physical Sciences and Engineering, with a particular focus on fields essential to Singapore's manufacturing industry and new growth industries. It oversees 22 research institutes and consortia and supports extramural research with the universities, hospital research centres and other local and international partners. At the heart of this knowledge intensive work is human capital. Top local and international scientific talent drive knowledge creation at A\*STAR research institutes. The Agency also sends scholars for undergraduate, graduate and post-doctoral training in the best universities, a reflection of the high priority A\*STAR places on nurturing the next generation of scientific talent.

Website: [www.a-star.edu.sg](http://www.a-star.edu.sg)

### **About the Science and Engineering Research Council**

A\*STAR's Science and Engineering Research Council (SERC) promotes public sector research and development in science and engineering with seven full-fledged, advanced research institutes that develop high-tech research in a wide range of fields including communications, data storage, materials, chemicals, advanced computing, microelectronics and process manufacturing.

### **About the SERC Aerospace Programme**

Through A\*STAR's research institutes and industry, the SERC Aerospace Programme aims to drive innovation research in the aerospace industry and sustain Singapore's position as a global aviation hub. It also aims to strengthen the value-chain among the key industries of aviation, maintenance, repair and overhaul (MRO) and precision engineering, so as to contribute to accelerating overall growth of the industry as well as increase the proportion of aerospace manufacturing activities in Singapore.

The mission of the SERC Aerospace Programme is to drive innovation and sustain competitiveness and growth of the local aerospace industry with constant technology infusion through collaborative R&D. The Programme actively engages industry players as well as the R&D community and tap on existing capabilities, infrastructure and resources in all seven of the A\*STAR Science and Engineering Research Council (SERC) research institutes to conduct pre-competitive basic-directed and applied research work. It will address technological challenges in five key areas identified by the local and international aerospace industry:

- a) Inspection & non-destructive testing
- b) Manufacturing processes & automation
- c) Advanced materials
- d) Information & communication
- e) Computational modelling & dynamics

The SERC Aerospace Programme is open to all companies on a membership basis. Participating members will have full access to the R&D results developed under the programme. Members also have the option of attaching their company staff to the programme to work on joint research projects with the researchers from SERC research institutes. This would help pave the eventual technology transfer of the research conducted to the companies.

## **SERC Aerospace Programme Members**

### **About Boeing**

Boeing is one of the world's leading aerospace companies and a top U.S. exporter in terms of sales. Employing more than 160,000 people in 70 countries and providing products and services to customers in more than 90 countries around the world, Boeing is a global market leader in commercial jetliners, military aircraft, satellites, missile defense, human space flight, and launch systems and services.

Website: [www.boeing.com](http://www.boeing.com)

### **About European Aeronautic Defence and Space Company (EADS)**

EADS is a global leader in aerospace, defence and related services. In 2007, EADS generated revenues of \$39.1 billion and employed a workforce of about 116,000. The Group includes Airbus as the leading manufacturer of commercial aircraft, with Airbus Military covering tanker, transport and mission aircraft, Eurocopter as the world's largest helicopter supplier and EADS Astrium, the European leader in space programmes from Ariane to Galileo. Its Defence & Security Division is a provider of comprehensive systems solutions and makes EADS the major partner in the Eurofighter consortium as well as a stakeholder in the missile systems provider MBDA.

Website: [www.eads.com](http://www.eads.com)

### **About Pratt & Whitney**

Pratt & Whitney's Commercial Engines & Global Services is an industry leader in customer solutions and service excellence through its broad portfolio of offerings. Its Global Service Partners network helps customers benefit from overhaul and repair facilities worldwide capable of servicing all Pratt & Whitney engines, as well as those made by other manufacturers.

Pratt & Whitney is a world leader in the design, manufacture and service of aircraft engines, space propulsion systems and industrial gas turbines. United Technologies, based in Hartford, Conn., is a diversified company providing high technology products and services to the global aerospace and building industries.

Website: [www.pratt-whitney.com](http://www.pratt-whitney.com)

### **About Rolls-Royce**

Rolls-Royce, the world-leading provider of power systems and services for use on land, at sea and in the air, operates in four global markets - civil aerospace, defence aerospace, marine and energy. The company continues to invest in core technologies, products, people and capabilities to broaden and strengthen the product portfolio, improve efficiency and enhance the environmental performance of its products. These investments create high barriers to entry.

Rolls-Royce has a broad customer base comprising 600 airlines, 4,000 corporate and utility aircraft and helicopter operators, 160 armed forces and more than 2,000 marine customers, including 70 navies. The company has energy customers in 120 countries.

Rolls-Royce is a technology leader, employing 38,000 people in offices, manufacturing

and service facilities in 50 countries. This global presence allows the Group to access long-term international growth opportunities with its technology, presence, partnerships and people.

Each year, in collaboration with its partners, Rolls-Royce invests over £800 million on research and development, two thirds of which has the objective of further improving the environmental aspects of its products. Sixty per cent of research and development investment and 40 per cent of new product development spending over the past five years has been outside the UK. Research and development is carried out in facilities in the UK, Germany, Italy, Singapore, Japan, the US and Scandinavia. Annual sales in 2008 totalled £9.1 billion, of which 52 per cent was services revenue. The firm and announced order book was more than £55 billion, which, together with demand for services, provides visibility of future levels of activity.

Website: [www.rolls-royce.com](http://www.rolls-royce.com)

### **About BASF**

BASF is the world's leading chemical company—The Chemical Company. Its portfolio ranges from oil and gas to chemicals, plastics, performance products, agricultural products and fine chemicals. As a reliable partner BASF helps its customers in virtually all industries to be more successful.

With its high-value products and intelligent solutions, BASF plays an important role in finding answers to global challenges such as climate protection, energy efficiency, nutrition and mobility. BASF has more than 95,000 employees and posted sales of almost €58 billion in 2007.

Website: [www.basf.com](http://www.basf.com)

### **About Coherix**

Coherix is a leader in High Definition Machine Vision. We market innovative defect detection and surface measurement products for precision parts “where a micron matters”. We design high speed, non-contact Machine Vision Products offering superior inspection solutions to our customers. With our proven products, we are lowering our customer's operating costs while improving their quality. We are also enhancing our customer's product development process. By making “process performance visible” we

enable our customers to certify their manufacturing process in a short period of time which shortens time to market for new product introductions.

Website: [www.coherix.com](http://www.coherix.com)

### **About GT Industrial**

GT Industrial, with Nadcap approved related party GT-Baiker Metal Finishing, are leading providers of complementary metal refurbishment services in Singapore. GT Industrial offers a wide range of specialised equipment and techniques in supporting various aerospace OEMs with vibratory finishing involving compressor and turbine blade refurbishment. GT-Baiker Metal Finishing can also provide shot peening expertise certified in accordance with Nadcap approvals for Aerospace Quality System (AC 7004) and Surface Enhancement (AS 7117). Our expertise has secured approvals from various OEMs including Rolls-Royce, Boeing, Singapore Aerospace Management, Hamilton Sundstrand, Windsor Airmotive and GE Aircraft Engines.

Website: [www.gt-ind.com.sg](http://www.gt-ind.com.sg)

### **About IDI Laser Services**

Established in 1999, IDI Laser Services Pte Ltd is a leading equipment manufacturer specialising in design & manufacturing of Laser systems. We provide Total Solution in laser needs, including Laser Engraving, Marking, Cutting, Drilling and Welding. The company designs, integrates and assembles machines that meet a variety of material processing needs. IDI Laser is distinctive for its development of laser machines, quick translation of technical concepts into user-oriented innovations, high standards of quality and reliable customer service.

Website: [www.idilaser.com](http://www.idilaser.com)

### **About IPG Photonics**

IPG Photonics is the world's leader of high power fiber lasers and fiber amplifiers that are quickly revolutionising performance and utility in a remarkable array of materials processing, telecommunications, medical and other advanced applications.

The result is an exploding list of applications enabled by the cost-effectiveness, performance, reliability and efficiency that represent an unprecedented leap in laser and

amplifier performance per footprint, power and cost. Quite simply, IPG's products are disrupting the market by empowering tomorrow's applications today.

Website: [www.ipgphotonics.com](http://www.ipgphotonics.com)

### **About MAG Industrial Automation Systems**

MAG is one of the world's largest providers of manufacturing systems and services for the entire spectrum of durable goods industries. We can support you globally and locally from 25 facilities on five continents.

Our core capabilities are focused on green production technologies for traditional and emerging manufacturing. We serve large OEM's and contract shops alike in the fields of aerospace, wind and solar power, auto & truck, rail, off-road and mining machinery, and oil and gas.

We can help you exceed your manufacturing objectives with...

- process development
- turning and milling systems
- automotive powertrain production
- automated composites solutions for aerospace, wind and automotive
- assembly systems
- high-performance tooling and fluids
- life-cycle maintenance
- automation and controls

Website: [www.mag-ias.com](http://www.mag-ias.com)

### **About Resem Technologies**

We specialise in Laser Processing System for industry and process such as

- a. High Precision Laser Drilling System
- b. High Precision Laser Cutting System
- c. Laser Cladding on Rapid Prototyping System in joint development with SIMTech
- d. Moulding product and process as well as Aerospace industry

Website: [www.resem.com.sg](http://www.resem.com.sg)

### **About Rofin-Baasel Singapore**

Rofin\_We Think Laser... and we have been doing so for more than 30 years. With more than 31,000 systems installed worldwide, ROFIN has dedicated itself to becoming one of the leading manufacturers of lasers and laser-based solutions for industrial materials processing. Whether it is cutting, welding, marking or surface treatment, more than 1,750 qualified employees at 35 locations worldwide guarantee that we create the laser technology of tomorrow.

Website: [www.rofin.com](http://www.rofin.com)

### **About SIA Engineering Company**

SIA Engineering Company (SIAEC), together with its 22 joint ventures and subsidiaries across eight countries, forms the SIAEC Group.

The SIAEC Group provides extensive maintenance, repair and overhaul (MRO) of aircraft to more than 85 international airlines worldwide.

With certifications from more than 20 airworthiness authorities, SIAEC's six hangars and 22 in-house workshops in Singapore provide complete MRO services in airframe, component, engine, aircraft conversions and modifications to major airlines from four continents. Our 16 component, engine and modifications joint ventures forged with the world's leading engine and component manufacturers, further deepen our MRO service offerings.

At Singapore Changi Airport, SIAEC provides line maintenance services to more than 60 airlines passing through Singapore. We ensure a high level of punctuality for all our customers' flight departures. Beyond Singapore, our growing network of line maintenance support is extended to more than 40 airports in Australia, China, Indonesia and the Philippines.

With our comprehensive and integrated MRO solutions, we are dedicated to providing on-time deliveries and meeting every need of our customers.

Website: [www.siaec.com.sg](http://www.siaec.com.sg)

### **About Sonatest**

Sonatest Limited has one over-riding and driving motivation - to design, manufacture and market the worlds best 'Non Destructive Evaluation' (NDE or NDT) products. From our UK based HQ, we design and produce a wide range of high performance ultrasonic

equipment and NDT accessories, employing cutting edge technology in our range of non-destructive testing equipment.

Website: [www.sonatest.com](http://www.sonatest.com)

### **About Sunny Instruments Singapore**

Sunny Instruments Singapore provides measurement and inspection solutions that harnesses the powers of optics and electronics. We can address your needs for dimensional measurement, vibration testing, and close-up inspections.

Website: [www.sunnyinstruments.com.sg](http://www.sunnyinstruments.com.sg)

### **About Tru- Marine**

From our early beginnings in 1977, Tru-Marine has held a leading position today with a worldwide network as a specialist in turbocharger servicing. The heart of Tru-Marine's excellence lies in the uncompromising reliability of our service delivery. Tru-Marine takes pride in offering high standards of customer-centric service that is backed by sound technical expertise and superior savings of innovative repair alternatives to the replacement of worn turbocharger parts.

With over 30 years of expertise, Tru-Marine takes pride in our in-house competencies to overhaul and service all makes and models of turbochargers. Our specialised repairs include:

- Dynamic balancing of turbocharger rotors
- Turbine blade repairs
- Rotorshaft repairs
- Reconditioning of bearings and lubricating oil pumps
- Reclamation of worn cover ring

Headquartered in Singapore, Tru-Marine has an expanding network of service stations strategically located in Shanghai, Tianjin, Guangzhou, Sharjah, Mumbai, Haiphong and Rotterdam.

Website: [www.trumarine.com.sg](http://www.trumarine.com.sg)

**FactSheet**

**Cycle 1 Projects**

**Laser Processing:** Laser processing presents many opportunities for aerospace applications due to its inherent advantages. Machining of composite materials possesses a challenge for conventional machining techniques since it introduces tool wear, undesirable vibrational effects and appreciable cutting force. Being a non-contact and abrasionless process, laser processing has the advantage in creating minimal distortion during machining of composites. Conventional cleaning and paint removal of aerospace components uses either toxic chemicals that possess potential health hazard or sand blasting that is messy and may damage the original surfaces. Laser assisted cleaning is known to be a comparatively safer, cleaner and environmentally friendlier process in that it uses localised thermal mechanisms to remove coatings. Our work in this area has yielded a three-fold removal rate.

**Advanced Robotics:** This technology is set to introduce greater automation in the MRO industry and is set to address MRO complexities with smarter systems and greater flexibility. Since MRO costs typically exceed 20 per cent of an airline's operational budget, this will help airlines to cut costs and have faster turnaround times.

**Non Destructive Testing Techniques and Inspection:** Effective assessment of integrity of structural components in an aircraft is critical as it enhances safety and reduces maintenance costs as well as the need for repair lead time. Current techniques involve a laborious process of dismantling and re-assembly of the components and the testing procedures. The development of portable, non-destructive testing and inspection methods to conduct assessment will be timely with the advent of new manufacturing materials and new structural geometries that will lead to reduced downtime and costs. Ongoing work will enhance the resolution for NDT defect inspection of aerospace composite material and provide the avenue for development of sensors to detect various flaws in composite aircraft structures.

## **Cycle 2 Projects**

**Advanced Materials:** Aircraft structures are subject to wear and tear due to operation cycles and sustained exposure to environmental elements including temperature and pressure changes, sand, rain, and strong winds. To combat such wear and tear, aircraft structures are protected with erosion resistant coatings on the surface. However, currently available coatings are susceptible to erosion damage and require frequent maintenance. The programme aims to develop new, low-cost coating materials for a wide variety of geometries to provide reliable product performance and durability. Not only will such improvements extend lifetime of the components, it will help to reduce the frequency of maintenance and downtime, as well as lower operational costs.

**Manufacturing:** The manufacturing of metal alloys leading to production of suitable aircraft components need to be one that is sufficiently low-cost and time-saving, whilst remaining innovative. Cost-Performance-Process analysis calls for improvements in manufacturing practices that reduces complexity in processing, enhances design flexibility and improves ductility and fatigue properties. The programme will explore a non-traditional method to satisfy requirements needed to fabricate net-shape, complex geometries. When successful, this method will be able to produce complex components in a single-step, offering the potential for high degree of automation, high volume production and high yield of component with reduced materials usage.

**Maintenance, Repair and Overhaul (MRO):** MRO plays a significant part in the lifecycle of an aircraft since services provided are crucial to its upkeep and maintenance of airworthiness. The development of reparation techniques to reduce lead time and material cost is a welcomed approach to increasing repair yield and improving turnover. With stringent industry standards, aircraft components sent for maintenance, repair or overhaul need to have their histories recorded and tracked each step of the way. With robust growth of the MRO industry due to expanding commercial fleets, the industry recognises that current practices need optimisation and streamlining. With these in mind, the programme proposes a way to achieve complete, timely and accurate information to improve management and operation efficiency of MRO services.

**Structural Health Monitoring & Diagnostics:** To improve safety and reliability of aircraft structures, structural health monitoring is increasingly being used. Commonly viewed as preventive techniques, such practices involves use of intelligent sensor networks that provide an avenue for manufacturers to be forewarned of non-visual physical damages that may lead to eventual failure. The early warnings buy time to enable diagnosis and subsequent definition of remedial strategies that will aid in the reduction of repair lead time as well as the management of high material replacement costs.

**Company Quotes**

"This unique consortium offers a win-win arrangement: It provides an excellent platform for companies in the aerospace industry and their partners to work closely together on customer specific needs. BASF will contribute through its world-class knowledge in chemistry and material sciences. We will help to find successful solutions for the aerospace industry."

Name: Dr Andreas Fechtenkoetter,

Designation: Department Head,

Company: BASF Global Research Center Singapore

"The SERC Aerospace Programme is a valuable collaborative environment combining maintenance and repair objectives of the global aerospace industry utilizing Singapore's world class research infrastructure."

Name: Peter Lawrence

Designation: Director

Company: Boeing Research & Technology, Support Technology

"Coherix joined SERC to provide the SERC Alliance of Aerospace companies insight into the research, applications, and benefits of High Definition Machine Vision."

Name: Dwight Carlson

Designation: CEO

Company: Coherix

"The SERC Aerospace Programme is an important initiative as we build-up our operations at the first EADS Innovation Works research centre in Singapore. It allows us to quickly explore a variety of fundamental multidisciplinary problems with the expertise of the SERC research institutes, while leveraging the combined wisdom and experiences of key aerospace players."

Name: Mr Gan Yeow Beng

Designation: Vice President & Head

Company: EADS Innovation Works Singapore

“GT Industrial foresees the positive potential that the SERC Aerospace Programme can provide in terms of research and technology to the aerospace industry in Singapore. We would also like to stay in the forefront of such technological developments to further enhance our capabilities as an independent service provider to leading aerospace OEMs and MROs.”

Name: George Tan

Designation: Director

Company: GT Industrial

“The programme moves IDI Laser up the technology ladder. IDI Laser with developed new knowledge and expertise in handling and optimising laser, enables the company to keep abreast with the latest in laser technology, thereby maintaining its competitiveness internationally.”

Name: Mr Chris Chan

Designation: Managing Director

Company: IDI Laser Research

“We are honoured to join the SERC Aerospace Programme and be part of the consortium that contributes to the success of Singapore as the leading Aerospace maintenance, repair and overhaul (MRO) centre in Asia.”

Name: Dr Bo Gu

Designation: Director of Asian Sales and Marketing

Company: IPG Photonics

“MAG has undertaken the opportunity to join the Singapore Aerospace Programme as part of our global commitment to continuous improvement. Through this participation we expect to become a closer partner with the aerospace and research community in the

Southeast Asian market. MAG has a long tradition of active participation with university and industrial research groups, worldwide. We are excited to expand this activity and expect to be a valuable member and contributor to the consortium. Our hope is that the contacts and knowledge gained will guide and facilitate our investments in research, and the development of manufacturing solutions to enable economic production of next generation technologies in aerospace, renewable energy and related industries.”

Name: Mr John Wiese  
Designation: EVP Global Marketing & Sales  
Company: MAG Industrial Automation Systems

“Pratt & Whitney sees significant benefits in our participation in the SERC Aerospace Programme. We look forward to enjoy the positive results from our collaboration with A\*STAR on some of the most advanced technologies for jet engine repair.”

Name: Mr Carl Soderberg  
Designation: General Manager  
Company: Pratt & Whitney, Global Services Engineering-Asia

“ As part of Resem Technologies, I feel great to join the frontline of developing the Singapore Aerospace landscape with the great team from different sectors and expertise.”

Name: Jack Wan  
Designation: Manufacturing Manager  
Company: Resem Technologies

“The SERC Aerospace Programme is well in line with our commitment in laser applications for Aerospace technology. We are happy to have strong team work with our partners, and see our latest laser technologies contribute to the successes of the programme.”

Name: Dr Ulrich Hefter,  
Designation: Chief Technical Officer  
Company: Rofin-Sinar Technologies Inc.,

"As a pioneer member of the SERC Aerospace Programme, Rolls-Royce is very pleased with the research programmes and actions developed in the first year. This Programme is ideally placed to address many of the unique challenges and opportunities facing our industry. As such, we are looking forward to working with the SERC team to develop and implement step change technology-driven manufacturing and repair solutions."

Name: Dr Hamid Mughal,  
Designation: Executive Vice President, Manufacturing Engineering,  
Company: Rolls-Royce plc

"Our aim is to foster closer ties with esteemed members of the Singapore Aerospace community, so as to establish co-operation, or partnerships that will bring about mutual benefits. We believe we can contribute to the growth of the Aerospace industry in Singapore by working closely with SERC and its esteemed partners."

Name: Dr Zhu Chuangui  
Designation: General Manager  
Company: Sunny Instruments Singapore

"We join the aerospace programme to bring our engineering standards, within the next 3-5 years, a clear step higher than our competitors. At the same time, with the high customer expectation on the performance of turbocharger components, we envisage that turbocharger technology will converge with aerospace technology in the near future. Hence adopting the aerospace standard, we believe, is the right direction forward in compression and turbine technology."

Name: Mr David Loke  
Designation: Group Managing Director  
Company: Tru- Marine

**MEDIA CONTACTS**

<b>MEDIA CONTACTS</b>	<b>MEDIA CONTACTS</b>
Lee Swee Heng A*STAR SERC Shared Services Tel: +65 6793 8368 HP: 9620 3902 Email: leesh@scei.a-star.edu.sg	Jimmy Lim A*STAR SERC Shared Services Tel: +65 6419 1223 HP: 90089425 Email: limjkm@scei.a- star.edu.sg/jimmy_lim@a-star.edu.sg