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Automated Landing

Inner Marker Middle Marker Outer Marker

Prof. Lim Yeow Khee BBM
Mohd Faisal b M. Salleh

The use of computers in flight has been debated for many decades. With the coming of AI, the issue of final accountability for flight safety is again hotly debated. In this article, we look at the earliest venture of using computers to guide aircraft to safe landing.

HOW THE ILS WORKS

The ILS consists of the localiser (LOC), the glideslope (GS) and three marker beacons. The LOC provides azimuth guidance, while the GS defines the correct vertical descent profile. Typically, the guidance LOC coverage extends to top of descent about 1,000 feet from touchdown.

The ILS LOC antennas, located at the end of the runway transmit two narrow intersecting beams. Where they intersect, define the "on LOC" indication (see Fig.1). This information guides the pilot towards the runway centreline.

The ILS GS antennas in the aerodrome transmit two narrow vertically intersecting beams. Where they intersect, defines the "on GS" indication (see Fig.2). The GS antennas are usually located to give the runway threshold crossing height of about 50 ft and GS angles are usually positioned

between 2.5 to 3.5 degrees. As the area around the ILS operation will need to be cleared of obstacles, this is normally determined after consultation with relevant local authorities or foreign government with considerations of flight safety, buildings, ship operations and future developments. This does not normally pose a problem as flight safety cuts across national and cultural boundaries. Besides, an improved airport navigation system attracts more aircraft and operators to use the airport and usually benefits the community around the airport. From the pilots' point of view, any airport with good facilities represents another safety net to the whole aviation community.

Three marker beacons are usually installed to give the pilots an indication of how close is the aircraft to the runway threshold (see above). The Outer Marker is about 6 km while the Middle Marker is about 1 km away when the aircraft altitude is at Decision Height (about 200 ft). The Inner Marker is about 300m from the runway threshold.

ILS is easily accessible by aircraft equipped with relatively simple receivers. However, it has only two approach paths, 180 degrees apart. Over the years, more sophisticated systems have been developed to allow more approach paths to reduce the need to fly long loops to land.

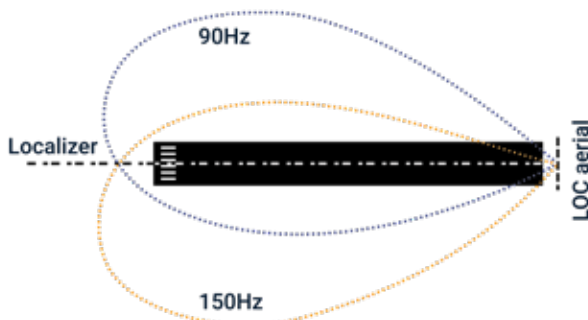


Fig.1: Localiser – the two VHF beams are modulated by 90Hz and 150Hz signals

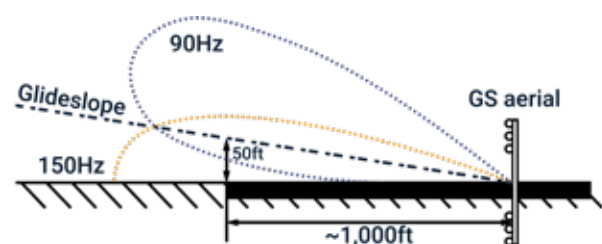


Fig.2: Glideslope – the two UHF beams are modulated by 90Hz and 150Hz signals

Contents

- 1-2 **Automated Landing**
- 3 **Personality**
An Interview with CAAS
Director General Mr. Kevin
Shum
- 4 **Technical**
Cabin Fireworthiness
- 5 **Engineer Pilot**
- 6 **UK Channel**
Through Our Eyes...
- 7 **SATEC 2020 - Transforming
Aerospace through
Innovation**
- 8-9 **SIAE History**
An Interview with Prof. Lim
Yeow Khee
- 10 **Pre-departure @ Changi
Airport**
- 11 **Advertorial**
SIAEC Innovations
In Enhancing Safety
Standards at Changi Airport
- 12 **Hobbies**
Drone Racing
- 13 **Space**
GSTC - Pushing the
Innovation Frontier
- 14 **Well-Being**
Evaporating with Colour
- 15 **Building the Aviation
Culture - Learning from
Mistakes**

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Microwave landing systems (MLS) were developed in the 1980s which allow pilots to pick a path best suited to their type of aircraft and to descend and land. This helps to reduce noise around airports and enabled small aircraft to avoid dangerous vortices behind large aircraft. Because of the complexity and high cost of implementation, it was not widely adopted by airports around the world. From 1994, the FAA halted further development of MLS and looked into using satellite-based navigation systems for alternative landing systems.

It was found that the current GPS (Global Positioning System) can be enhanced for approach and landing. Some airports are using Differential GPS

where the residual errors of the system are collected by a ground receiver at the airport and transmitted to the aircraft to improve the accuracy.

SATELLITE NAVIGATION

Ground-Based Augmentation System (GBAS) (see Fig.3) uses DGPS principles to provide corrections and integrity monitoring of GPS to aircraft for precision approach within 23 nmi of the airport. It broadcast correction message via a VHF data link from a ground-based transmitter. GBAS is able to bring accuracy to less than 1m in both the horizontal and vertical axis. This is sufficient for Cat I, and eventually Cat II, and Cat III precision approaches.

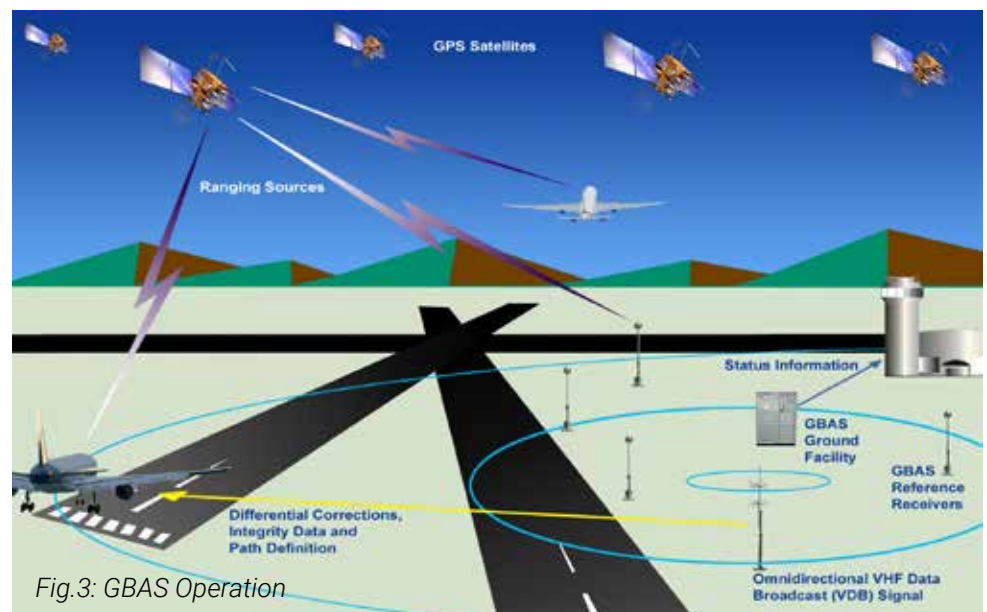


Fig.3: GBAS Operation

Editor's Message

SIA won World's Best Cabin Crew, World's Best First Class and Asia's Best Airline, missing out World Best Airlines award to Qatar Airways. SIA has won the World's Best Airlines many times in the past. To achieve such accolades, it takes a team of professionals from various aviation disciplines to drive and maintain high standards in areas like safety, operational efficiency and service excellence.

In this issue, we interviewed two people from different sectors of the aviation industry. DG CAAS, Mr Kevin Shum shared his views on the challenges in airport operation and regulatory functions while SIAE President, Lim Yeow Khee dug through the development of aerospace engineers and technicians through his 51 years in the industry. Through the lenses of an engineer in fireworthiness certification and an engineer pilot, we see the importance of flight safety in everything we do. For the interest of aspiring aviation practitioners, our regular columnists from UK and hobbyists shared their perspective in pursuing their passions.

We hope you will enjoy the articles and we welcome your feedback. Your continued contributions and support will be our motivation.

Lim Chui Ping
Editor-in-Chief

An Interview with CAAS Director General Mr. Kevin Shum

Mr Kevin Shum is the Director-General of the Civil Aviation Authority of Singapore. He is responsible for the development of Singapore as a sustainable aviation hub. He is also the Vice-Chairman of the Executive Committee and the Chair of the Asia Pacific CEO Committee (APC3) in the Civil Air Navigation Services Organisation. He has special interests in competitiveness, safety and productivity issues in the aviation sector.



Mr Shum, you have been the DG at CAAS since 02 Aug 2015. What are the projects and events that have kept you busy?

There are 4 priorities that guided me. First, creating a stable and enabling regulatory environment for our aviation businesses to grow. Sudden and unexplained changes in policies and practices create uncertainty for airlines, reduce the efficiency of air services, and limit long-term investment. For civil aviation to thrive, airlines need the assurance that they can continue to operate in a business and operational environment with balanced, predictable and rational policies and regulations.

Second is to enhance our value proposition. Guided by the Air Transport Industry Transformation Map, CAAS is driving transformation both within our own organisation and the wider aviation industry to strengthen our hub offering. By delivering a vibrant air hub, we provide more quality jobs and facilitate trade, investment and tourism for the wider economy to the benefit of Singaporeans.

Third, strengthening our ATM capabilities and to leverage on technology and forge partnerships with established global players to conduct Research and Development (R&D) on new solutions to optimise our use of airspace, create capacity, and ensure the safety of passengers.

Last but not least, maintaining confidence in the international aviation system. CAAS actively participates in over 100 ICAO panels, committees, working groups and

task forces to help develop and strengthen international standards in various aspects of aviation, ranging from aviation safety, security, air traffic management to aviation environmental protection, aviation law and airport operations.

It was announced on 24 May 2019 that a CAAS panel will be set up to engage the public as part of unmanned aircraft systems review. Can you share more on this?

CAAS set up the Unmanned Aircraft Systems (UAS) Advisory Panel (UASAP) to review and recommend enhancements to Singapore's UAS regulatory framework. The Panel will work with UAS users to promote a safe and responsible culture for the use of UAS; and will reach out to seek views and feedback from users, residents and other stakeholder groups.

Changi Airport has received accolades of being the Best Airport in the world for many years. What do you think are the key factors that enable us to reach this status?

For many in the aviation industry and millions of travellers passing through our gates, Changi Airport has become the gold standard for what an airport should be.

What sets Changi Airport apart from other airports is the passion and commitment from everyone in the community, from the companies to the unions and Government agencies, who play their part towards enhancing our connectivity to the world, ensuring the highest levels of operational safety and efficiency and delivering a single, consistent Changi experience to all passengers.

One of the missions of CAAS is to build a vibrant aviation industry in Singapore. What advice would you give to an aviation graduate who is about to enter the workforce?

This is the best time to join the aviation industry. We are at the cusp of an exciting and fundamental transformation of the business. There are various emerging trends, from new aircraft, urban air mobility and autonomous vehicles, to big data and data analytics that will push the frontier. There will be many opportunities for graduates to learn from the best, and innovate together with us to shape the future of Singapore aviation together. 🇸🇬



Cabin Fireworthiness

Lloyd Ernest Lazaro

***"Mayday! Mayday! Fire in the Cabin!"** This distress call is certainly one event that we hope never escalates to a uncontrolled situation. Aircraft, air, fuel and fire is certainly a combination that we don't want to deal with inside the aircraft cabin.*

WE LEARNED FROM THE ASHES

Aviation history has taught us many lessons that fire can harm aircraft in the air and on the ground. The best knowledge we take from these incidents is that **prevention is the only effective solution**. Features to stop a flame from becoming a monster will give the pilot time to land the plane and the passengers the chance to escape must also be built into the design of the aircraft.

DIVIDE THE THREAT

The threat from fire inside an aircraft is categorized into two:

1. In-flight fires
2. Post-crash fires.

In-flight fires originate in small ways and can grow depends on the material and air available. Having a dry high altitude cabin air causes combustible materials to be less resistant to fire. Powered wires that rub against each other can start a spark. Cigarette buds thrown into waste bins can easily ignite dry waste.

For post-crash fire threats, we need to add in the energy of aircraft fuel joining into a fire situation. The petrol fuel source is like a bridge into the cabin of high heat fires. Wrongly declared flammable baggage and cargo also can cause such catastrophe. Post-crash fire is such a

severe situation that the name suggest that survivability is possible if an in-flight plane makes to the surface.

WE DESIGN FIRE-RESISTANCE INTO EVERYTHING

To address fire threats, regulations have been put in place to ensure that aircraft design meets fireworthiness standards. For in-flight fires, the tactical approach is to ensure everything non-metallic inside the aircraft meet a self-extinguishing test. Containments that hold trash (waste compartments), baggage and cargo must be capable of isolating a fire from its air source thus self-extinguishing and not spread to adjacent compartment and materials. Post-crash fire threats test regulations require that materials are proven resistant to high heat, in order to delay a unescapable scenario. These post-crash test uses high heat test chambers that measure delay before spontaneous combustion and fuel gobbling flame throwers that prove even seat foams can resist fuel fires. These tests ensure that the escape systems that are in place have the sufficient time to do their job.

ARE WE SAFE NOW?

Aviation fireworthiness regulations have significantly reduced the incident of fire related incidents but we cannot remain unevolved. Although smoking in commercial flight is almost banned worldwide, there emerge new threats from new ignition sources. Lithium battery powered devices can cause fires that behave so differently. New age materials like carbon fibre have become economically viable. While they are lighter and stronger than aluminium, aluminium resist heat better than carbon fibre. These changes require constant research and revision of regulations.

We must remember that fire has a character that seeks to exploit what never thought possible! 🚗

Engineer Pilot

Kevin Khoo

Recent aviation accidents, like , Asiana Airlines Flight 214 and Ethiopian Airlines Flight 302, have raised a multitude of concerns regarding standards of pilot training and airplane equipment and software. Investigation reviewed that on Flight 302, pilots were unfamiliar with handling erroneous functioning of MCAS (Maneuvering Characteristics Augmentation System), while on Flight 214, it was a combination of inadequately described systems and pilot training. Another issue raised was the eroding camaraderie between pilots and engineers due to the disparate nature of their work, which has a “snowball” effect on operations. This has placed a growing spotlight on the role of Engineer Pilots, who could drastically increase the safety and efficiency of all aircraft operations, namely, the safety of crew members and airline passengers.

Due to the increasing complexity of modern-day airliners, the aviation industry has typically been split into two distinct occupations - that of the pilot and the engineer, as contrasted against historical aviation pioneers. With digitisation and computerisation of the aircraft, pilots' training is generally focused on compliance to Standard Operating Procedures (SOPs) while engineers are guided by their AMM (Aircraft Maintenance Manuals) without relating to operational considerations. These gaps in the understanding between both professions of complex operating systems such as FMS (flight management system) and Autopilot, is worrying, especially during emergencies and operational exigencies.


SO HOW COULD THIS GAP BE PLUGGED?

One of the solutions to this issue pertains to the cultivation of **Engineer Pilots**, who are equipped with sufficient understanding and training in both fields. Firstly, the knowledge, skill and attitude requirements of both professions should be extended generously to allow for deeper understanding across trades. Extended HR induction with recurrent training and development could be considered to promote camaraderie. The best solution would be to organise annual or biennial job

swap detachments to allow the exchange of experiences. The detachments should ideally be in 1-week periods to reduce the disruption of normal operations. During the detachment, due to professional qualification and accountability, participants may be unable to perform the tasks of flying or maintenance, observing the planning and execution of jobs would still go a long way; having such detachments hosted by Engineer Pilots would further facilitate mutual comprehension.



Job swap detachments may encourage deeper understanding of the other profession by facilitating the exchange of experiences.

Such detachments will undeniably have drawbacks which include high costs and extensive HR planning to facilitate such exchanges. Apart from laborious coordination and planning, additional training to dual-equip the potential Engineer Pilots may be necessary. Fortunately, the frequency of such exchanges need not be high. An initial induction followed by biennial or triennial exercises should provide sufficient exposure and opportunities for interaction and discussion. The effort will be more than compensated for by the effective relationships and teamwork developed from “the swap”. A more cohesive team will ensure that professionals in different field respect mutual risks, increasing the safety of everyday airline operations. 

Through Our Eyes...




Jasper Ng
Fuel & Inerting Systems Intern
Airbus UK


This past year, I had the incredible opportunity to intern in one of the leading aeronautical engineering company in the world – Airbus. I took a year out of my aeronautical engineering course at Imperial College London to do this internship as I wanted to get real life experience working as an engineer.

As a fuel systems engineering intern, I support the department in fuel tank modelling and ground test analysis. I not only got to learn more about aircraft fuel systems but also how the company provides support to existing operations while planning for challenges in the future. During my time, I got to meet a lot of incredible individuals, each an expert in their own field, who have a lot to share about their knowledge and experiences in their engineering career.

Airbus is a very diverse place with people from all walks of life. It has a very supportive and inclusive culture and you feel welcomed from the start. I have learnt a lot and benefitted greatly from my experience there. I learnt that as a new person, it is important for you to be curious and inquisitive, but yet be able to assert yourself in a respectable way, challenging ideas and fuelling discussions. Also, being able to work well autonomously and in a team while being pro-active in your job allow you to thrive as an engineer.

I have thoroughly enjoyed my experience in Airbus as it has taught me what kind of engineer I want to be. I look forward to applying for Airbus' graduate program. 

Indeed, time flies. Before I know it, it is my turn to bid farewell to Imperial College and London, a place I called home for the past four years. The moment is bittersweet, and it is time to embark on a new phase. Looking back, the initial idea of going overseas to study, away from the comforts of home and familiarity, was a daunting yet exhilarating one. What I had envisioned was going to be a journey of self-discovery soon turned into one filled with uncertainty. Prior to tertiary education, there had always been an unrealised comfort of a 'next step' mapped out after every major milestone in our education. However, it was only in university that reality hit. We could no longer just mark out waypoints on a defined route to work towards but instead carve out our own path.

Stepping out into the working world as a fresh graduate today can be intimidating. Not only is there a spectrum of industries and fields to dive into, but also many qualified hopefuls vying for the same roles. Increasingly computerised job application processes also mean the chance to leave an impression on or simply getting to know a future employer does not come by easily, at least not at initial stages. If there is one thing I took away from the roller-coaster ride that is job-searching, it is that we will never fully know if the path we choose to take will be the right one for us. Maybe all we need is a leap of faith, and what's to come might just take us by surprise. 



Teo Xinyi
Final Year Student
Imperial College London

SATEC 2020

Singapore Aerospace Technology and Engineering Conference

Transforming Aerospace Through Innovation

Shaun Tan
Chong Geng Lin

Higher standards of living and a growing middle class in the emerging markets are pushing the demands in the global aerospace industry to record high levels. The International Air Transport Association (IATA) recently announced that global passenger traffic for January 2019 rose 6.5% compared to the same month last year. At the same time, commercial aircraft order backlog remains at an all-time high as demand for fuel-efficient aircraft continues to surge. This trend coupled with a rapidly evolving landscape from shorter development cycles has spurred the industry to explore innovative means to keep up with the market's needs for efficiency and cost effectiveness.

The theme for SATEC 2020, "Transforming Aerospace through Innovation" is in line with the Aerospace Industry Transformation Map released by the Ministry for Trade and Industry (MTI) in 2018. The key drivers of "Pursuing Operational Excellence" and "Driving Innovation in Emerging Technologies" illustrated in the Transformation Map highlights Singapore's focus in the development of public R&D infrastructure and the application of emergent technologies such as Industrial Internet of Things (IoT) and Data Analytics by the year 2020. The aerospace industry

is set to undergo yet another decade of unprecedented changes. Riding on the innovation wave, reduction of operating costs, maintenance and manufacturing downtime can be achieved. This will lead to changes in the ways which operations, logistics planning, maintenance practice and engineering solutioning are conducted.

In conjunction with the 2020 Singapore Airshow, SATEC in its 9th edition will again be jointly organised by the RSAF Air Engineering and Logistics Department (AELD) and the Singapore Institute of Aerospace Engineers (SIAE) in Singapore on Wednesday, 12 February 2020. The biennial conference provides a platform for researchers and engineers from both academia and industry to present and discuss key developments and an opportunity to match theories and practices together.

The SATEC 2020 publication committee is inviting submissions of papers relating to the development and implementation of new technologies in aerodynamics, structures, materials, propulsion, aero-systems, avionics and unmanned aerial platforms. The deadline for abstract submissions is 1 September 2019. Selected presenters will be notified by 31 October 2019 for submission of the full papers and presentation slides.

Last year's event saw 424 participants with 38 presentations from militaries, defence partners, commercial industries and academia, including three speakers from Airbus Defence and Space, Pratt & Whitney and the RSAF who shared their perspectives and their organisation's approach to the digital transformation process.

SATEC 2020 promises yet another exciting conference ahead. Revolving around the theme of "Transforming Aerospace through Innovation", SATEC 2020 will feature emergent technologies from the 4th Industrial Revolution in the Aerospace Sector. The key focus will be on the innovative use of technology to meet new and evolving challenges in the aerospace industry. The conference will feature a plenary session and five breakout sessions by speakers from different backgrounds presenting on their research findings. These sessions aim to provide an overview of current trends and a glimpse of future opportunities in the industry.

SATEC 2020 will not only serve as an excellent platform for researchers, academics and practicing aerospace engineers to present their research and discuss new advances in the areas of aerospace technology, but will also offer boundless opportunities for the establishment of networks among aerospace industry professionals.



Organised by:



In Conjunction with:



An Interview with Prof. Lim Yeow Khee

Lim Yeow Khee has been with the aviation industry for 51 Years. In 1968, he took up an apprenticeship with Malaysia-Singapore Airlines, the fledgling airline which emerged following Singapore's independence. Aviation experts had contended that Singapore is too small to have an airline, but MSA soon split in 1972 and Singapore Airlines went on to become one of the best airlines in the world. In 1975, the Association of Singapore Licensed Aircraft Maintenance Engineers (ASLAE) was formed and later in 1993, changed its name to Singapore Institute of Aerospace Engineers (SIAE). Mr Lim served on both ExCo for 36 years.

Our editorial team spoke to Mr Lim on his work with SIAE.

Mr Lim. How did you start and why your dedication to SIAE?

It is difficult to pinpoint exactly what led me to serve in this voluntary role all these years. I guess we can put it as a situational demand. I was at the right place at the right time. Some may disagree – probably wrong place, wrong time..., well, that is history.

I was in Britain when Mr Poon Chia Wee spoke to me about forming an association for the LAEs. The training and certification system for LAEs was undergoing changes and SIA was also expanding very fast from 707 to 747. An association could influence the evolving systems and enhance the status of LAEs so that we can attract talented people with the right attributes to join the profession.

When I returned in 1977, the late Mr Ng Swee Liang had already registered ASLAE and Mr Poon became its first President. I took on as VP and then Hon Secretary for 17 years while Mr Poon continued as President for 20 years. Singapore's aviation industry was expanding rapidly when I took on as President and then Immediate Past President over the next 12 years.

What are the memorable triumphs and challenges you have encountered over the years?

We had very enthusiastic people in the membership and ExCo and with Mr Poon's vision we did several pioneering projects. Aircraft Engineer, launched in 1976 became the only local aviation magazine for many years. It gave us the channel to reach out to our members and industry. In 1979, we built and flew the first Hot Air Balloon in Singapore. In 1986, we undertook the project to restore the Airspeed Consul for Singapore Airlines' 40th Anniversary Celebration in 1987.

Following the success of the 1983 International

>> 2005 National Day Celebration at Seletar Hangar 151
From Left: Tan Chu Hiang (Current VP), Poon Chia Wee, First President for 20 Years. (1975 – 1995), Mr Charles Chong, 3rd President (2002 – 2008), Ivan Neo (VP), Leon Chua (Committee Member), Sarath M (Asst Hon Treasurer)



Federation of Airworthiness Conference in Singapore, we went on to organise the biennial New Challenges in Aircraft Technology and Maintenance Conference in conjunction with the airshow in Singapore since 1986. The conference has since been renamed Singapore Aerospace Technology and Engineering Conference when we went into partnership with the RSAF.

Managing the magazine and leading these projects and events gave me exposure to different environment and opportunity to learn new skills in communication and dealing with people. There were challenging situations of meeting deadlines against personal and work demands and occasionally negative publicity about our activities in the media to deal with.

Surviving each round made me stronger and ready to take on more challenging tasks. In the end, sharing the joy of successful completion of each project with the team was particularly satisfying. That kept me going.

One early setback was SPC's rejection of our application for membership because of insufficient tertiary education in our membership. We amend our membership requirements to align with SPC. That also prompted us to focus on developing our members through higher education. We partnered University of Technology, Sydney and RMIT University to conduct BSc and MBA programs respectively, in Singapore.

We had enthusiasm and energy and support from our employers and industry. We moved on as the sole NGO representing aerospace in Singapore. We started training courses for certifying technicians which led to the setting up of ATTC in 1999. With our vast experience in aircraft maintenance, we were consulted on aero training and many of our members sat on advisory committees in IHLs. In 2002, we founded AAIS to organise industry activities



>> April 1987. Dr Cheong Choong Kong (Right) receiving the restored Airspeed Consul. From Left: Chris Tay (VP), Poon Chia Wee (President), Lim Yeow Khee (Hon Secretary)



so that SIAE could continue to focus on professional development and education. One of my most fulfilling tasks was Chairing the Aero WSQ Technical Committee which validated over 60 Aero WSQ Modules.

Can you share with us some of your personal reflections of your career in Aerospace?

Certainly. With 51 years, I did quite a bit of reflection on my career. I walked into aerospace through a newspaper advert, "Apprentice Aircraft Maintenance Engineer". I had just turned down a place in the then University of Singapore and saw this as another chance to be an engineer. I didn't even bother to check out the pay, company or workplace. I had always wanted to be an engineer, preferably one involving nuclear energy or space travel.

The 5-year apprenticeship was just great for me. There were so much things to learn. The hot, dusty and often noisy environment didn't bother me. It was just nice to be with all the hi-tech stuff around.

An important turning point came when I was awarded the SIA Engineering Scholarship. I went to Leeds University to do electrical engineering. It was an awakening to the power of research in industrial leadership and the value of engaging people of diverse culture and backgrounds. I came back with a vengeance – to provide every opportunity for our LAEs to further their study in engineering. The ROI on an engineering degree is always worth the effort.

Engineering education became my focus, resulting in my sitting on advisory committees in ITE Colleges, polytechnics and universities. I volunteered to judge technical competitions in Science Centre Singapore and Tan Kah Kee Young Inventors' Award. These activities gave me the opportunity to engage school children to encourage them to take up careers in engineering. When NTU started its Aerospace Engineering course, SIAE members mentored many of the students and I was invited to conduct seminars and teach some modules. In 2013, I was appointed Adjunct Associate Professor and I continue to teach till today. I am also Adjunct Faculty with Singapore Institute of Technology. Teaching in NTU and SIT gave me tremendous opportunity to learn more, not just about aerospace, but other disciplines through engaging other faculties and conferences.

In 2009, when Changi Airport Group was formed, I was appointed Authority Member of CAAS until 2017. I am honoured and cherished every moment of the time I spent to contribute to the advancement of aviation in Singapore.

I did get a touch of Space after all. Through organising conferences and seminars, I have the privilege of meeting four NASA astronauts – John Young, Marsha Ivins, Catherine Coleman and Leroy Chiao. I was also advisor and executive committee of Singapore Space and Technology Association.


I often reflect on the circumstances which enabled me to pursue such a fulfilling career in aerospace engineering. Luck must have played a part. My passion for aerospace engineering aligned with the time of rapid growth of the aerospace industry in Singapore - it was "right place at the right time" after all. I also have this insatiable quest to understand the world – continuous learning. In recent years, through my quest to understand how people learn and why people make mistakes, I have gone into neural science and cognitive psychology. And surprisingly, they led me into music and a whole new world of how music has shaped life on earth through the millennia. In 2017, I was honoured to be awarded "Adult Education Fellow" by the IAL.

Finally, could you share with us your thoughts on the future for SIAE?

Unlike prisons which are necessary evils, associations are often good to have but seldom necessary. Associations formed for common good can only last as long as the common good has value to the members. There must be a higher vision for the members to work towards. Abstract vision often last longer than tangible value propositions. There is also an identity component for members to stay on.

ASLAE started off as a common good organisation, providing opportunities for members to upgrade and career advancement. By 1993, we have accomplished our mission and moved on to provide educational opportunities to a wider group in the aerospace industry, hence our change of name to SIAE. We lost some members who could not identify themselves with the new name. Over the years as the social and educational profiles of the aerospace engineers changed, our membership suffered significant losses.

In 2013, we kept our vision to promote aviation safety and aerospace technology but shifted our focus to NGAP. This somewhat abstract mission raised new questions on our relevance. Some members felt the government should be responsible for the Next Generation. We moved on and seek support from government and industry to push on our mission to build a strong aviation culture for the NGAP to grown on.

Today, with instant communication available to everyone, the traditional value proposition to members gets outdated very quickly. I think an abstract mission addressing future concerns will keep us relevant. However, this can only be useful in a culture where people value abstract ideas bigger than themselves. The challenge is for SIAE to build that culture in the NGAP. 

Pre-departure @ Changi Airport

What you can do with 2½ hours before your flight

Gabrielle Foo



The idea of spending 2 ½ hours before your flight may seem daunting to some, with many imagining nothing but sitting around and waiting. As a seventeen-year-old girl travelling alone, I've come to realise that a large part of the anticipation and excitement of going overseas starts at the airport. Nowadays, when people talk about Changi Airport, the buzz is about Jewel, Changi's latest addition. But Jewel aside, the departure terminals have so much to offer, as a world's best airport should. Changi Airport Terminals are themselves an experience not to be missed, and here I'm going to run through one of my typical pre-departure.

2 ½ HOURS BEFORE THE FLIGHT...

I arrive at my departure terminal, check-in, deposit my check-in baggage and complete all pre-boarding procedures. Most airlines allow you to check in online, so you can save yourself quite a bit of time and the hassle by doing this before arriving. I find the process friendly and intuitive, so I was got through this stage easily.

MINUS 2 HOURS ...

Once everything is settled and my boarding pass tucked safely in my passport, it's time for me to wander around - the most exciting part. Cleared of the burden of my bags, I'm free to roam, grab a quick bite, watch a movie etc. the list goes on. Usually, I skip breakfast or lunch to save space for my airport meals - with so many eateries open, why waste stomach space on food at home? Some of my favourite eateries include Pret a Manger (T3), with its wide range of soups and sandwiches, organic coffee and vegetarian options. There is also the International Food Hall (T4), which offers affordable delicious food of various cuisines.

For dessert, I'll make a quick pit stop at Beard Papa's (T3), Krispy Kreme (T2 and T3) or Paris Baguette (T4) to satisfy my sweet tooth.

MINUS 1 HOUR AND 15 MINUTES ...

With my stomach reaching bursting point, it's time to move

on to the shops and other attractions.

I quickly pick up some small bites for the flight at one of the many convenience stores, where you can also get other last-minute travel necessities like neck pillows and eye shades.

I also pick up a coffee from Coffee Bean as I can feel the food coma settling upon me. You can also get a cheaper one last "Teh C siew dai" before you leave, at Wang Cafe.

As I head for the boarding gate, I pop into whichever shops catch my eye. There are shops here, selling everything from chocolates, clothing (think Adidas, Burberry, Charles and Keith) to mobile gadgets, so there is something for everyone.

If my wallet is feeling a little empty, I'll choose one of the countless free attractions. T2 and T3 have free movie screenings, while T2 also features an entertainment deck with arcade machines and even PlayStations! Some of my other favourite spots include the various gardens scattered around the terminals. T1 has the cactus garden, my personal favourite with its many interesting species of cacti, while the other terminals house an orchid garden, a sunflower garden and a butterfly garden.

If I'm feeling particularly artsy, I'll go check out the sculptures. There's the famous Kinetic Rain in T1, the thought-provoking Memory of Lived Space in T3 and the intricately designed Heritage Zone in T4 with its rows of traditional Peranakan shophouses for a glimpse into the past. The inner (and perhaps outer) kid in me is also delighted by the knowledge that T3 has the world's tallest slide in an airport.

MINUS ½ HOUR ...

I arrive at my boarding gate in the nick of time, ready to board my plane and to move on to the next leg of my journey.

Hasta la vista Changi! 



SIAEC INNOVATIONS

In Enhancing Safety Standards at Changi Airport



In February 2016, SIAEC announced that the Company will be investing up to S\$50M on innovation initiatives and technology adoption projects over the next few years with EDB support.

The Innovation Group was established to spearhead these innovation initiatives and technology adoption across all business units to transform the workplace into the MRO of Choice. The key focus was to use technology and innovative solutions to drive automation through robotics, enhance process efficiencies, improve dispatch reliability and safety standards for our customer airlines operating into Changi Airport. These innovations will also improve and enhance workplace and aviation safety within the SIA Engineering Group of companies.


One of the key products that we have developed is the aircraft towing simulator for our air tug training course in April 2017. A range of 18 critical scenarios are simulated and included as part of the enhanced training syllabus. The simulator also allows simultaneous training of the entire towing team, consisting tug driver, headset man, tail and wing watchers, in a risk-free environment so that they are better prepared to handle a variety of operational towing scenarios.

The towing simulator features a motion platform providing three degrees of freedom to simulate driving operations, giving realistic feedback such as braking and turning effects. Actual Changi Airport and SIAEC hangars operating terrain and environment are projected on a curved screen, providing drivers with a viewing angle of 180 degrees. The team was awarded the Gold Award in Changi Airport Group (CAG) Annual Airport Safety Awards in 2018.

Separately, Innovation Group has worked with technology partners to develop a suite of Virtual Reality (VR) modules to enhance training. The objective of the VR training modules is to enable aircraft maintenance training to be carried out in an immersive, safe and repeatable environment. The VR training modules cover aircraft maintenance tasks such as fuel computation, walkaround

check and opening of fan cowl. It also allows unexpected technical scenarios or emergencies to be injected during the simulation to enhance the realism of training. This will further reinforce the need of maintenance crew to remain vigilant and enhance their preparedness to handle such emergencies.

The VR training modules were implemented in September 2018 and the team was awarded CAG Quarterly Airport Safety Award in December 2018.

Following the successes of these projects, the Innovation Group will continue to identify and develop competencies in technologies and innovations that will further improve aviation and workplace safety. 



Drone Racing

Jonathan Tan

Australia, 2013, witness the birth of a new sport when amateur drone pilots got together for semi-organised races in Brisbane and Melbourne. Cameras, live-stream and First-person View (FPV) goggles soon brought the fantasy of flight into an exciting adrenaline filled sport of drone racing. This issue, we interview Ryan Tan, alumni from the Singapore Institute of Technology, about his 4-year journey into FPV Drone Racing.

THE MAN

"3 years ago, I received toy-grade drone from my girlfriend. As a tinkerer, I went to YouTube in search of improving the flight characteristics of that drone and stumbled upon the world of FPV drone racing.

'VR-like goggles to fly?! It must be like Star Wars!', was my reaction when I first watched FPV drone racing. Since then, this little hobby turned to regular weekend flights – and so much more."

THE PASSION

Zippering their machines through the sky past 100km/hr within a second and around obstacles with precision and control. It is a breath-taking combination of adrenaline and elegance.

"The most memorable competition for me was the Asia Drone Championship 2018. Pilots from over 7 countries in Asia came to Singapore for this event. After a long day of racing, it all came down to the finals where I took my first win in a major competition.

Drone racing has also taken me to places like Korea and Turkey to meet and race alongside some of the fastest pilots in the World, and I am very grateful for such opportunities to have emerged."

THE COMMUNITY

"Ever since I read about FPV racing, I have been flying regularly on weekends and have met many friendly and knowledgeable people that have helped me along the way. There is a community of flyers in Singapore from 14 to over 50 years old.



Ryan Tan

THE MACHINE

Racing drones are basically the bare essentials of a quadcopter less any sensors or fancy body kit, and an additional video system, with speed and agility as the main focus.

"One big difference though, are the blades per propeller. Conventional 2 bladed ones allow high top speed, while 4 blades are very grippy at corners. Hence the most popular for racing are 3 bladed, offering good balance." Ryan added.

Some do fly on weekdays but as most are schooling and working, the flyers usually gather over the weekends."

Perhaps not everyone gets a chance to fly the red bull air race or have their hands at the controls of an aerobatic aircraft, and while some may argue it is an illusion, flying the drone in real world physics is unlike any simulation. With an FPV live stream that puts the pilot straight into the "Seat" of the drone, whilst disorienting at first, it is nothing short of becoming one with the machine. Perhaps the dream of flight is after all, closer than we think. 🚁





PUSHING THE INNOVATION FRONTIER

Jonathan Hung

11th GSTC

Held at St Regis Singapore, GSTC 2019 continues with the theme 'Pushing the Innovation Frontier'. It brought together almost 700 delegates from across the world – including Malaysia, China, India, Indonesia, Korea, Japan, France, United Kingdom, United States and Sweden.



Discussions of space technology were leavened with business opportunities and contemplation of its possible side effects and issues on cybersecurity. A panel discussion on the displacement of traditional larger satellites and the shift towards small-sat featured industry experts who provided commercial, research and industry insights. Several industry leaders spoke about advancement of satellite applications and innovations contributing towards disaster risk management, earth observation and geospatial data.

"Satellite data are fuelling development of numerous services that are set to become part of our daily lives and businesses"

Jean-Yves Le Gall, President, CNES

"With the emergence of a data-driven economy, Earth observation, positioning and communication satellites are today seen as vital links in the global digital infrastructure," Mr Jean-Yves Le Gall, President of CNES, said. "Satellite data are fuelling development of numerous services that are set to become part of our daily lives and businesses in fields such as the environment, healthcare, mobility and many more".

The two-day convention was launched by Guest-of-Honour, Mr Chan Chun Sing, Minister for Trade and Industry, with an opening address by Mr Philippe Pham, Head of Earth Observation, Navigation & Science of Airbus. Mr Jean-

Every year at the Global Space and Technology Convention (GSTC), held since 2007 in Singapore, stakeholders from across Asia and the globe, including international space organisations, policy makers, innovators, start-ups and venture capitalists convene to share the latest updates, innovation and breakthroughs of the space industry internationally.

Yves Le Gall delivered the opening keynote address on Day Two. We had over 60 speakers from regional space agencies including China's CNSA, Israel Space Agency, World Bank, SITAEL S.p.A, Singapore Land Authority, Pictet Wealth Management.

Topics covered included NewSpace, business opportunities, capital financing in space and the commercialisation of space. "The signing of three partnerships with three diverse organisations is a sign of commitment and contribution that SSTA represents," GSTA 2019 hosted partnership signings between SSTA and Singapore Land Authority, venture capitalist - Leonie Hill Capital; and Indonesia's Space and Aeronautics Association (SAAI). Mr Jonathan Hung, President, SSTA said, "They solidify space technology cooperation as we work together to advance Singapore's space ecosystem and position as the regional space hub."

"GSTC today attracts not just traditional or pure space or satellite companies, but also a growing set of adjacent industry players"

Jonathan Hung, President, SSTA

A start-up pitching session and the Singapore Space Challenge Award Ceremony celebrating our youth's innovation and ideas, rounded up GSTC 2019. Ms Indranee Rajah, Minister in the Prime Minister's Office and Second Minister of Finance and Education presented cash prize to the winning team.

"GSTC today attracts not just traditional or pure space / satellite companies, but also a growing set of adjacent industry players that contribute to our space ecosystem", Mr Jonathan Hung shares.

Conceptualised and organised by the Singapore Space and Technology Association (SSTA), GSTC has been bringing together industry leaders, heads of space agencies and government agencies to Singapore. In the past decade, it has grown to include innovators, start-ups and users of space applications and has served as a platform for "sharing visions, uncovering new opportunities, meeting new partners and addressing pressing issues for the responsible use of space and sustainability".

GSTC 2020 will be held in Singapore on 6 & 7 Feb 2020.

www.space.org.sg 



Evaporating with Colours

Carol Cheng

In today's fast-paced and competitive society, people aim for 'quick fix' of things in their daily lives. We find ourselves constantly trying to catch up with time and meeting deadlines to get things done. Gradually, we lose our sense of "harmony and alignment" with our mind and bodies which are continually being pushed to keep up with the daily demands. As a result, we become more vulnerable to stress. We burnt out easily, and in some cases, mental issues arise.


In recent years, we saw an increasing number of people signing up for mindfulness or meditation classes and retreats. The growing popularity of such activities showed that people are aware of the problem and are seeking remedies. While many people could benefit from practising mindfulness or meditation, some may find it challenging to keep their mind focused. The inability to prevent our mind from wondering is not confined to children. It happened to adults too.

According to the American Art Therapy Association (AATA), colouring pictures allows us to mindfully focus on a single task and protect the mind from stress-causing distractions. For people who struggled to meditate or being mindful, colouring is a useful and easily achievable alternative. It is meditative as attention will flow away from ourselves onto the present-moment event. When we are disturbed by our own thoughts or appraisal of the surrounding, our brain is unable to relax. Through colouring, the difficulties of life evaporate from our mind resulting in harmony for our bodies and our brains.

Unfortunately, the benefits of colouring are undervalued. People often perceive it as an activity for children. But it has been proven to work with many people. I encourage you to try out what we have prepared for you. Below is a simple picture to kick start your colouring experience. It is fun and worth the effort. Add some music while you are colouring and feel for yourself how the music could enhance the overall experience. Here are some suggested music to go with your colouring adventure:



Suggested Music	Composer
Sheep May Safely Graze	J.S Bach
Air on the G String	J.S Bach
The Wind of Change	Acoustic Alchemy
Spiegel im Spiegel	Arvo Pärt
Il Postino	John Williams
Reflections	Ola Gjeilo
Pied-en-l'air from Capricol suite	Peter Warlock
Enigma Variations no. 8 and no. 9	Edward Elgar
Only Time	Enya
Canon in D	Johann Pachelbel

This is a 'Dream-catcher', originated from North American Indians. It is believed to give its owner good dreams. So here it is for you to color your way to good dreams! 

Email carol.musicimagery@gmail.com if you are experiencing difficulties in life and have problems coping with it.

Building the Aviation Culture

Learning from Mistakes

It is 70 years since the maiden flight of the Comet 1 in 1949 launched the Jet Age. I was privileged to work on a later version, the Comet 4B when Malaysia-Singapore Airlines flew this aircraft for its international flights in the 1960s.

Prof. Lim Yeow Khee BBM



Photo by Clinton Groves

The development of jet aircraft endured several serious accidents which led to technical improvements and changes in operations and regulatory processes resulting in safe flights through the years.

In Jan 1954 BOAC 781 from Singapore to London crashed soon after take-off from Rome on the last leg of the flight. That was the 2nd new Comet crash under similar circumstances within seven months. Three months later SAA 201 made it the third Comet crash in a year.

Comet flights were suspended and production halted. Investigation revealed that all three crashes were result of structural failures. A team of engineers and scientists rebuilt recovered wrecks and found that cracks had developed in the fuselages of the ill-fated Comets. Under repeated pressurisation cycles the rivets couldn't sustain the stress on the hull. Cracks also propagated from the corners of rectangular windows and doors. The Comets had blown apart at the seams.

It was learnt that the nature of metal fatigue and new construction methods under repeated pressurisation cycles were not well understood. Improved construction methods and rounding the corners of windows, doors and

panels were among the changes made to ensure safety of later Comets.

The aviation industry has learnt much over the decades with super jumbos and supersonics and ULR aircraft flying hundreds of thousands of people around the world every day. But lapses do occur every now and then.

In Apr 1988, Aloha 243 had part of the fuselage of the 737 flying from Hilo to Honolulu blown off at 24,000ft. It was found that the aircraft had gone through 89,000 flight cycles – the early Comets had failed at between just 900 and 3,000 cycles. There were also maintenance lapses that contributed to the accident.

Aircraft suffered catastrophic failures compounded by weather and pilot error. This is part of the tedious process of "Learning from our Mistakes" to make flying safe. James Reason has developed a "Just Culture" system to balance between no-blame and punitive working environment to enhance learning from our mistakes. This requires good reporting culture and administrative policy to discourage cover-ups of errors committed. But in this world of litigations and commercial pressures, getting the balance right can be challenging. But we must continue to strive to keep the balance as the future of air transport lies in our ability to hold this balance.

Errors in the work environment are not the only problem in managing safety. Gordon Dupont had warned of latent risks in the whole chain of aviation safety management. Organisation, HR policies and error reporting culture are some of the hidden risks which are much more difficult to uncover. The Space Shuttle Challenger disaster in 1986 and recent 737 Max crashes are examples of organisation risks which are latent and can rear their ugly heads at the most inappropriate moment. 🛩️

<< Recovered parts of the Comet shown as shaded regions



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