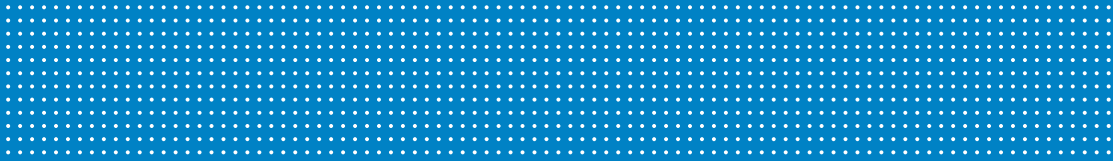


DSO: WHAT MAKES US TICK?



WE ARE ALL ABOUT

**PEOPLE
PASSION
INNOVATION**

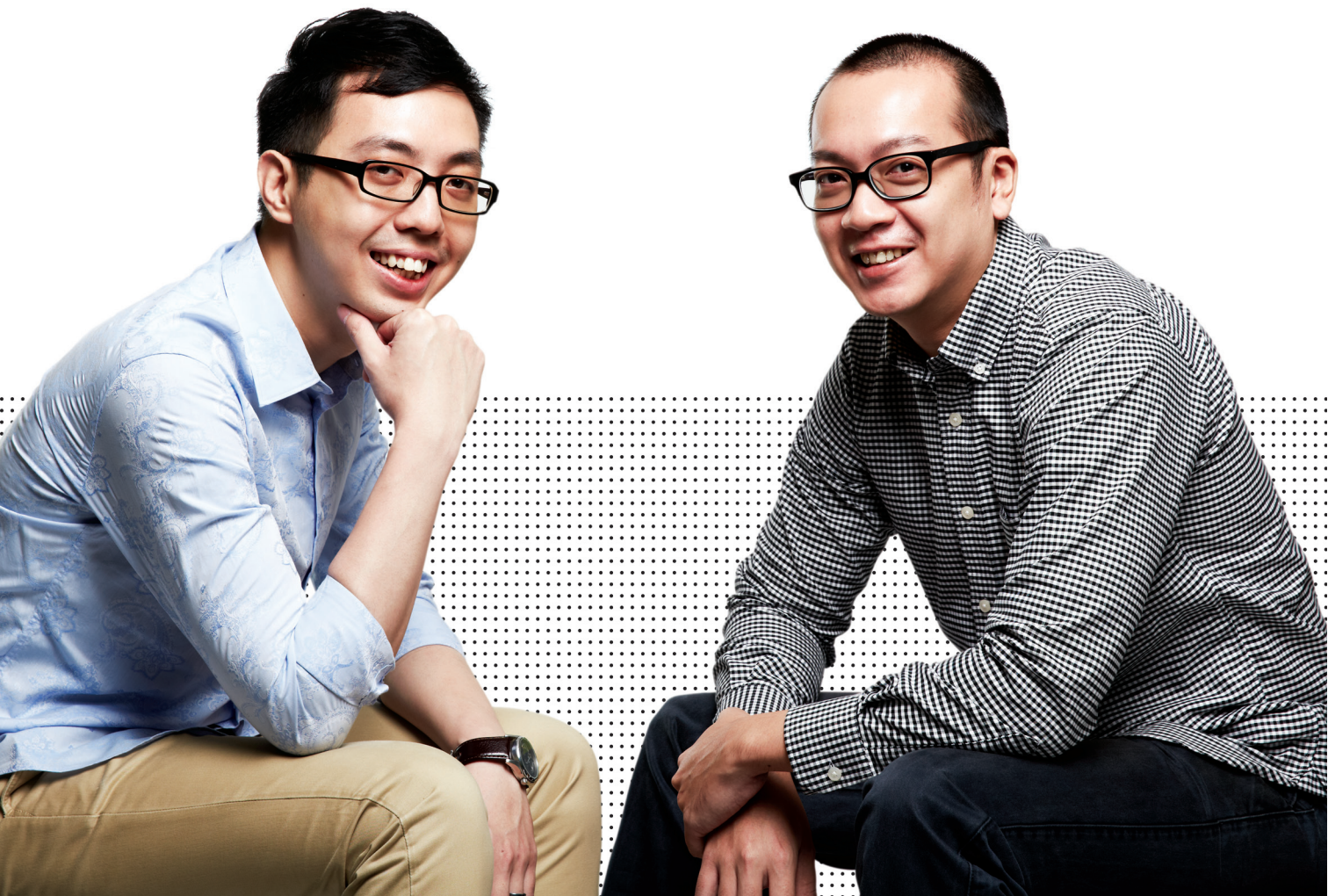
THE EDITOR'S LETTER

.....
Bjorn Lim and Franz See
Corporate Communications

You stare at the monitor, crunch numbers and even venture into uncharted territory. Every Monday to Friday. Maybe the occasional Saturdays too. Have you ever stopped to ask yourself: "What's the point of it all?"

We believe that at the heart of a man is his spirit. It is the bare essential of every existence, including Singapore's oldest R&D institution. Hence, for this issue of our staff magazine, we broke down the brick and mortar of DSO to uncover what we truly stand for. We readied our shovels, armed ourselves with an almost free flow of caffeine and dug deep into DSO's most precious asset: our people.

What followed was a series of impromptu chats, quick conversations and intensive discourse. Our colossal news archive was even raided. And we were pleasantly surprised. We discovered that it is the unique combination of our People, Passion and Innovation (PPI) that defines DSO. It keeps us going and getting better. So here we are, with our latest Staff Magazine, and we thank you for being part of our PPI – all 41 years of it.



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THE MASTERMINDS

We all know that we can count on our Management Committee members for their wealth of experience, depth of knowledge and sound advice. That's why we pick their brains so often. But what you may not know is this: besides leading the charge for a better DSO, they are also ardent advocates of PPI! Don't take our word for it; hear what it means to them and their divisions.

1. Quek Gim Pew (Chief Executive Officer)

PPI defines DSO. It also encapsulates the management philosophy. It reminds us that we need to bring in good people and provide them with the environment that ignites their passion and helps them create innovations.

2. William Lau (Chief Technology Officer & Director, Defence Medical & Environmental Research Institute)

People are the most important asset in DSO. Passion and innovation are two important attributes that we want all our people to have. Passion is the key driving attribute that propels us towards excellence in everything we do. Innovation is part of our core values and it is the magic that gives our products that secret edge.

3. Philip Chan (Director, Electronic Systems Division)

Much of the work in Electronic Systems is developmental, and we also support other divisions in their projects. There is a high demand for quality in our output. It is therefore essential that we



continue challenging our people with interesting R&D work so that their passion is sustained, and they are motivated to innovate.

4. Dr Tan Guan Leng (Deputy Director, Electronic Systems Division)

Increasingly, innovations will be the key to DSO's future as a distinctive provider of high ops-impact solutions to the SAF. When you have a workplace filled with people with passion, innovation is only a matter of time. So PPI is a reminder that DSO should continue to attract and cultivate staff with passion to fill our ranks.

5. Dr Goh Joo Thiam (Director, Emerging Systems Division)

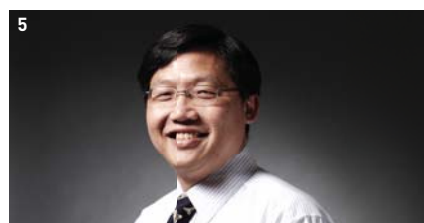
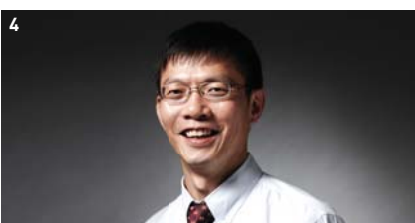
People will always be our key resource, and they will often face difficulties due to the unique and challenging nature of our work. If we can develop a group of passionate people who not only love the work they do but also believe in the cause itself, then innovations will flow freely!

6. Lim Teow Hoe (Deputy Director, Emerging Systems Division)

PPI is about individuals and teams having a strong conviction to positively impact things around them, be it as grand as national security, or more down-to-earth like running projects well and building camaraderie. Innovation is the most direct output of this in the context of DSO as a technological organisation.

7. Andrew Leong (Director, Finance and Administration Division)

F&A provides unwavering support to the operations of the organisation, and ensures that DSO flourishes in her capability development. Doing this requires people who are able to serve with passion. And it is with this passion that we are able to innovate corporate initiatives that can leapfrog DSO's organisational efficiency and effectiveness.



8. Dr Tan Kok Tin (Director, Guided Systems Division)

PPI is in everything we do. Our talented people, driven by their passion, create innovation for the sole purpose of our national security. If we stay true to PPI, DSO will surely reach new heights while becoming a more valuable partner of SAF.

9. Serene Tan (Assistant Director, Human Resource)

Passion can only come from people. It is also derived from a strong conviction in our professional value and contribution to DSO. Both combined gives the drive to change or to catalyse change, to realise dreams and ambition. If we can dream it, we can realise it.

10. Dr How Khee Yin (Director, Information Division)

People with passion are key to delivering on DSO's mission to enhance Singapore's defence capabilities. Without passionate people who understand the importance of what we do, DSO will not be able to achieve our mission.

11. Cheong Chee Hoo (Director, Networks Division)

PPI means that our focus is on people. We bring in the best people who are passionate about defence R&D, and bring out the best in them by providing a conducive environment for them to innovate. For NW Division, many of the innovative breakthroughs were brought about because of the passionate people we have.

12. Chua Poh Kian (Director, Organisation Development Division)

Innovation is an important pillar for DSO, including corporate divisions. OD must play our part to innovate corporate systems and processes, as well as enterprise systems that are lightweight, intuitive and efficient. This will provide a conducive environment for all in DSO to innovate, and deliver technological surprises for our national defence.

13. Chia Chung Hong (Director, Project Management Excellence Office)

The primary role of PME0 is to strengthen the management skills

of our project leaders. Ultimately, whether DSO is able to deliver systems that delight the users depends on how well our project leads are able to unleash the passion of their people, leading to stronger innovation and greater products.

14. Chan Hian Lim (Director, Sensors Division)

Delivering technologies and solutions that give Singapore's defence the critical edge requires people with a passion for defence science and engineering. It also means that DSO has to provide the environment that nurtures our people and enables them to exercise their passion in the pursuit of innovation.

15. Yeo Kee Kong (Director, Quality Division)

As professionals tasked in ensuring the quality of DSO's innovations, we have to be passionate and innovative to develop pragmatic processes, and ensure their timely implementation for the wide range of R&D activities in DSO.

"DSO without people will be like a dish without flavours, a rainbow without colours, or a car without the engine."

Tan Lik Sin

"People form the foundation and backbone of an organisation. They are the brains behind the machines and the source of knowledge and innovation. Having the right people is almost like striking the jackpot!"

Heng Wee Ling

PEO



“People add the dynamic dimension to DSO’s core values to make them come alive.”

Sharon Sng

“DSO on its own is just an organisation. It is the people who are the real capital; the assets capable of harnessing the different resources to propel DSO towards achieving its mission and vision.”

Goh Xin Yi

”

PILE



"Passion is about believing in the value of my work, and this belief is the real motivation."

Sik Ban Huei

"When we do whatever we do with a passion, we are more than likely to discover the next level of our purpose. Your passion can earn you money, but your money will never earn you passion!"

Elson Tan

"Passion is important to produce quality work, strive for excellence and push the boundaries."

James Cheng

PASSI



ON

“

“Passion to me is like fuel for a car. It empowers the human spirit to contribute to the best of its ability and encourages it to burst man-made boundaries. I strongly believe that passion breeds success.”

Harminder Singh

”



“Constant innovation is what differentiates us from our competitors. It is our bread and butter.”

Woon Shi Hui



“

“Innovative ideas - be it simple ideas within a project, or grand ideas for new projects - generally reward with high returns. The sense of satisfaction after a successful attempt sows the seed for one to come up with more innovative ideas.”

Lam Lap

”

INNOV

"I want to create, not follow."

Andy Zhang

"My work needs to cater for the
unique operational needs of the SAF.
The only way to fulfil those needs is
to provide cutting-edge solutions that
are driven by innovation."

Wong Ngee Hui

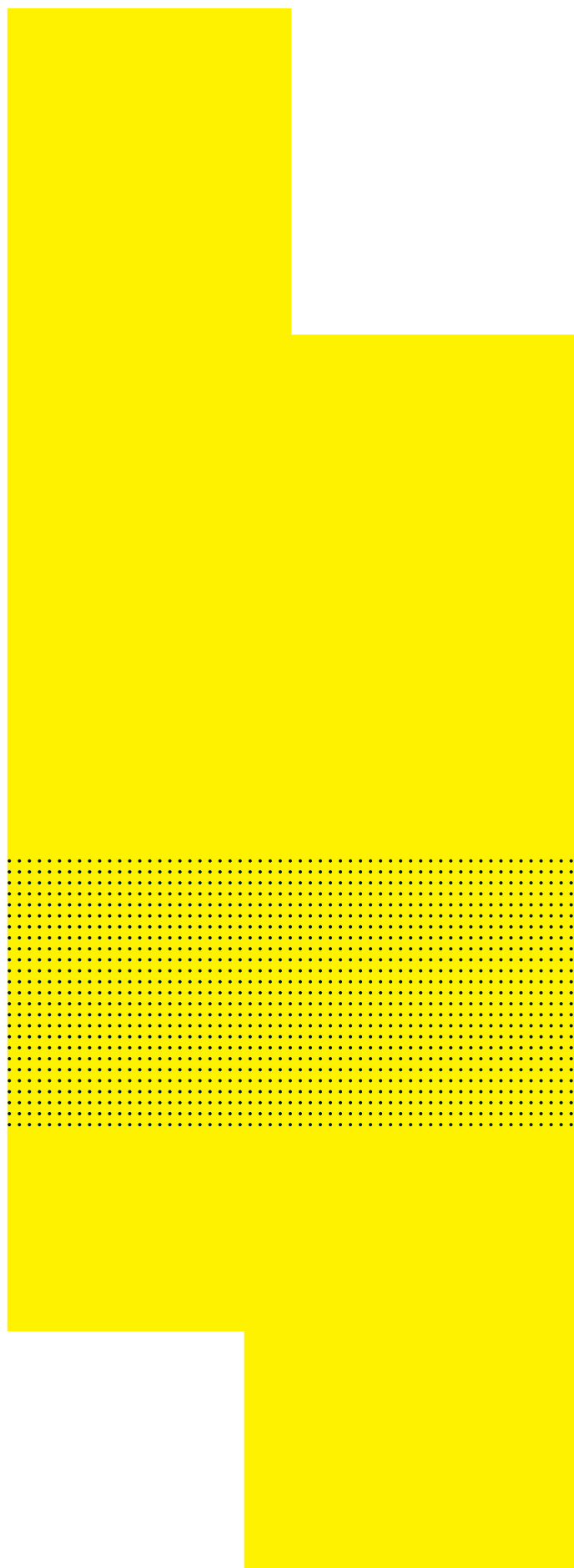


ATION



THE TALENT FACTOR

Our People. Our Passion.





TALENT ALERT!

It's an absolute jungle out there: every organisation is on the hunt for talents. At DSO, our radar for the best is always on. This is because the key impetus to our innovation is our people – individuals who share a deep passion for excellence, unafraid to challenge the limits and innovate. This was true when DSO was first established in 1972 with a 3-man team, and the same ethos remains in the 21st century.

And how far we have come.

Today, we have more than 1,300 research scientists and engineers. We have talents who believe in making a difference and have chosen DSO over the private sector, like Joshua Chao and Teo Wei Hao. We continue to attract the cream of the crop in schools. Scholars Huang Huimin and Lam Jun Wei are two fine examples. Then we have Ong Kai Wei, Robert Foo, Foo Wei Jian, Thomas Quah and Lim Yee Siang – in their pursuit of excellence beyond their area of expertise. To sum it up, we want and have talents, and here are some of them.

'High flier' at unmanned airplane contest

By JERMYN CHOW
DEFENCE CORRESPONDENT

MR JOSHUA Chao, 25, is plane crazy.

When he was in national service (NS), he applied to join the Republic of Singapore Air Force as a pilot, but failed to make the cut.

So after his NS, he went to study aerospace engineering at the Nanyang Technological University (NTU) to learn about flying machines.

He had always been designing and building pilotless surveillance planes. With a team of NTU students he assembled, he came up with a prototype for an Unmanned Aerial Vehicle (UAV) he named Extractor X.

He entered this in UAVForge Challenge, an international competition organised by United States defence research outfit Defence Advanced Research Projects Agency and the Space and Naval Warfare Systems Centre.

The plane has been placed sixth, beating a field of 140 unmanned aircraft – including those designed by the Massachusetts In-

stitute of Technology and defence contractors.

Weighing all of 1.5kg and GPS-enabled, the battery-powered craft stays aloft for half an hour and can pick up ground targets.

The plane's edge over the top nine teams was that it was made the most cheaply – with just US\$2,081 (\$\$2,590) worth of parts.

It was also the only entry in the competition that could be converted from a rotary-wing aircraft into a fixed-wing plane.

But Mr Chao is not just a geek who won an international airplane-design competition.

Up until recently, the newly minted NTU graduate owned a company specialising in producing UAVs.

The elder of two sons of an electrical engineering lecturer had already worked on up to 40 UAVs in two years.

"I want my work to have real applications and to sell in the market," he said.

He has since sold his shares in the company to take up a day job with DSO National Laboratories. He starts this month, specialising in unmanned systems.

It is a job that will put him in touch with more experienced people in the field, he said.

Recalling his experience building the Extractor X, Mr Chao said he had built a 3kg UAV as a final-year school project.

But it could be entered in the competition only if it fulfilled size and weight criteria, so, with his team, he reduced its wingspan and halved its weight.

And while some teams in the competition worked on their "babies" for as long as four years, his team had all of seven months to meet the competition's deadline.

"I wasn't sure if we could get into the finals, but there was nothing to lose," he said.



(From left) Mr Jasper Sim, Ms Eunice Lim and Mr Joshua Chao worked together to create the Extractor X that took sixth place in a UAV competition held in the US. The plane weighs 1.5kg and costs just \$2,590. ST PHOTO: DESMOND WEE

He and the team missed meals and lost sleep working on it – and he was in the middle of his final-year examinations at that.

His 25-year-old girlfriend Eunice Lim, now a teacher, put her design and media training into use by producing the team's presentation video.

Team member Jasper Sim, 23, a second-year aerospace engineering undergraduate, said: "I learnt a lot more than from textbooks and saw how engineering applies

in the real world."

Mr Chao may not be donning a pilot's G-suit for a day at the office, but he said that he is happy to be able to create the next-generation unmanned fighter jet, which could well make pilots obsolete.

He said: "Humans have limitations. Pilots cannot take the kind of pressure or risks that these flying robots can."

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06 aug
2012

Bright young minds pick DSO lab over private sector

They are lured by real-world application of research in defence science laboratory

By LIM YAN LIANG

AS THE cream of the academic crop, they could easily be making big bucks in the private sector.

Instead, they choose to labour in the shadows, developing military technology to help keep Singapore safe.

Mathematics whizz Teo Wei Hao, 27, is one of the bright young minds employed at the country's oldest defence science laboratory, which celebrates its 40th anniversary this year.

His love affair with numbers began in primary school, when he realised he had a talent for complex sums. "Before that, I always thought I wanted to work as an SMRT train driver," he said.

These days, he puts his talent to good use at DSO National Laboratories. He is an expert in the arcane art of cryptology, which involves coming up with new mathematical algorithms that keep the military's communication and top-secret files hidden from prying eyes.

"My mum keeps asking what I do but I had to tell her 'Sorry, just don't ask me'," he said. "She couldn't even brag to her fellow aunts, sadly."

One factor that attracts talented young people such as Mr Teo is that their work usually ends up not in a paper or a patent, but as real-world tech-

nology. "The things we do directly impact Singapore's defence," he said. "It is applied research, and even in peacetime we are relevant."

Altogether, DSO employs about 1,300 scientists, who are experts in fields ranging from radiological research to communications technologies to unmanned systems. The aim is to make sure it never stops attracting and retaining home-grown talent.

This was easier said than done back in the 1990s, when it had to compete with the private sector for the nation's top engineering, science and maths minds. "It was the dot.com boom, when there was huge interest out there for people," said DSO chief executive Quok Gim Pew.

"I didn't know whether or not we could attract talent to defence if we continued to operate within the civil service rules and regulations."

The solution, to corporatise DSO, was a major change, but the fruits are evident today.

In 2007, slightly under a quarter of its research scientists were aged below 30. Today, the proportion is closer to a third. On average, researchers and engineers stay with DSO for nine years before moving on, unheard of in sectors such as IT and financial services.

Miss Cheryl Seow, 25, is another of the lab's bright young sparks. Her job



Cryptology expert Teo Wei Hao, 27, is one of the research scientists employed at DSO National Laboratories, which marks its 40th anniversary this year. ST PHOTO: JOYCE FANG

involves hyperspectral imaging: a kind of photography that can see beyond what the human eye can, picking out anomalies and hidden enemies by detecting their unique chemical signatures. The technology was used during the mission that led to the death of terrorist leader Osama bin Laden.

"A traditional camera might be able to tell you what does not belong in a scene, but the next question, then, is 'What is it?'" said Miss Seow. "Hyperspectral tells you which anomalies you need to be worried about, and which you don't."

Another factor that helps DSO to

attract young talent is its long-term view of career development. Around 20 PhD and postgraduate scholarships were given out in the past five years.

But perhaps its biggest draw is its commitment to what Mr Quok called "spiral development", in which a prototype is pushed out at the earliest opportunity, then continually improved with field testing.

Miss Seow said: "It's quite different from the research that I did in university, because now what I do will actually contribute to a real system in the end."

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From James Bond-style secrecy to civilian projects

IT WAS once seen solely as a breeding ground for top-secret military inventions. Now, however, DSO National Laboratories is increasingly branching out into civilian work.

Over the past decade, it has taken on more than a dozen non-military projects - including one that used computer models designed for the battlefield to simulate how disasters and conflicts abroad can affect Singapore.

Even the lab's own researchers have been surprised by the variety of civilian work it has been doing.

"My impression of DSO when I first applied was that it was very secretive, like those James Bond movies with the scientists hidden in the background, wearing white coats," quipped Dr Sim Mong Soon, 37. "It's turned out very different."

The lab has been wooed by various civilian agencies, including the Energy Market Authority.

Last year, a group of researchers at DSO delivered a computer model to the authority that could estimate how Singapore's supply of crude oil might be affected by conflicts or other disruptions in countries that supply it.

"We found out where the critical choke-points crucial to securing our energy sources were, and various alternative routes usable in the event of disruption," said team member Johnson Poh, 29.

Another part of DSO that has been called up for duty in times of national crisis is a nondescript, whitewashed building on top of Marina Hill. This location is no coincidence. It is still one more precaution taken by the country's oldest Biosafety Level 3 laboratory.

During the anthrax scare in 2001 and the severe acute respiratory syndrome (Sars) outbreak in 2003, the Government relied heavily on the facility, which tests samples that may be contaminated with chemical or biological agents.

It was also called upon when the H1N1 virus struck in 2010, said Detection and Diagnostics Laboratory senior staff member Tan Yan Kim.

"For Sars, we received about 1,500 samples over two to three months, which meant we had to process tens of samples every day," said the 37-year-old. "For anthrax, we could be called back any time of the day or night."

LIM YAN LIANG



Researcher Loh Kok Kee brushing a blood agar petri dish, used to culture bacteria, at the Biosafety Level 3 laboratory at DSO National Laboratories. It was thrust into the limelight in 2001 during the anthrax scare, when it was the only lab here capable of safely handling the bacterium. ST PHOTO: LIM YAN LIANG

GIVING SAF THE LETHAL EDGE

Behind cutting-edge hardware is the software that makes the machines work with the SAF's current technology. These are examples of how DSO's magic makes the difference.

SKYBLADE III

- Length: 1.4m
- Wing span: 2.6m
- Maximum take-off weight: 5kg
- Endurance: Over an hour
- Range: 8km



ENHANCED SKYBLADE III

- Length: 1.8m
- Wing span: 3m
- Maximum take-off weight: 9kg
- Endurance: Up to six hours
- Range: 15km



- Instead of depending strictly on the conventional battery source power, the next-generation Skyblade III unmanned aerial vehicle (UAV) also has hydrogen fuel cells. The conventional lithium battery is used during take-off and altitude climb, while the spy plane switches to the fuel cells while cruising.
- By creating an intelligent power management system that knows exactly when to switch power sources, the net effect is an improved, battery-sipping spy plane with six times the air time.
- With more juice on tap, the hybrid-powered spy plane can also take higher-powered and heavier surveillance cameras.

Anti-GPS jamming antenna array

- Autonomous air vehicles of today rely on mapping information and global positioning satellites (GPS) to self-navigate. But GPS signals, which come from space, are weak and easily jammed by military-strength equipment.
- To cancel out interference that might cause the UAV to crash, DSO has shrunk a conventional GPS antenna patch down from 9cm by 9cm to 1cm by 1cm. The team then squeezed five of the antennas into the same 15cm space that the old antenna occupied.
- But the linchpin is the researchers' signal processing software that not only got the antennas to talk to one another, but to work in sync to cancel out any rogue signals.

ST GRAPHICS

FROM 3-MAN TEAM TO POWERHOUSE

DSO National Laboratories chief executive officer Quok Gim Pew tells Defence Correspondent Jeremy Chow how the organisation grew from its humble beginnings to Singapore's largest R&D body.

In the 1970s...

1972
Dr Goh Keng Swee, then Minister for Defence, handpicked three newly graduated engineers to form the Electronics Test Centre (ETC) to build up the Singapore Armed Forces' (SAF) edge in electronic warfare. They operated out of a building along Whitley Road.

1976
ETC grew to a 20-man team and moved to its new premises in Marina Hill in Kent Ridge.

1977
The Defence Science Organisation (DSO) was established. Staff size: 50 engineers.

From the 1980s to 1990s...

1986-1991
The Defence Ministry (Mindef) formed the Defence Technology Group (DTG), which brought together the technology and logistics groups in Mindef, and established DSO as the centre of research and development (R&D) for the SAF.

DSO moved to its current location at the Science Park in Kent Ridge - a move which required its role and importance to be publicly revealed for the first time.

1997
DSO was corporatised and renamed DSO National Laboratories.

In the 2000s...

2002
DSO offers a peek into the secretive research outfit and its work on electronic warfare and guided weapons in its first commemorative book, Creating The Technology Edge.

2003
DSO's specialties expand beyond electronic warfare to include human sciences which studies improving a soldier's performance in the field.

DSO provides diagnostic support for clinical samples during the Sars outbreak. It develops a diagnostic kit to detect the virus.

DSO's expertise was tapped by homefront and civilian agencies like the Ministry of Home Affairs and Ministry of Health to create "spin-offs" from defence solutions. They included chemical, biological, radiological and explosives threats and cyber security.

2004
One of DSO's projects, a TV-guided bomb, was shown to the public for the first time, 20 years after work first started to build a prototype.

2011
DSO and the Nanyang Technological University successfully launch the microsatellite X-Sat, that the two sides partnered to design and build in 2000.

2012 and beyond
DSO is the oldest and largest R&D body with 1,300 scientists and engineers.

Up to 20 DSO innovations are operationalised in the SAF every year, with at least two deemed by servicemen as "game-changing technology".

R&D talent pool to grow to 1,500 within the next few years.

Doing the real thing



PHOTO: DSO NATIONAL LABORATORIES

DSO chief executive Quok Gim Pew (above) gives his take on:

The First Gulf War in 1990-1991: It was the eye-opener and harbinger of how technology can add the edge to the armed forces and play a decisive role in the battlefield.

DSO's corporatisation in 1997: The move freed DSO from the civil service procedures, and administrative and budgetary process. The intention was to give DSO the flexibility and freedom to adopt best market practices, compete for talent, allow it to be more nimble in the R&D world.

Sense of satisfaction: It is one of

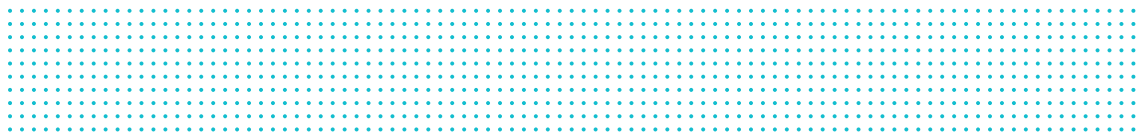
the few places that allow scientists to do the real thing... it's not just... research on paper... you see it move into application, into a product.

Finding unique military solutions: Whatever the SAF can buy from the commercial market, we should not be involved. We focus on things that are not available outside; you don't necessarily find a solution (by putting out) a tender.

Total commitment: We are looking for people who will invest their time, energy and effort to understand the operational problems that the SAF faces... If they have absolutely no interest in the SAF, then they are a liability to us.

SPOTTED: YOUNG AND FAB

Working at DSO is a one-of-a-kind experience because we are buzzing with like-minded people who want to make a difference with their innovative ideas. Whether you're grabbing a bite at the cafeteria or simply walking along the corridors, don't forget to say hi and chat with some of our featured young talents - you'll never know what inspiration you'll get!





Game on for Singapore's Defence

A big fan of video games since young, Andy Zhang grew intrigued and started developing software on his own. Today, he continues to experience the thrills of having "Serious Fun" as a DSO software engineer, as he relentlessly pushes the boundaries to make a difference to Singapore's defence capabilities.

Your passion in software engineering...how did it all begin?

When I was in primary school, I loved playing computer games every day. It inspired me to create software, be it games or other applications. I started to dabble with HTML to try to create simple websites before chancing upon an introductory course on Flash. I then realised that it was amazing what I could do with just clicking and typing. My interest in software led me to major in computer engineering in NUS. During my final year, I successfully applied for the position of a software engineer in DSO.

Why did you choose DSO?

I learnt about some of the work that DSO does during one of the career fairs organised by NUS and my faculty, School of Computing. It really piqued my interest and I wanted a career that can make a big difference in the defence of Singapore.

What are the challenges of your work?

Creativity and deadlines. To improve the software's performance, creative solutions are required in the redesigning of the code. Being able to have different perspectives on the problem at hand and staying updated with the latest technology are a must. Also, some projects are time-critical. Before trying a new algorithm, I must always factor in time to consider the potential performance impacts.

How do you stay motivated?

The thought of being able to conquer the challenges spurs me on. It also helps that DSO has a very supportive environment. The organisation has many staff bonding activities and my team is like a big family. I can always count on them when I need advice for a software problem. DSO is also a strong advocator of work-life harmony and the initiatives in place allow me to recharge for more challenges!

Do you have any advice for those who are interested in following your footsteps?

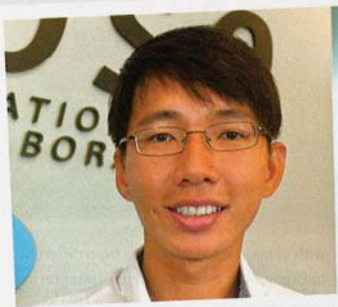
Be innovative, think ahead and persevere. Most importantly, you have to love what you're doing. As long as you are passionate about what you do, I believe you can succeed.

Interested in a career that puts you at the forefront of science and technology? More than 1,200 DSO research scientists and engineers work seamlessly across disciplines to build strategic capabilities in the domains of land, air, sea and cyberspace. Visit www.dso.org.sg to discover our exciting array of career opportunities.

10 apr
2013

SPOTTED: YOUNG AND FAB

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2013



EXPLORE POSSIBILITIES BEYOND THE CONVENTIONAL

NAME Kwek Weilun, 27

QUALIFICATION BEng (Hons), Electrical Engineering, NUS, 2010

JOB Research Engineer

EMPLOYER DSO National Laboratories

I AM MOTIVATED BY continuous honing of technical competencies through working with like-minded individuals.

At university

As an Electrical Engineering graduate, I specialised in the area of communications engineering. My education enabled me to build a strong theoretical foundation in the areas of digital and radio frequency, as well as optical communications. The knowledge and skills I acquired have been immensely useful and applicable in my current job as a Research Engineer in the area of Electromagnetic Compatibility (EMC). If you are interested in doing research in EMC, you should consider taking up electives related to the study of microwave circuits, antennas, signal processing and modulation techniques.

My background

I joined DSO as a Research Engineer after graduating in 2010. I have always been intrigued by the workings of electromagnetics and its defence applications. EMC has often been described by engineers as being similar to 'black art'. This description has always intrigued me, and spurred me on to learn more so that I could unravel its 'mysteries'.

My company and job

As Singapore's national defence R&D organisation, DSO creates innovative technologies that force multiplies the Singapore Armed Forces' (SAF) capabilities, and gives them the critical edge in the battlefield.

In our dense electromagnetic environment, Electromagnetic Interference (EMI) is a big concern as it degrades a system's performance and effectiveness. Hence, my work ensures that components within our systems do not interfere with each other, as well as with other systems.

For fresh graduates who are looking to join DSO, the learning curve may be steep as the job scope goes beyond what textbooks teach.

My work involves a good mix of research and theoretical analysis, as well as practical field trials. I am also given opportunities to work on a good spread of projects. This can range from subsystem level design to achieve intra-system EMC, to full system integration onboard platforms to ensure inter-system EMC. I have been involved in integrating payloads onboard aircraft, upgrades to naval platforms and even implementing EMC design for an autonomous underwater vehicle!

Getting the job

The selection process comprises two interviews. The first interview was conducted by a panel of directors from the R&D divisions who assessed my passion and interest in defence R&D. The second interview was conducted by my potential immediate supervisor who assessed my skills and matched them with the requirements of the laboratory.

Having good academic results definitely helps in getting an interview. More importantly, you will need to have a genuine passion for defence research. If you possess that passion, half the battle is won!

Be prepared for

Exploring the unknown! In defence R&D, solutions are usually commercially unavailable, and have to be developed from scratch. This requires us to have a critical mind and a willingness to explore possibilities beyond the conventional so that solutions can be developed.

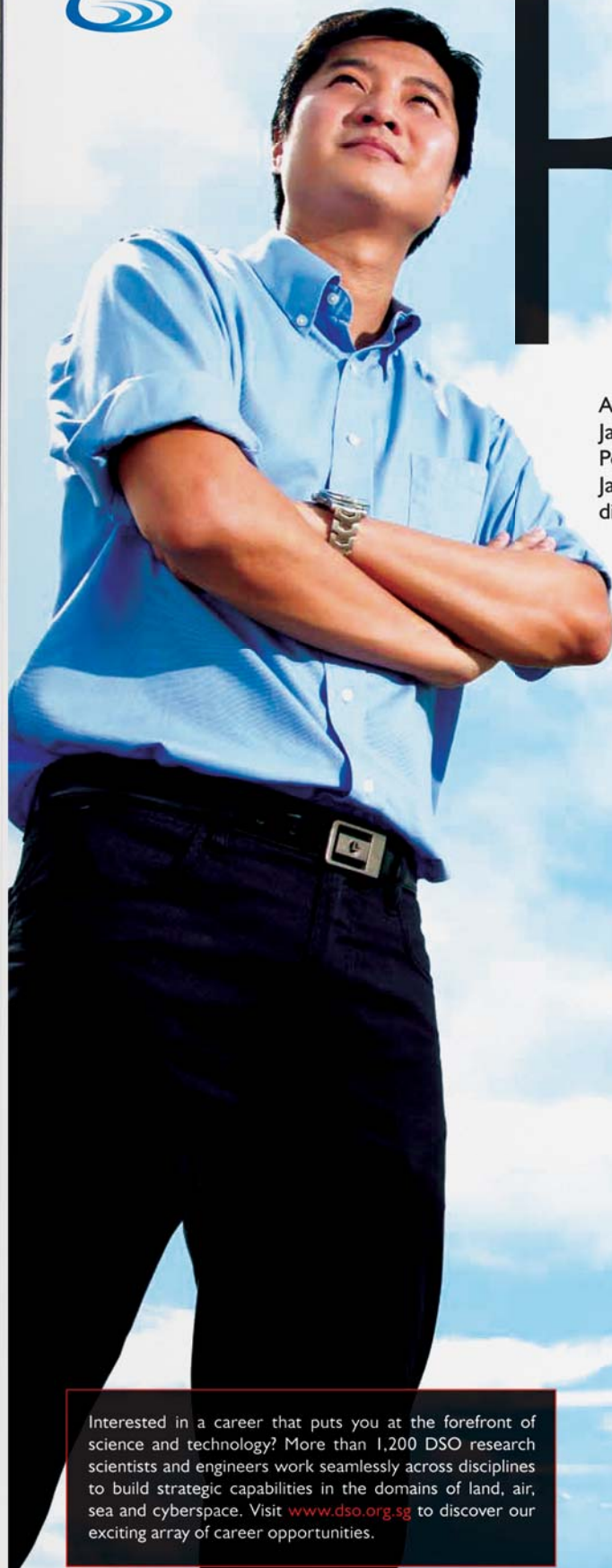
Research involves continuous learning and DSO recognises this. We are given opportunities to attend in-house training programmes, local and overseas conferences, so that we can stay up-to-date by interacting with experts from industry and academia.

Some advice

Take up relevant subjects in your field of interest during university, but don't just learn from textbooks. Try to explore translating your theoretical knowledge into working prototypes and systems. For fresh graduates who are looking to join DSO, the learning curve may be steep as the job scope goes beyond what textbooks teach. But the open learning culture means that helpful and experienced colleagues will always be on hand to guide you along by sharing their wealth of expertise.

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2013



Rising

to the challenge of

Singapore's Defence

At DSO National Laboratories (DSO), the sky's the limit for Jason Yap, an electronics engineer. An alumnus of Ngee Ann Polytechnic's Electronic and Computer Engineering faculty, Jason now works at the forefront of technology to make a difference to the security of Singapore.

How did your interest in electronics start?

It began when I was a student and was strengthened by the Avionics system course which I studied in Ngee Ann Polytechnic. My final year project about simulated aircraft flight performance analysis exposed me to in-depth knowledge and valuable analytical skills. That sparked my aspiration to pursue a career as an electronics engineer.

What convinced you that DSO was the right place for you?

I was looking for opportunities in the aerospace industry when I chanced upon a DSO recruitment advertisement. I did some research and found out that DSO could allow me to build in-depth expertise in a wide range of technical fields. Thus, I decided that DSO is the place to be.

What is the biggest challenge of being an electronics engineer in DSO?

The constant change in scenarios and test platforms' requirements! To ensure quality and reliability in our tests, electronics engineers need to stay resourceful, innovative and up-to-date with the latest technology. For example, Singapore's lack of space may not be suitable for our test platforms. To overcome that, we have to consider different test methods or even venture overseas.

How do you stay motivated?

Knowing that my work contributes to the enhancement of Singapore's defence capability keeps me going despite the challenges. It also helps that my efforts are recognised within the organisation, and at a national level. During my tenure at DSO, I have received a team award from DSO and the coveted Defence Technology Prize (DTP) Award from the Ministry of Defence for my contributions.

Do you have any advice to share with those interested in following your footsteps?

Just four simple words: "DO NOT GIVE UP." Stay focused, and pursue your dream with passion. You will eventually get there!

Interested in a career that puts you at the forefront of science and technology? More than 1,200 DSO research scientists and engineers work seamlessly across disciplines to build strategic capabilities in the domains of land, air, sea and cyberspace. Visit www.dso.org.sg to discover our exciting array of career opportunities.

THE FRESHMAN

Lam Jun Wei

We believe the best way to cultivate talent is to start them young. And trust us, Lam Jun Wei is so young that his age will make you feel old real quick. Here's our quick 15-minute chat with our latest and freshest scholar - the ink is not even dry on the contract!

🕒 **Welcome to the DSO family! How did you chance upon our scholarship?**

I had the opportunity to participate in the Young Defence Scientists Programme (YDSP) when I was studying at NUS High School of Mathematics and Science. It was through YDSP that I found out about the DSTA Scholarship, which gave me the option to work with either DSO or DSTA after my graduation.

🕒 **So how did you arrive at your current choice?**

I decided to join DSO because I was more interested in the Physical Sciences. Plus, I wanted to do research. DSTA had a different focus – acquiring and integrating systems.

🕒 **What piqued your interest in R&D?**

It all began during my first internship in Nov 2010. I was an intern at DSO and had the opportunity to work with my mentors, Dr. Ng Hui Khoon and Dr. Lim Yuan Liang, on understanding how a certain configuration of lasers works. I found myself applying Linear Algebra, Calculus, and programming that I learned in school. It was immensely satisfying to be able to use my knowledge for something productive.

🕒 **What is it about R&D that you like?**

Research is largely about ideas. To me, ideas are one of the greatest contributions that a person can make to society. It may take a thousand people to implement a great idea, but such an effort would not have been possible without the party that created the idea in the first place.

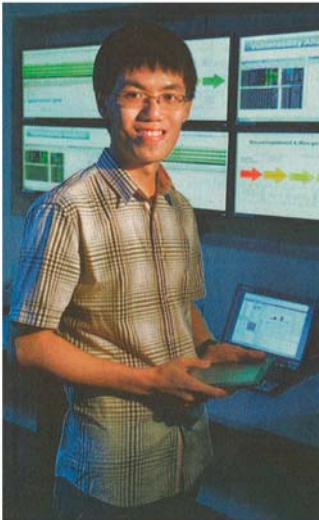
🕒 **What aspirations do you hope to achieve at DSO?**

I hope to be able to develop technology based on new ideas as opposed to improving existing technology.

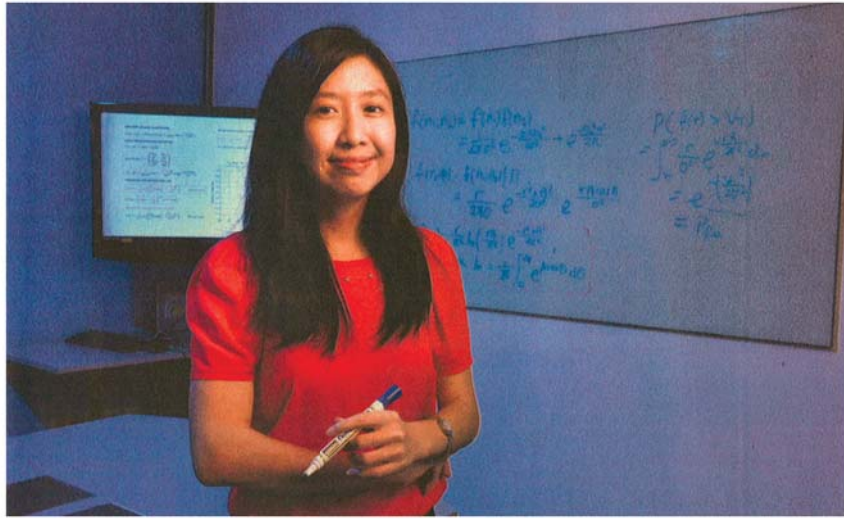


01 mar
2013

Engineering innovation



PHOTOS: CHONG JUN LIANG



■ The DSTA Scholarship was a forward-looking one with a strong drive towards staff development. This was important to me and a big consideration when choosing a scholarship.

— Ms Huang Huimin, member of technical staff, DSO National Laboratories

Defence Science and Technology Agency (DSTA) scholars Huang Huimin and Celestine Lau do cutting-edge research

by Joyce Lim

THEIR respective jobs at DSO National Laboratories and the Defence Science and Technology Agency (DSTA) see Ms Huang Huimin (right), 25, and Mr Celestine Lau (below), 27, help to keep Singapore safe.

Ms Huang is currently a member of the technical staff team at DSO National Laboratories, doing research on electronic warfare. The Hwa Chong Institution alumna holds bachelor's and master's degrees in electrical engineering from Purdue University and Stanford University respectively.

Mr Lau is an engineer with the infocomm infrastructure team at DSTA. As a defence engineer, he provides security assessments and consultancy to a variety of different projects managed by various departments in DSTA. He graduated with bachelor's and master's degrees in electrical and computer engineering from Carnegie Mellon University.

When Ms Huang's classmates started discussing studying overseas and scholarships during her second year of junior college, it led her to contemplate what she wanted to do for the rest of her life.

She says: "I had an affinity for the sciences as I have always been interested in how things around me work."

Similarly, Mr Lau had been fascinated by computer science since his secondary school days, and he knew he wanted to become an engineer by the time he graduated from Raffles Junior College.

Both Ms Huang and Mr Lau found out about the DSTA scholarship from scholarship guides, scholarship fairs and by reading up on the DSTA website.

"The DSTA scholarship offers a range of specialisations across diverse fields in defence science and technology," says Mr Lau.

"You also get to choose from a wide selection of courses and programmes at world-class engineering institutions. I chose the DSTA Scholarship as I was drawn by the prospect of contributing solutions that strengthen our nation's defence capabilities."

Ms Huang was attracted to the fact that it was one of the few scholarships that covered students up to the master's level.

She says: "The DSTA Scholarship was a forward-looking one with a strong drive towards staff development. This was important to me and a big consideration when choosing a scholarship."

Cutting-edge research

Their scholarship allowed both scholars to pursue their studies overseas and get exposure to cutting-edge research in their respective fields.

"The DSTA Scholarship provided the opportunity for me to gain a first-rate education, and opened my eyes what engineering innovation can achieve," says Mr Lau. "At Carnegie Mellon University, I took part in several projects to develop applications that strive to enhance our daily lives and benefit society."

One of his most memorable projects involved creating a micro wearable computer to monitor one's heartbeat, respiratory rate and other vital body signs conveniently.

He says: "After the excitement of developing a work-

ing prototype, I tested it out by strapping it on and running around campus. I was delighted to find that my innovation worked."

The scholarship also provided a sense of job security. Ms Huang says: "A significant number of my peers were affected by limited career opportunities in the United States during the global recession of 2009."

Instead of worrying about finding a job, Ms Huang enjoyed being able to focus on learning. She also approached her professor to do research with PhD students during her holidays.

As a scholar, Ms Huang could choose to intern with various organisations within the defence technology community. These include DSTA, DSO National Laboratories (DSO), Centre for Strategic Infocomm Technologies (CSIT), Air Logistics Organisation (ALO), Naval Logistics Organisation (NLO) and Headquarters, Maintenance and Engineering Support (Army) (HQMES).

Ms Huang chose to intern at DSO and was motivated by the high level of pride that DSO staff displayed in their work.

The period of internship for Mr Lau prepared him for his career as a defence engineer.

"Throughout the internship, my mentor and other colleagues were very supportive," says Mr Lau. "Despite their busy schedules, they readily rendered their help whenever I encountered a problem. It helped me to settle in easily and reaffirmed my decision to join the DSTA family."

Mr Lau adds: "It gives me great satisfaction to know that our collective efforts help Singapore to stay one step ahead of hackers and protect critical defence systems against cyber threats and attacks."

Ms Huang says: "When you apply for a scholarship, you are really applying for a career. If you know that you want a career where you can make meaningful contributions to national security, then the DSTA Scholarship is definitely your best choice."

My biggest inspiration..

Is my wife who is in Pittsburgh with me. Being by my side, she's been my biggest source of encouragement and support. She keeps me sane and always makes sure that I don't forget to eat, especially when I get stuck trying to debug a programme or when I get stuck on a homework problem. She even listens to my practice presentations and tells me when I'm unclear in explaining something!

Most memorable incident since going overseas..

Was when my wife and I took a day trip to Cleveland - a 2.5-hour drive from Pittsburgh - and found a restaurant serving Malaysian/Singaporean food like fried hokkien mee and satay. For an hour or two, we felt like we were back home in Singapore - hearing the Malaysian accent of the restaurant owner, and eating familiar food. We enjoyed the food so much that we bought more for the next day! The restaurant was definitely the highlight of the road trip!

When I return to DSO..

I want to put the knowledge I gain in my academic research to good use by helping to improve our national defence capabilities.

**I miss..**

My family and friends. Although they're a Skype call away, it's not the same. I also miss my colleagues whom I've had the opportunity to learn a lot from.

To all in DSO, I hope you have an enjoyable National Day weekend, and I wish everyone good health and inspiration in your work!

Tan diaqi

Carnegie Mellon University, US
PhD in Computer Science

The most memorable experience during my PhD studies..

Is actually quite an embarrassing one! After finishing classes one day, I walked out of the building and straight into a sign post. To make things worse, I got a laceration on my forehead and had to be admitted to the Emergency Room (ER) for the first time in my life! Four hours later, I walked out of the ER with seven stitches and learned that the real ER is not nearly as glamorous as the television series of the same name.

What I hope to achieve with my PhD..

I study viruses that cause human diseases, and how the immune response controls their replication. Often, viruses develop mechanisms to evade or subvert immune responses, so a better understanding of such mechanisms may be useful for developing interventions during an intentional outbreak of viral infections.

What I miss about Singapore..

Is being able to wear flip-flops to the hawker centre and ordering my favourite food! A simple luxury compared to my life in Boston.

Also, during Boston's brutal winters, Singapore's tropical climate can seem very inviting.

**I would like to say "Hi!" to..**

My colleagues from Biological Defence! Hope all is well, stay cool and see all of you soon!

Chan Ying Kai

Harvard University, US
PhD in Infectious Diseases

AROUND THE WORLD



Going back to school.

Means getting used to attending lectures and reading academic publications again. However, the professors are more unforgiving towards graduate students and we're expected to comprehend new material within a short period of time. Moreover, I have to assist professors in conducting tutorials and laboratory sessions, write journals and attend conferences. Going back to school is not a trivial task indeed!

My inspiration in academic life..

Is Dr Eben Upton, founder of the Raspberry Pi Foundation. He has single-handedly revived interest in the Electrical Engineering and Computer Sciences in the UK by creating an affordable ARM Linux computer known as the Raspberry Pi - now widely used in UK schools and universities. He made engineering fun and I think Singapore needs education pioneers like him!

**I may not be overseas..**

But I still miss the folks in Advanced Electronics Lab (AEL)! They're really friendly and always insist on feeding you. Within AEL, we're known as Always Eating Lab! To my colleagues in AEL, "I'll be back in January 2014, so don't miss me too much!"

Ang Zhi Ping

National University of Singapore
Masters in Engineering

Most difficult thing to get used to overseas is..

British humour and sarcasm. It can get quite hard to distinguish genuine advice from bantering! I really miss Singlish.

Most inspirational person in your academic life..

Should be my PhD supervisor! Otherwise I must be doing something wrong. Coming in a close second is my father. He's the first person I know who found and read my preprint paper on arXiv (online archive of scientific papers).

Biggest accomplishment in the UK to date..

Has to be operation "Meet Mom". My parents have gone into semi-retirement in one of the most remote places I have ever visited - Victoria, Canada. In order to meet them, my wife and I had to plan the most elaborate travel itinerary by air, land and sea ever:

- 1 x Train ride
- 2 x Tram rides
- 1 x 10-hour flight
- 1 x Ferry ride
- 2 x Bus rides

**To all staff in DSO..**

Stay healthy!

Loe Chuan Wen

Imperial College London, UK
PhD in Complex Systems



THE RUNNING MAN

Dr Ong Kai Wei

We're talking about the one and only Ong Kai Wei - the bona fide running man of DSO. A perfect example of our people embracing excellence in and out of work, Kai Wei has participated in many ultra-marathons. As a matter of fact, he has recently completed a 230km race. So pay heed to our advice: if Kai Wei is ever in hot pursuit of you, it's better to just surrender. Let us show you why.

TODAY



Lab researcher first S'porean to complete 298km Hong Kong trail run in three days

Going way off the beaten track

"The DSO National Laboratories researcher's training also included running for about 10 hours a week, for a year.

I had to build my base, so my training included a lot of road and trail running and stair climbing" he said. "I concentrated my training on the techniques needed to activate the correct muscles - glutes and hamstring. I did a lot of squats and strengthened my core."

09 mar

2013





Total of races
(from 9 Dec 2010 to 8 Jun 2013)

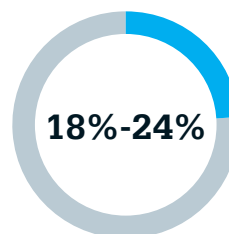
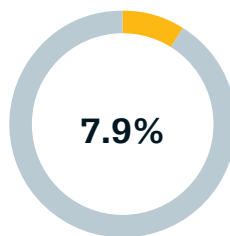
19



Countries raced in



Percentage of body fat



Kai Wei Average males

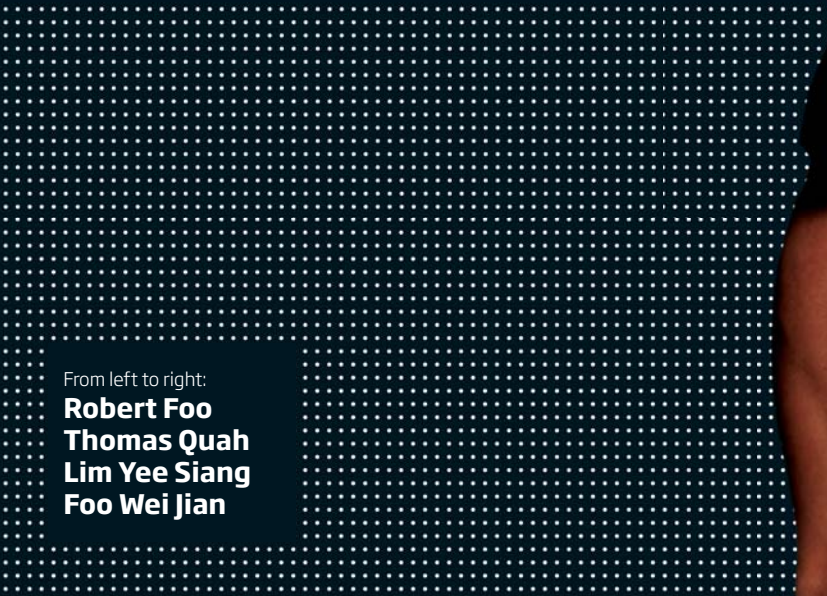
Total km ran
(from 9 Dec 2010 to 8 Jun 2013)



THE DSO SPORTS AWARDS



From left to right:
Robert Foo
Thomas Quah
Lim Yee Siang
Foo Wei Jian





THE DSO SPORTS AWARDS



The Multitasking Player-Manager

Robert Foo

☉ When did you start playing badminton?

I only started playing badminton when I first joined DSO. A couple of my colleagues (Charles Low and James Cheng) asked me to join them for their usual Friday sports hour and I decided to tag along. There were players from other divisions as well, and I found them to be really friendly. They even taught me a trick or two on the court!

Since then, we've been pushing each other to constantly improve our game.

☉ As the manager of the CIG, what are you responsible for?

My two biggest responsibilities are:

- Logging on every Friday at 6.59am to click the "book" button so that we have somewhere to play during sports hour.
- Coordinating the after-game dinner and entertaining them with the occasional joke.

My other responsibilities involve looking for external competitions in which the team can participate and test their skills, as well as managing the logistics to ensure that they're well equipped for the competition.

☉ Top five skills needed in badminton are...

- Explosive strength for smashing
- Precision to place those smashes!
- Good racket movement to catch your opponent's smash
- Aerobic stamina to last the game
- Agility to execute good footwork

☉ And the most memorable competition is...

Definitely the Ascendas Singapore Wide Open 2012. We were undefeated in all games and categories all the way till the finals where we met a formidable opponent and ended up with a silver medal.

But what was more memorable was the great team spirit and overhearing other competitors and spectators praise our players' great footwork and skill. That made me really proud of everyone in the team.



Team Player of the Year

Thomas Quah

☉ How did your love for the beautiful game begin?

I started playing when I was in Primary 6. I was influenced by my dad who avidly followed the Malaysia Cup and the English Premier League. I would be sitting beside him watching the games every week. So naturally, his love of the game just rubbed off on me.

☉ Who's your most inspirational footballer?

Gareth Bale. He started out as a defender and was scrutinised for his poor performance. Instead of transferring clubs, Bale trained harder and with the advice of his manager, he converted into a forward and the rest is history. His story reminds us that the initial fit may not be the best fit. With determination and advice from others, we can create new possibilities.

☉ Who in your team would you give these awards to?

- a. The Golden Boot
Leam Yew Piao – Always lurking in the opposite penalty box while waiting for the opportunistic pass and scoring in every game. A fox-in-the-box player.
- b. The Midfield Maestro
Tan Peng Yeow – The classic number 10. He dictates the tempo of the game and provides telling passes to open players.
- c. The Steadfast Defender
Lim Kok San – Always stays back (even at work!). When the reliable Kok San is in our team, we can attack the opponent with ease.

☉ Which competition was the most memorable win?

The Ascendas League in 2010. Playing on the hard court requires speed and lots of stamina. We had to complete a few games within the same evening to be crowned champions. When we were very tired, we gave each other support and encouragement on and off the pitch. This spirit eventually saw us winning the league in a convincing fashion.



Yoga Guru

Lim Yee Siang

☉ It all started with...

The annual short-term Yoga class organised by the DSO 26th RC in early 2011. I enrolled because I thought it would be fun to try something new and it was very affordable too. When I became part of the 28th RC Enrichment Team, I volunteered to plan the same activity, and it evolved into a formal Yoga CIG.

☉ A good Yoga session is...

The feeling of relaxed joints and muscles after 45 minutes of stretching. It is especially rewarding after sitting down for a whole day at work. There is also the option of sweating it out with a more intensive Hot Yoga. Most importantly, it is a good come-together session for like-minded Yoga enthusiasts!

☉ My most inspirational Yoga practitioner is...

Lay Na from Networks Division! She was an ex-instructor for Yoga, and had kindly volunteered to coach us on several occasions. Her coaching style is more intensive so you are guaranteed a good workout. I was also motivated by her to practice Yoga more often.

☉ Your advice for first-timers...

Yoga is a sport that relaxes your joints and muscles, tests your concentration, builds up your strength and tones your body – all at the same time. If you hope to achieve all the above benefits, persistency and consistency are the must-have keys to success.



The Rising Star

Foo Wei Jian

Meet Foo Wei Jian – the man who will be taking over as the captain of the DSO Dragons from Matthew Yeo. Wei Jian has got some pretty big shoes to fill, so we decided to check in and see if he's up to the challenge.

☉ How I got started

I only tried out dragon boating for the first time during my Induction Programme at the end of July 2012 and joined the DSO Dragons the very next month.

☉ Why I like the sport

The feeling of achieving a perfect race set. Doing so requires focus on individual technique, power, rhythm and strategy while being aware of the synchronicity of the boat. When all paddles achieve perfect alignment, and team members pull at maximum strength, the surge of speed gives me an adrenaline rush!

☉ A great dragon boater should be:

1. Dependable
2. A team player
3. Willing to accept critique to improve technique
4. Punctual for training!

☉ The challenges ahead

- a. Retain current paddlers: Matthew has managed to retain a good core of dragon boaters and has nurtured very strong bonds between the members – very difficult to achieve considering the age range of our team members (late 20s to late 50s). I'll need to build on this so that we can continue doing well in competitions despite training only once a week.
- b. Attract new paddlers: This is important in order to ensure the team's continuity. New regular paddlers will also enable us to mount stronger forays in competitions.

REACHING FOR THE STARS

The Outreach Department is all about building DSO's talent pipeline and exposing our youth to the wonderful world of science and technology. The team of three, consisting of Tan Soo Kee, Agnes Chia and Kiara Lay, is ever-ready to engage students with fun competitions and exciting programmes.

The DSO Amazing Series of Competitions comprises the Amazing Science-X Challenge, Singapore Amazing Flying Machine Competition and Singapore Amazing Machine Competition. To date, the competitions have reached out to close to 9,000 students from over 200 academic institutions.

More than just organising competitions to engage the students, there's also the Young Defence Scientists Programme (YDSP) which brings the world of defence research and development to them. Check out what Agnes and three students, Aaron Quak, Elaine Goh and Morgan Lim, have to say about their outreach adventure!

🗣️ **Agnes, tell us more about your programmes.**

Agnes: I run the School Outreach Programme in DSO. Under the Young Defence Scientists Programme (YDSP), there are the World of Science (WOS) Enrichment Programme, Research@YDSP (R@YDSP) and YDSP Congress. I also have to provide support for other programmes like the Science & Technology Camps and collaborations with Hwa Chong Institution, Ministry of Education, National University of Singapore, NUS High School of Mathematics and Science and Raffles Institution.

🗣️ **All of you "graduated" from Agnes' programmes. How was the experience?**

Morgan: I participated in the YDSP camp, WOS and R@YDSP. They were all very enriching experiences, allowing me to learn many things that I would never ever get to know

about in school. For example, I learnt more than just the theories in the WOS Aerodynamics module, but also got to apply the knowledge I acquired to build gliders and improve their performance.

Elaine: The programmes were actually very different from what I had expected - but in a good way! I thought they were going to be an academic, science-related experience but they turned out to be a lot more. I also made new friends and learnt lots of new skills!

Aaron: My first experience with DSO's outreach programmes was in 2010 when I was still in Secondary 2. I took part in the YDSP Mine Finder Challenge and really enjoyed it. Three years later, I signed up for a Science Research Programme on phased array radars with DSO. It was just fantastic!

🗣️ **What was the main highlight?**

Elaine: Witnessing the camaraderie of the DSO researchers and their

working environment during R@YDSP. The researchers foster a vibrant and interesting community - they are definitely not boring scientists!

Morgan: I was fortunate enough to go on a field trip with my mentors during my two-month internship at DSO under R@YDSP. It was a great opportunity to observe how researchers and scientists collect their data.

Aaron: Being able to connect the dots and relate each scientific concept to the other. I really enjoyed the chance to make use of the cycle of engineering thought. It's a constant cycle of working out the theory, using established software to model and run the theory, performing experiments or tests to verify the theory, and teasing forth some relationship or effect hitherto overlooked.

🗣️ **Looks like all of you really get along with Agnes.**

Aaron, Elaine and Morgan: Yes, she's our friend!

🗣️ **How did that happen?**

Aaron: I don't know! It just happened!

Morgan: She is always very friendly and cheerful, talking to all the students and asking how we feel about the programmes. The more DSO programmes I attended, the more we had to talk about. That kick-started our friendship.

Elaine: I added her on Facebook and around May this year, she asked me for help for a WOS Welcome event. Little did I know she was going to ask me to be the emcee! Subsequently, when we met at DSO for rehearsals, we chatted more and became more comfortable around each other!

Agnes: Actually, I'm also not sure how it happened. But I always make it a point to talk to the students. All the students in my programmes

have my mobile number and they know they can call me if they have any queries. It is with their feedback that I am able to constantly improve on my programmes. It also gives me the opportunity to understand their mindsets and sometimes, correct them. I guess being an ex-teacher makes it easier for me to connect with the students as well.

Today, we have the "DSO gang" and we go for lunches and karaoke sessions. They also consult me on subject selection and choice of scholarship. I even baked cookies for them!

☉ Would the programmes be different without Agnes?

Aaron: Yes. When Agnes is around, we feel that our opinions and how much we learn are valued. Her presence makes us feel that the programmes are worthwhile and it motivates us to do our best in them.

Morgan: I agree. She is always very caring towards the students, making sure that we get the best experience out of the programmes. I probably would not have such good impressions on the programmes without her personal touch.

Elaine: I actually enjoyed my internship at DSO a lot more because of her. She cracks jokes to make us laugh and never hesitates to help us. When I was an intern at DSO, the Internet connection in the entire complex went down and she was the first person whom I called for help!

Agnes: Thank you! I'm so touched!

☉ Anything you would like to say to each other?

Agnes: Yes! Always try new things. Don't be afraid if you do not understand something. Be open and ask questions when you are in doubt. Never walk away with questions unanswered.

Aaron: Go Agnes! You've inspired many students to pursue their respective passions, and you certainly inspired me too. You'll always have a place in our hearts!

Elaine: Your passion for your job is truly amazing. If you are planning some new activities and you need students, don't forget me!

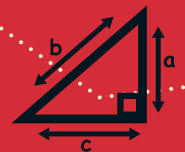
Morgan: Thank you for all the care and concern that you have showered over all of us throughout the years! If you need help, I would be more than willing to help you in any way that I can.

01 Agnes
02 Elaine
03 Morgan
04 Aaron





DSO AMAZING SERIES OF COMPETITIONS



18 mar
2012

18 home

thesundaytimes March 18, 2012

Soaring above the competition

Singapore Polytechnic Aviation Club members (from left) Jonas Hii, Yap Feng Wei, Damian Cheng and Jonathan Liew, demonstrating their entry for this year's Singapore Amazing Flying Machine Competition yesterday.

Their submission, which was modelled after a pirate ship, won them the championship title in the "Unconventional" category.

The competition, organised by the Singapore Science Centre and Defence Science Organisation, is aimed at giving budding technologists a hands-on experience in areas such as aerodynamics.

Some 300 teams entered this year's competition, which was held at the Singapore Science Centre.

Chow Jia Ying



ST PHOTO: NURIA LING

31 aug
2011

SINGAPORE

More than one way to sharpen a pencil, according to 250 students

SINGAPORE — The simple act of sharpening a pencil sparked some 250 students from various schools to come up with 60 different ways of doing so.

Participating in the Singapore Amazing Machine Competition last weekend, the students had to design and build machines that take as many steps as possible to sharpen a pencil.

A total of 111 teams registered for the competition, with 60 of them making it to the finals. Winners are judged according to their creativity and innovation, environmental friendliness and successful completion of the entire process.

One of the students in the competition, Marcus Soon from Unity Primary, said: "This competition is quite meaningful because it helped us learn about science concepts. Furthermore, we learnt about the importance of teamwork so that we can cooperate with each other."

Into its third year, the competition hopes to become a unique platform to propel students into the world of science and creativity. Besides category A for upper primary students and category B for Secondary 1 to 3 students, a new category C, for Secondary 4 to Junior College year 1 students, was introduced this year.

The judging panel was made up of representatives from NUS High School for Mathematics and Science, DSO National

The students had to design and build machines that take as many steps as possible to sharpen a pencil. A total of 111 teams registered for the competition.

Laboratories, Science Centre Singapore and the School of Science and Technology.

Minister of State for Education and Defence Lawrence Wong felt such competitions will teach students the spirit of enquiry, experimentation, the desire to push the boundaries. "These are all critical ingredients for education. So I think to inculcate these mindsets from young through a platform like this, will certainly help the students in the schools so they are not just bound to rote-learning," he added.

More significantly, Professor Lim Tit Meng, chief executive of Science Centre Singapore, felt the competition would teach students that there are many solutions to a task. "In other words, (it helps to) open their minds when they enter the real world; there is no single solution to accomplish your task," he said.

CHANNELNEWSASIA

18 sep
2011

thesundaytimes

140 teams compete to create best exhibit in science challenge

Published on Sep 18, 2011
By Stacey Chia

A total of 140 teams from 63 schools and organisations took part in this year's Amazing Science X-Challenge.

The competition, which is now in its third year, aims to ignite a spirit of innovation among students by inviting them to conceptualise and build an exhibit that explains a physical science phenomenon. Participation in the competition has more than doubled since its inception.



A photo of the most interactive exhibit which will be revealed at The Amazing Science Challenge. Some exhibits that will be on display: an exhibit showing how sound can be used to levitate objects, and how Angry Birds - the hit video game - can be used to demonstrate real life physics principles. Mr Lawrence Wong, Minister of State for Defence and Education will grace the event. — ST PHOTO: LAU FOOK KONG.

An interesting exhibit that was showcased on Saturday was one called 'Image Manipulation' by team Rulang Fun-3 from Rulang Primary School. It won the top prize in its category for cleverly utilising light beams and a piece of glass to create a magical light effect, to convey the concept of reflection.

The competition is divided into four categories from primary to university level.

In his speech, Mr Lawrence Wong, Minister of State (Defence and Education) encouraged the participants to continue their passion for science, which may contribute to Singapore in the future.

"We may not be venturing into rockets or space. But whatever the domain area - whether in business, industry, or the military - we can be sure that a strong scientific capability base will give Singapore the technological edge to stay ahead in the future," he said.

SINGAPORE'S BIGGEST DEFENCE SCIENCE EXHIBITION

国防科技展 让学生了解军事‘机密’

配合40周年庆，国防科技研究院(DSO)与科学馆联办“国防科技大揭秘”(Defence Science Revealed)展览，鼓励学生了解军事“机密”。

国防科技展 国防科技研究院(DSO)与科学馆联办“国防科技大揭秘”(Defence Science Revealed)展览，鼓励学生了解军事“机密”。

Revealed: Secretive world of defence scientists

By JERMYN CHOW DEFENCE CORRESPONDENT

THE veil over some of the highly secretive work of local defence scientists will be lifted when Singapore's biggest defence science exhibition opens today.

The Defence Science Revealed exhibition gives visitors a peek into technology on items ranging from surveillance devices and smart bombs to replicas of unmanned aerial vehicles and armoured tanks. More than 80 innovations showcasing equipment and technology made or modified in Singapore take up the bulk of the 3,000 sq m exhibition floor at the Science Centre.

Workshops and experiments at booths give visitors a good idea of how planes fly or how radars detect planes but not birds. Mr Qoqk Gim Pew, chief execu-

tive of Singapore's largest defence science organisation DSO National Laboratories, said the hour-long workshops are aimed at deepening visitors' understanding of science and getting them interested in science and technology.

"We want to show the difficulty of science yet not put them off with equations and formulas," said Mr Qoqk, 55.

His target audience are primary and secondary school students. DSO scientists roped in defence contractors, writers and Science Centre staff and worked a year to put up the exhibition, the first in a decade. It also marks 40 years since DSO was set up as the Electronics Test Centre.

By Desmond Lim, the organisation's networks division programme director, said the biggest challenge was explaining scientific concepts in layman's terms.

"We may find it difficult to explain things in words and pictures," he said. "We need to use simple words and pictures to explain things."

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军事科技展中小學生也看得懂



国防科技展 国防科技研究院(DSO)与科学馆联办“国防科技大揭秘”(Defence Science Revealed)展览，鼓励学生了解军事“机密”。

30 oct

2012



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THE STRAITS TIMES TUESDAY, OCTOBER 30, 2012

thinkbig



PHOTOS DSO NATIONAL LABORATORIES

Scientific secrets

Discover the amazing science behind military might.

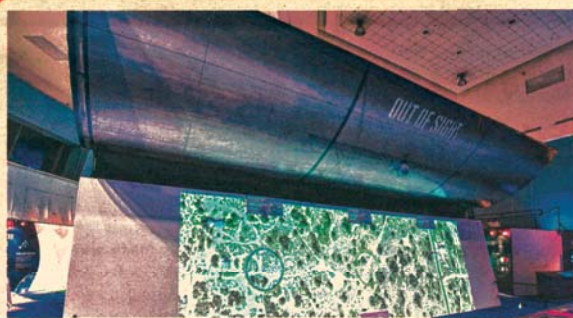
Eileen Aung-Thwin reports

Have you ever wondered what goes on in the highly secretive laboratories of our defence scientists and engineers?

Here is a chance to peek into their mysterious world and experience the amazing science behind their many innovations!

Defence Science Revealed (DSR), the largest exhibition of its kind in Singapore is now open to the public. Organised by DSO National Laboratories, the nation's defence R&D organisation, and Science Centre Singapore, DSR will show you the world of defence in a different light.

Get up close and personal with more than 80 interactive exhibits in three exciting zones at the Science Centre Singapore. Here are some you must not miss!

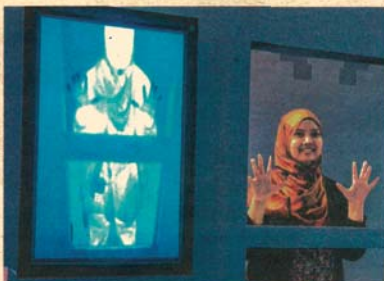


1 Out of Sight

Hunt down hidden enemy targets in this multimedia game using different types of cameras. Pit your skills against two other players and see who can spot the threats in the fastest time and with the highest accuracy.

2 Seeing Heat

Did you know that your body heat can give you away? See yourself through the lens of a thermal camera and find out how to prevent your body heat from betraying your hiding place.



3 Armour and Protection

View some of the hardest protective material known to man and find out how many of these materials are used to counter dangerous explosive threats. Get up close with a replica of a battle tank and experience what it is like to be inside when it is under attack.

Connect with Defence Science Revealed (DSR) on its Facebook page at www.facebook.com/defencesciencerevealed, and find out how you can win an iPhone 5 when you visit DSR! DSR is open daily from 10am to 6pm. Enjoy a special entry fee of \$12 (adult) and \$8 (child, three to 12 years old) into DSR and Science Centre Singapore.

4 Stealth and Surveillance

This zone is all about hide and seek.

Find out how defence science can make soldiers invisible but also hunt them using cutting-edge technology.

5 The Science of Flight

Learn about the science behind flight in this zone.

Choose from two different pairs of ready-to-wear wings, step inside a nine-fan wind tunnel and feel the lifting force.

6 The Invisible Night Cloak

Ever wish you had Harry Potter's invisibility cloak?

Now you can step into the wizard's magic garment with the help of science. This exhibit will keep you invisible even to those wearing night vision goggles.

The image features a bold, graphic design. A large, solid pink letter 'P' is positioned at the top right. Below it, the word 'POSSIB' is written in a dark blue, bold, sans-serif font. The letter 'P' is partially obscured by a white, curved shape that also overlaps the word. The background is white, with several pink geometric shapes: a vertical bar on the left with a white dotted pattern, a large pink shape at the bottom right with a white dotted pattern, and a solid pink shape at the bottom left. The overall composition is modern and minimalist.

POSSIB



ILITIES)ⁱ

empowered by innovation

THE POWER OF INNOVATION

26 may

2011

home.thursday special report

Beefing up the Little Red Dot

DSO National Laboratories' cutting-edge research gives the SAF a technological edge

By JERMYN CHOW
DEFENCE CORRESPONDENT

IN AN AGEING, nondescript, four-storey building in Buona Vista, more than 1,000 scientists and engineers are at work, designing hardware and software for Singapore's defence arsenal.

These men and women of the DSO National Laboratories neither don army fatigues nor get sent out-field. They wear white lab coats and shuffle along air-conditioned corridors that give few clues about what they do for the Singapore Armed Forces (SAF).

But a publicity poster on one wall in this Science Park facility declares DSO's mission – "to transform Singapore, the little red dot, into a lethal red dot".

DSO's Information Division programme director Ng Gee Wah likens this mission to "swimming against the current": "As we seek to achieve a cutting edge, there is a need to go against the technical norms of today."

That DSO had been granted 22 patents by 2008 for its innovations since 1999 may indicate the amount of "swimming against the current" going on there.

It started as a three-man outfit called the Electronic Test Centre (ETC) in 1972, and has since grown into a defence-science research body that works with global-research outfits like the United States Air Force Research Laboratory and the European Aeronautic Defence and Space Company.

Its mission, baldly stated, is to develop game-changing technology that creates – or snuffs out – the element of surprise in battle, giving the SAF a technological edge.

While electronic warfare remains its top priority, DSO's researchers have branched out to specialities ranging from radar, sonar and infra-red sensor systems to guided weapons, biological and chemical security, and, more recently, unmanned systems and surveillance gadgets.

DSO declined to reveal how many of its innovations – many considered "black box" or top-secret – have been put in use by the SAF, but its land, sea and air troops have all benefited from DSO's work.

In the high seas, for example, the Republic of Singapore Navy's stealth frigates are manned by about 70 sailors, roughly half the number it takes to man a similar-sized American frigate. The tight ship is a result of DSO-designed surveillance systems and tools that can do more with fewer hands on deck.

In the air, the most recent achievement was the Skyblade III mini-Unmanned Aerial Vehicle (UAV), a portable pilotless surveillance plane that can beam real-time video images beyond a soldier's line of vision. The army battalions here are using it.

Mr Lim Kok Yong, a programme manager in DSO's Guided Systems Division, reads this as a sign of the organisation's track record with the SAF, known as "one of the most demanding customers when it comes to buying equipment".

Outside Singapore, the military world is also taking notice. Asia-Pacific militaries, for example, registered interest in the Skyblade III UAV at the recently concluded International Maritime Defence Exhibition (Imdex) Asia; its newer, more powerful cousin, which can travel up to 100km and can stay aloft for up to 12 hours, also garnered attention.

In surveillance technology, a piece of DSO is out in space in the form of microsatellite X-Sat; anticipation also surrounds the brand-new Pixel-X camera, which can track real-time movements in up to eight different places, reducing the number of cameras – and cost – of scanning large areas.

But beyond circuit boards and optic fibres, DSO researchers are also looking into improving the combat fitness and performance of SAF servicemen.

Projects include curbing heat disorders that can hit in blisteringly hot training areas and correcting the near-sightedness found in eight in 10 enlistees, which promises to widen the pool of pilots, commandos and naval divers.

DSO has also lately gone into studying how best to pair up soldiers for guard duty based on their personality traits. The findings could one day find application on the battlefield.

The Defence Ministry now commits about 4 per cent of the nation's annual budget to R&D. This amounts to more than \$500 million this financial year, with the DSO taking up about half that sum; the other half is shared among Mindef's other research and development entities like the Defence Science & Technology Agency.

Deputy Prime Minister and former defence minister Teo Chee Hean said in Parliament last year that the expenditure on R&D enables the SAF to tailor to its needs the technologies "that may not be available on the open market".

Defence analysts agree that the ability to churn out world-class weapons and technology on home ground is crucial also because Singapore has to be prepared to defend itself should bilateral ties sour.

Dr Bernard Loo, a defence analyst with the S. Rajaratnam School of International Studies, said: "There is this underlying belief that we have no permanent friends, only permanent interests."

This squares with the motivation that underpinned the setting up of the DSO's predecessor ETC by Singapore's founding father and first defence minister Goh Keng Swee, who saw the vital role of precision-guided weapons or smart bombs in the 1967 Arab-Israeli war.

The lesson drawn from seeing small Egyptian patrol boats sinking the larger Israeli destroyer, the Eilat, with Styx radar-guided anti-ship missiles was that, with technology, a smaller defence force can deter – and even defeat – a larger, but less-advanced adversary.

Dr Loo noted, however, that because the DSO can hire only Singapore citizens because of the sensitivity of its work, it means that it has a smaller talent pool from which to draw.

Hence, although the limited resources and manpower may be good enough for the size of the SAF and Singapore, its threshold for failure and risk is significantly lower.

"So the chances of DSO coming up with a game-changing technology may be a fairly rare occurrence," said Dr Loo.

But DSO chief executive Quek Gim Pew is more concerned that DSO does not have the luxury of choosing its competitors: "Our threats can come from many sources that are able to exploit the latest advances in technology, so the DSO must always be two steps ahead of them."

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Innovation is in our DNA. It is the key that unlocks new possibilities to force multiply Singapore's defence capabilities. While our work and sometimes even people are shrouded in a cloak of secrecy, we do not shy away from making DSO known.

To create composite structures of any shape, we made our very own braiding machine – the only one of its kind in Southeast Asia.

Our engineers and scientists develop 20 new inventions each year, with at least two deemed as game-changing technologies. We have Skyblade IV, an unmanned aerial vehicle, that was showcased in Imdex Asia, the region's largest naval exhibition. DSO also worked with our partners to create a made-in-Singapore flu vaccine and more recently, the world's first human test kit for ricin, a collaboration between DSO

and the Australian Defence Science and Technology Organisation. In our relentless quest for innovation, we took to the final frontier – space. Together with Nanyang Technological University, we created Singapore's first locally-built micro-satellite, X-Sat.

These innovations are made possible because of our continuous strive to provide technological surprises.

THE STRAITS TIMES THURSDAY, MAY 26 2011 PAGE B6



Besides developing game-changing technology in warfare, DSO researchers also look into improving the combat performance of SAF servicemen. ST PHOTO: SAMUEL HE

Where a soldier's personality matters

A STUDY done here into soldiers' personality traits and how they think has shed light on the types who work well together and the ways they can be turned into better combatants.

Such information on "human factors" can thus be applied when the Singapore Armed Forces (SAF) needs to figure out how to lighten a soldier's mental and physical burden so he stays sharp on duty, said DSO National Laboratories.

The human factors study looked into, among other things, whether people are talkative, are introverts or extroverts and how well they work in teams.

Getting these elements right can maximise performance and reduce errors, said Dr Frederick Tey from DSO's Cognition and Human Factors Research Laboratory.

The study was done on 90 soldiers on guard duty in an army division in May 2009. They were asked to fill up questionnaires on personality aspects such as whether they were conscientious, agreeable, open to new experiences and interested in people.

The data collected enabled defence psychologists to develop a simulation

model last December, which determined how soldiers could best be deployed for patrol duties based on their personality traits.

It found out, for example, that:

- Extroverts are most alert at night and work best with introverts;
- Soldiers are weariest between 2am and 6am; and that
- Those with negative emotional states tend to commit more lapses.

DSO conducted a similar human factors study for the Ministry of Home Affairs the year before to examine operational fatigue in the Home Team.

Dr Tey declined to say when the SAF would start using personality tests to deploy soldiers within operational units, but said commanders need to have a platoon of soldiers who can be most effective on the battlefield.

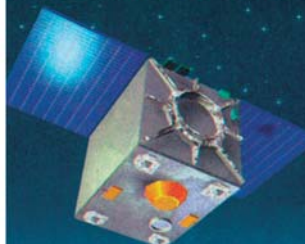
To illustrate his point, Dr Tey cited how weary soldiers failed to spot a dummy weapon that was left unattended when patrolling the camp.

"We're talking about the real thing... an SAF that's operational and ready 24/7."

JERMYN CHOW

LOOK WHO'S WATCHING

One of the DSO National Laboratories' strengths lies in its work with surveillance cameras, which allow users to see further, better and quicker. Here are some examples of their innovation.



In space

X-Sat

The microsatellite, jointly designed and built with the Nanyang Technological University, is Singapore's first locally built satellite.

DSO innovation:

- Design and build the systems that make up the microsatellite.

In the sky

Skyblade IV

Jointly developed with ST Aerospace, this locally made spy plane provides video images of terrain beyond a soldier's line of vision.

DSO innovation:

- Has made the latest version more powerful, increasing the distance it can travel from eight to 100km and lengthening its airborne time from one to 12 hours.

On land

PolarFour

A lens-like attachment which can be used with ordinary cameras. Has a hyperspectral sensor which can not only detect visible light but also infrared and ultraviolet as well. This allows users to spot objects that cannot be seen by the naked eye.

DSO innovation:

- Shrink current hyperspectral cameras in the market that are as big as a mini fridge to a 2-inch, 40mm thick lens. Cost, which could go up to \$1 million per camera, is slashed to a tenth of the price.



Pixel-X

A surveillance camera that can scan a large area with multiple independent zoom-in views. Allows the user to monitor up to eight high resolution images of movements in different locations, yet still maintain an overview of the main area.

DSO innovation:

- Design one camera that can do the job of up to eight individual closed-circuit television cameras
- Camera can track moving objects real-time and be used at night with infrared technology.



PHOTOS: ST ENGINEERING, DSO NATIONAL LABORATORIES, ST FILE ST GRAPHICS

AGAINST ALL ODDS

Elvin Chia

'Unstoppable' would be a perfect word to describe Elvin Chia. A series of hurricanes couldn't stop him from completing his mission. Not even the bankruptcy of an appointed vendor faltered his determination to give DSO the first-ever braiding machine, now fondly known as the "DSO Flyer". When he's not busy conquering the odds, he works with the Composite Team in the Special Materials Laboratory to provide the technological edge to Singapore's defence and security capabilities.



🕒 How did the idea of the braiding machine come about?

I first saw a braiding machine when I was with the Fibrous Material Research Laboratory of Drexel University (USA) as a visiting researcher in 2001. I was fascinated by the machine's ability to turn fibre into almost any shape. The possibilities of what the machine can produce are only limited by our imagination. It was then that I envisaged DSO having a state-of-the-art braiding machine to support our R&D work.

🕒 What were the challenges?

Everything that could go wrong, went wrong.

Within three months of undertaking the project, the prime contractor who was then based in Florida was badly hit by a series of hurricanes. The company also failed to fulfil the contractual obligations. Despite our best efforts to work on-site with the vendor, the delays continued and we incurred additional expenses. The lack of progress persisted for a few years and the last straw came when the vendor went bankrupt.

Even when we took over the project, there was a mountain of technical challenges to overcome because we had no prior knowledge in building a full-scale industrial machine. We met many failures along the way.

Internally, there were calls to terminate the project amid concerns that resources were mismanaged, and uncertainty about whether the machine would ever be completed. It was a difficult period.

© How did you overcome them?

I was determined to deliver an operational braiding machine to DSO, so I kept reminding myself not to give up. Having a strong heart to face the critics helped as well, but I was fortunate to have the support of CEO and the management team. Otherwise, the outcome could have been very different.

I am also indebted to Dr Zhang Jin Min who volunteered to help me on the software programming of the motion-control aspect of the braiding machine. I remembered him telling me, "If you can set up the hardware of the machine in Singapore, I will deliver the software programme to run the machine." It was his words that made me understand that I wasn't alone on my mission.

In a seemingly never-ending process, we failed, learnt on-the-job, and implemented solutions to eventually overcome all problems. I am glad that we delivered an operational machine.

01 oct
2012

RESTRICTED ACCESS

As DSO National Laboratories marks its 40th anniversary this year, PIONEER journalist Sheena Tan gets a rare tour of three of its laboratories.

Sorry, that's classified." That was the answer I was expecting when I launched the idea of visiting the DSO labs. After all, the labs, in which technologies to enhance national security are developed, are closely-guarded vaults that most Singaporeans will never set foot in.

TESTING POTIONS
The first place I visited was in a building at Marina 191, and after walking through what felt like a labyrinth, I entered a chemistry lab. Describing the work done here, defence scientist Mr Neo Tiong Cheng said: "We use small quantities of toxic chemicals and test them on the protective suits worn by our armed forces in chemical defence. This is to verify the vendors' claims on the efficacy of the protective gear against such agents."

This DSO lab has permission from the Organisation for the Prohibition of Chemical Weapons (OPCW) to use and handle toxic agents.

The OPCW, with headquarters in The Hague, Netherlands, is an inter-governmental organisation that promotes adherence to the Chemical Weapons Convention, which prohibits the use of chemical weapons and requires their destruction.

FROM THE "FLYER" TO THE SKY

From the potions lab, I moved on to a textile pre-forming lab in Boon Lay. In it were weaving devices, giant spools of hair-like fibre measuring the length of my forearm, and a machine that resembled a Ferris wheel, except that it seemed to be made of yarn.

"This is a braiding machine, but we call it our DSO Flyer, because it looks like the Singapore Flyer, doesn't it?" said Mr Elvin Chia, a DSO composite engineer.

So what does a braiding machine, that joins fibres together, have to do with defence?

Mr Chia explained: "The machine braids and intertwines fibres together into the shapes of the parts that we want. After that, we add resin (think of it as a kind of glue) to harden and turn them into composite structures."



Compared to traditional metals, engineered composites are stiffer, stronger and tighter materials, making them ideally suited for UAV (unmanned

aerial vehicle) components, and the resulting lighter weight allows the UAV to fly faster and carry more payload, he added.



Mr Chia inspecting the pre-form product made by the braiding machine.



Mr Neo in full protective gear as he handles an agent in the lab.

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SATURDAY, DECEMBER 1, 2012

01 dec
2012

A WONDER WEB OF MILITARY TECHNOLOGY

Engineer Elvin Chia getting to grips with a machine that produces a hybrid material for use in military equipment.

It braids an intricate web of fibreglass and carbon to form a light fabric that withstands extreme weather and wear and tear. When tested on the wings of a drone, the fabric cut their weight by half, allowing the drone to stay in the air for longer or carry more gear.

The 7m-tall machine was produced by DSO National Laboratories, which celebrates its 40th anniversary this year.

ST PHOTO: CHEW SENG KIM



MAKING HEADLINES

22 nov

2012

THE STRAITS TIMES

HOME

20 new inventions from DSO each year

Defence lab marks 40 years of developing technologies for SAF

By **JERMYN CHOW**
DEFENCE CORRESPONDENT

SINGAPORE'S soldiers, sailors and airmen use up to 20 new inventions that come from Singapore's biggest defence laboratory every year.

This was revealed by DSO National Laboratories chief executive Quek Gim Pew, who added that at least two a year are deemed by servicemen as game-changing technology.

The research body's breakthroughs are scored on the impact they have on the everyday training and operations in the Singapore Armed Forces.

The most impactful innovations are rated 3, while those with the least operational impact are scored zero.

Mr Quek said he is happy that DSO can now make at least two breakthroughs a year in SAF's operations since it was formed 40 years ago.

"That's a success. We completely upset the current scheme of things in the way our soldiers, airmen and sailors fight," added Mr Quek, 55, who recently spoke to The Straits Times in conjunction with DSO's 40th anniversary celebrations.

The made- or modified-in-Singapore innovations include electronic surveillance and communication software that allows the Republic of Singapore Navy's stealth frigates to communicate safely with each other and mini pilotless surveillance planes that army battalions here now use.

DSO's success rate today is a far cry from the 1990s, when it successfully put in use only one or two projects on the ground, in the air or in the sea.

It started as a highly secretive three-man outfit called the Electronics Test Centre in 1972.

Today, the outfit, based in Kent Ridge, has some 1,300 scientists and engineers who also work with research bodies in the United States and Europe to give the SAF home-grown technologies "not available in the open market".

The aim is to develop technologies that can create – and snuff out – the element of surprise in battle. Sharpening the SAF's technological edge is even more important as it faces shrinking enlistment numbers in coming years.



DSO makes at least two game-changing innovations a year, including unmanned aerial vehicles, such as the Skyblade III (above), which it developed with SAF, ST Aerospace and DSTA.
FILE PHOTO: MINISTRY OF DEFENCE

Citing the rapid modernisation of the world's militaries, Mr Quek, who took over the helm in 2002, said the SAF, in ongoing efforts to transform into a third-generation fighting force, also shortened the time taken for laboratory prototypes to be put in use in the battlefield. "Nobody can afford to wait for the Big Bang... You need an intelligent user, someone who is prepared to accept something that is not a fully developed product."

The Defence Ministry now commits about 4 per cent of the nation's annual budget to R&D. This amounts to some \$500 million this financial year, with the DSO taking up about half that sum.

The other half is shared among Mindef's other R&D entities like the Defence Science & Technology Agency.

Defence analyst Tim Huxley said Singapore's lack of strategic depth and small population will mean that it has to increase, if not maintain, its investment in R&D.

"DSO's challenge would be to keep new technologies relevant to the needs of the tech-savvy combatants," said the executive director of the International Institute for Strategic Studies in Asia.

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19 may
2011

home.

Unmanned systems make a splash at maritime show

They can collect data without having to put troops in harm's way

By JERMYN CHOW
DEFENCE CORRESPONDENT

WARSHIPS and naval aircraft may cause the biggest ripples but unmanned systems are also making waves at the region's largest naval exhibition, Imdex Asia, which opened yesterday.

One of them is the Skyblade IV, an unmanned aerial vehicle developed by home-grown firm ST Aerospace and DSO National Laboratories, the national defence research body.

A camera on the locally made mini spy plane provides video images of things beyond a soldier's line of vision.

Some army troops have started using the Skyblade III, which has a range of about 8km and can stay in the air for up to an hour.

The newer Skyblade model is more powerful than its predecessor which was launched last November, said ST Aerospace Advanced Systems' vice-president Milly Tay. It can travel up to 100km and can be airborne for up to 12 hours.

Final technical flight tests are being run before testing by army troops at the end of this year, said Mr Lim Kok Yong, a senior DSO researcher.

Also showcased at the International Maritime Defence Exhibition and Conference (Imdex) Asia, which has drawn more than 150 exhibitors, is an unmanned underwater vessel that detects and destroys sea mines.

The Autonomous Underwater Vehicle (AUV-3) is a remotely controlled mine-hunter jointly developed by DSO and ST Electronics.

ST Electronics' defence electronics division manager Tan Chee Yong said unmanned systems such as the AUV-3 can be deployed to shallower waters not suited to larger surface vessels such as the Mine Countermeasure Vessels (MCMVs).

The former navy officer said: "The imag-



Singapore's Chief of Defence Force, Lieutenant-General Neo Kian Hong, stepping from a helicopter on board the British navy ship, HMS Richmond, at Changi Naval Base. ST PHOTO: DESMOND LIM



The locally made Skyblade IV can travel up to 100km and can be airborne for up to 12 hours. Final technical flight tests are being run before army troops test it at the end of the year.

PHOTO: ST ENGINEERING

es collected are as good and sharp, if not better, than the MCMVs'."

Unmanned systems are becoming increasingly popular among defence forces worldwide, including Singapore, because they greatly reduce the need to position men in risky areas.

Speaking at the opening of the show yesterday, Deputy Prime Minister and outgoing Defence Minister Teo Chee Hean said the safety and security of maritime trade routes are important to all nations.

In his speech to more than 1,000 delegates, he noted that growing piracy has disrupted the sea trade which "remains the most economical and efficient mode of transport for the global economy".

He urged countries to continue to cooperate and share information so as to marshal "timely and effective response to maritime threats".

As part of Imdex Asia, 20 warships, including those from Australia, the United States and France as well as six from Singapore, are berthed at Changi Naval Base.

The three-day event, which is not open to the public, is organised by Experia Events, which is also behind the biennial Singapore Airshow.

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IMPROVING LIVES

In collaboration with other international institutes, DSO had a hand in developing a new flu vaccine technology that is currently undergoing a Phase 1 clinical trial in humans.

Dr. Brendon Hanson, Head of DMERI's Bio-defence Therapeutics Laboratory, said, "With the right infrastructure development, this technology will provide Singapore with a local vaccine production capability, allowing us to produce our own flu vaccine faster and cheaper than the current ones."

In other words, Singapore could have her own supply of vaccines in the event of a flu pandemic.

DSO's role in the collaboration was to perform the initial mouse efficacy studies which featured the protective potential of the vaccine. Other mouse studies were designed to determine the mechanism of the vaccine. "For all the animals used in the pre-clinical toxicology studies, we also performed the assays which highlighted their responses against the vaccine," Brendon added.

The team faced numerous challenges and difficulties. "The companies chosen for the Good Manufacturing Practice (GMP) manufacture of the vaccine had to be changed twice as they were either sold during discussions or downsized," Brendon recalled. "This was critical to the project's progress and resulted in its schedule being pushed back." The strong belief of those who were involved in the project, that it was something worth doing, was what kept the project going.

And it was all worthwhile. Brendon shared, "The technology used in this project is not just limited to the production of flu vaccines. It functions as a platform for the induction of an antibody response when placed in a test environment. The developer of this technology has created a number of experimental vaccines for a variety of diverse targets, all of which have shown strong immune responses." This bodes well in highlighting the potential of this technology to also serve as a vaccination platform for diseases other than flu.



Dr Brendon John Hanson

S'pore-made flu vaccine in the works

03 feb
2013

New method could mean faster, cheaper production if tests on patients are successful

Chang Ai-Lien
Senior Correspondent

A home-grown flu vaccine is in the works, with trials on patients starting here in April.

If successful, it will mean not only easy access to scarce vaccines during outbreaks, but also a cheaper, faster way of producing them.

"This could open a door to a relatively fast way of producing new vaccines against a range of viral diseases," said Professor Alex Matter, chief executive of the Experimental Therapeutics Centre (ETC) under the Agency for Science, Technology and Research.

"By the end of the year, we should know if it works."

The most effective way to prevent deaths or serious illness from flu is through a vaccination.

Such vaccinations are not popular in Singapore, where about 600 people die from flu every year.

According to the World Health Organisation, seasonal influenza epidemics make three million to five million people seriously ill each year, killing 250,000 to 500,000.

Currently, vaccines are made by growing the virus in chicken eggs, which is slow and costly. A more modern method uses cell cultures to grow the virus, but remains expensive, said Prof Matter.

The local vaccine which ETC

hopes will make it to market, however, harnesses bacteriophage technology. This uses virus-like particles which, in contrast to natural bacteriophages, are non-infectious for cells and bacteria, and is therefore very safe. It is also able to produce the vaccine fast.

Called a virus-like particle vaccine, it contains virus proteins that carry many copies of a flu protein triggering an immune response. And without any genetic material to replicate, it is harmless.

Initial production and testing of this particular vaccine can be speedy; it may take as little as 12 weeks from the time the genetic strain of the flu virus is known, compared with up to nine months for traditional methods, and cost considerably less.

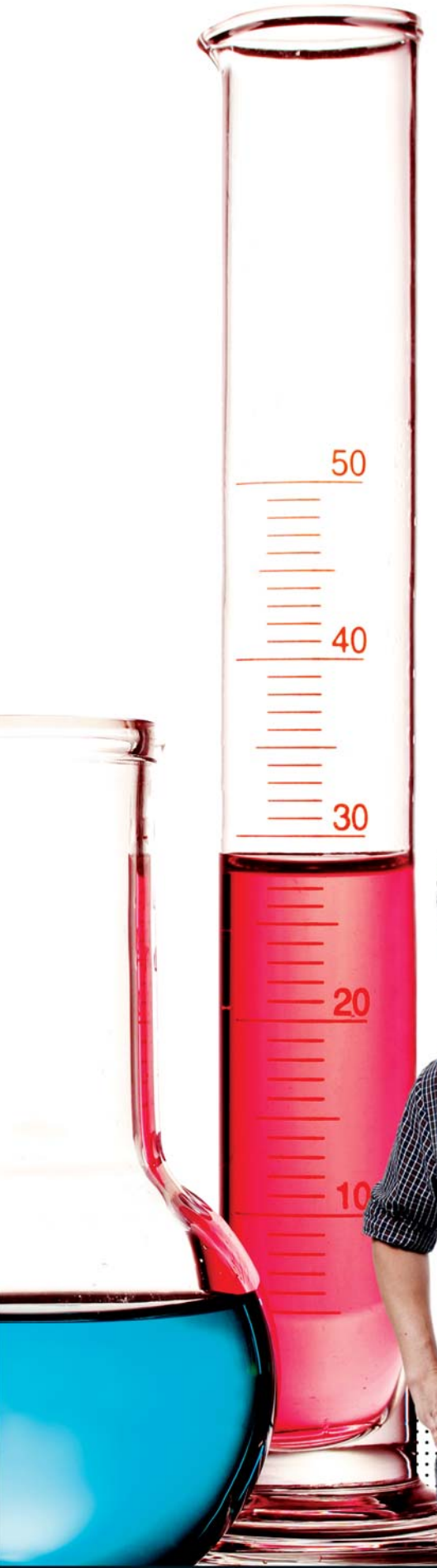
"Economics aside, we felt that this work would be a contribution to the preparedness of the nation in case of a flu epidemic," said Prof Matter.

Singapore does not currently make its own flu vaccines, he said, and has had to jostle with other countries with similar orders.

During the global pandemic in 2009, for instance, the one million doses of the vaccine ordered in September arrived in Singapore only at the end of the year. By that time, the worst of the outbreak was over.

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The work stemmed from a collaboration among several institutions including ETC, the Duke-NUS Graduate Medical School, DSO National Laboratories and the Singapore Immunology Network, together with industrial partners in Switzerland and Germany.



Chye De Hoe

Steven Wong

THE BREAKTHROUGH TEAM

Tracey Sew, Kevin Lim, Foo Ling Yann and Chen Hsiao Ying

In the field of Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) defence research, DSO collaborates with various international defence and academic institutions to further our know-how on areas of common interest. One such collaboration is with the Australian Defence Science and Technology Organisation (DSTO) and the resulting creation of the world's first ricin test kit.

The ricin test kit was first showcased at the Singapore International Symposium on Protection Against Toxic Substances (SISPAT) in 2012. We caught up with the DSO team behind the ricin test kit - Chen Hsiao Ying, Foo Ling Yann, Tracey Sew and Kevin Lim - on their R&D journey.

© How many years did the project take?

Hsiao Ying (HY): Developing the ricin test kit itself was a three-year project. Before that, there were the research phases which started quite a long time ago.

Kevin Lim (KL): Yes, research began in 2004 and clinical trials started in 2009.



☉ What was the collaboration with DSTO like?

Tracey Sew (TS): They were very easy to work with and did not hinder us at all.

HY: It was a smooth collaboration. They provided us with the crucial anti-body which contributed to the progress of the project. However, as the collaboration was at a government-to-government level, we had to observe proper communication protocol which took more time.

☉ What was the most memorable challenge?

HY: Getting the “black gold” samples. We actually had a faeces donation drive as we needed 200 samples for our research.

TS: It was difficult as there was a concern about how it would affect the

image of DSO. Our collection point had to be located at a discreet spot.

KL: Initially, we had posters on the donation drive but within a day, we were asked to remove them. Response to the donation drive wasn't very good too.

Ling Yann (LY): Eventually, we had to go to the office cubicles one by one to convince people to donate. We even asked the contractors to contribute.

KL: Still, we only managed to collect slightly more than 100 samples from DSO. The remaining samples were from our families and friends.

☉ Can you describe your team with three words?

KL: Hardworking.

TS: Focused.

HY: Systematic.

☉ Do you have any advice to share with other project teams in DSO?

TS: Experience is really crucial. Hsiao Ying has 14 years of commercial experience and she knows the requirements of the project well. This meant that we were able to design our project to meet all of the necessary targets. It really helped to shorten the process from the research to the contract manufacturing phase.

☉ Is there anyone whom you want to thank?

HY: We really have to thank Dr Loke Weng Keong for his support and advice. We are grateful for his guidance.

LY: We also want to say a big thank you to Ng Siew Lai for helping us to take care of the animals that we needed for our animal studies.

05 Dec

2012

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Scientists develop kit to test for ricin poisoning

Singapore-Australian collaboration on project results in world's first human test kit

By **JERMYN CHOW**
DEFENCE CORRESPONDENT

SINGAPOREAN defence scientists and their Australian counterparts have found a way to detect the highly poisonous chemical ricin in human beings.

The breakthrough has resulted in the world's first human test kit for ricin, just a few granules of which can cause victims to die of shock caused by lack of fluid.

The test kit was unveiled by biomedical scientists from Singapore's biggest defence research body, DSO National Laboratories, on the sidelines of a symposium on toxic substances yesterday.

Existing test kits can only detect ricin contamination in the environment. But with the new human test kit, scientists and doctors only need two drops of blood or faeces to detect the ricin toxin, 1,000 times more poisonous than cyanide.

“The diagnostic window of between four hours and five days also makes it easi-

er to catch the contamination more effectively,” said Dr Chen Hsiao Ying, a biomedical scientist at DSO.

He said detecting ricin in humans has been quite difficult because symptoms of ricin poisoning show up as everyday ailments like diarrhoea, fever and cough.

Ricin is found naturally in castor beans that are processed throughout the world to make castor oil. Castor oil plants are quite common in Singapore and can be found in places like the Botanic Gardens.

It was reported last year that the Al-Qaeda affiliate in Yemen was trying to produce ricin for attacks against the United States. But scientists also noted that ricin as a weapon is limited by loss of potency in dry, sunny conditions and because, unlike many nerve agents, it is not easily absorbed through the skin.

Even so, DSO's chemical, toxins, radiological and nuclear defence programme director, Dr Loke Weng Keong, said it is better to pre-empt the danger.

“We should not be reacting only when an attack happens, because by then it will already be too late,” said Dr Loke. He added that kitchen appliances like blenders can be used to easily extract ricin.

The Australian Defence Science and Technology Organisation partnered DSO in developing the test kit. Its human protection and performance division chief Simon Oldfield said the new capability would be a boon for first responders. Both organisations are now in the process of commercialising the test kit and expect it to be on the market in the next two years.

The ricin kit was one of the innovations showcased in the Singapore International Symposium On Protection Against Toxic Substances.

The biennial event, being held for the seventh time, runs in conjunction with the third International Chemical, Biological, Radiological and Explosives (CBRE) Operations Conference. Over the next three days, scientists, military personnel and doctors will discuss how to combat CBRE threats.

Defence Minister Ng Eng Hen, who opened the forum yesterday, said bio-terrorism and disease outbreaks transcend national boundaries. “Total protection is not feasible as threats from natural disasters are often unforeseen and the intent of terrorists is often to maim or kill in crowded public places,” said Dr Ng.

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MISSION POSSIBLE

"My contribution is just a small part of a much bigger team's effort that completed Singapore's first indigenously designed and developed micro-satellite. I was very fortunate to have the opportunity to be involved in X-Sat," shares Koh Wee Eng, Chief Engineer (Satellite Development).

The achievement, however, was anything but small - the first step into space for Singapore, and a giant leap for DSO on the R&D front. Built by the Nanyang Technological University and DSO, X-Sat is in the successful third year of its Earth-monitoring mission. We sat down with Wee Eng to hear more on his X-Sat journey.

☉ How did you feel when you were told about your involvement in X-Sat?

I was on overseas work attachment when I was informed about my involvement in the X-Sat project. It was going to be a "Singapore space project" and that evoked mixed feelings in me: excitement and a little bit of apprehension. Upon my return to Singapore in March 2002, I joined the project as a Systems Engineer.

☉ Were you always interested in space technology?

Yes! Since young, I have been interested in space - Astronomy in particular. So I guess it's quite natural for me to lean towards an engineering field that is somewhat related to Astronomy - satellite design and development engineering.

☉ What's unique about working on a satellite project compared to other R&D projects?

I believe one significant "feature" of satellite/space projects is the one-shot chance for success. Once the spacecraft is launched and inserted into its orbit, there is practically no chance for any form of "repair work". Anyone who wants to work on a satellite project must be fully aware of this stringent one-shot chance for success. He or she must embrace the need to practise a systems engineering approach and pay attention to details. There is also a need to implement established manufacturing processes, and a rigorous approach to robust design to handle faults. Testing at

every level is accorded paramount importance and quality is demanded in all activities. Additionally, I think it is good that one must not be overly-confident of success and have a small dosage of self-doubt.

☉ There must have been some heart-stopping moments.

There were two. The first one would be the moment just before our first successful ground contact with X-Sat. The whole team rejoiced when we received a strong communication signal and eventually, telemetry readings!

The second would be on 27 April 2011 during X-Sat's first ground night pass (about a week after its launch).



20,000

the number of satellites or space debris orbiting the Earth (tracked by USA NORAD)



7.5km/s

the speed of X-Sat (FYI, F1 racing car can reach 0.090km/s)



98mins

the time X-Sat takes to orbit the Earth



800km

the height that X-Sat orbits above Earth's surface

We realised that its battery was not properly charged, and we couldn't explain why. After the second night pass, the battery voltage level was still very low. It was bad news! The team decided to re-boot the Onboard Computer and sent the command up. Then, we kept our fingers crossed that it would recover. Fortunately, it did. Subsequently, we discovered the cause of the problem: the faulty GPS.

© **What was your personal aspiration for working on the project?**

To make Singapore proud with the fact that a small country can possess the indigenous capability to design and build an Earth-monitoring satellite. It may not be of the same class as many bigger and more sophisticated satellites, but from a personal point of view, it has indeed been very satisfying and fun (although challenging and tiring at times)!

© **What do you miss most about DSO?**

It has to be the many friends and colleagues whom I used to meet regularly, getting updates and discussing the many innovations within DSO.

Koh Wee Eng



MISSION POSSIBLE

prime.commentary

THE STRAITS TIMES WEDNESDAY, APRIL 27 2011 PAGE A2

One small step into space for Singapore

Launch of X-Sat satellite may help Republic grow its space industry



BY JERMYN CHOW
DEFENCE
CORRESPONDENT

AMID the hurly-burly of the coming General Election, it was easy to miss the news last week that Singapore had launched its very own satellite.

On April 20, X-Sat blasted off into orbit, riding on an Indian rocket.

It is true that as satellites go, X-Sat is a micro-satellite – the size of a bar fridge, weighing just 105kg.

Modest as it is, it is the first-ever satellite to be built from scratch in Singapore. Like the nation it represents, its successful launch has created a buzz that X-Sat could one day punch above its weight.

Just putting it in orbit was a feat for the 20-plus scientists and engineers from the Nanyang Technological University (NTU) and Singapore's defence research body DSO National Laboratories, who had been working on it for nine years. The satellite came after a four-year delay which saw costs go up from \$10 million to \$40 million.

As NTU outgoing president Su Guan-ing said after X-Sat's successful blast-off, the satellite launch represents a "huge leap" for Singapore's research efforts in space technology and building micro-satellites.

Singapore is one of the first few countries in this region to have their own satellites in space. Only Indonesia (Lapan-TUBSat) and more recently Malaysia (RazakSat) have launched their own locally built satellites in space – in 2007 and 2009 respectively.

In Singapore, efforts in satellite technologies started in 1995 when NTU's School of Electrical and Electronics Engineering started a satellite programme.

In 1999, the Satellite Engineering Centre and the University of Surrey in Britain jointly developed and launched the UoSAT-12 satellite with the Merlion payload, a communications sub-system for the satellite designed by NTU.

DSO also began research work on micro-satellites in 1997 and has collaborated with South Korea's Centre for Research in Satellite Technologies.

One question on some people's minds is whether the launch of X-Sat signals the start of the Republic's space ambitions. Will it aim for a place in the big league of nations – Russia, China, Israel, the United States, among many others – that have sophisticated satellites and established space programmes?

Those involved in the X-Sat project are quick to downplay any such sugges-

tion. They say X-Sat is experimental. Its scope is also narrow: The primary objective of the satellite is to monitor environmental changes by taking photos of soil erosion, forest fires and sea pollution.

What is unsaid about this remote sensing satellite, however, is whether there are attendant defence applications.

For example, X-Sat is able to capture and beam satellite pictures at the same time, allowing for almost real-time sensing. X-Sat's project director, Dr Goh Cher Hiang, had said in the past that this capability is one usually performed by bigger satellites weighing more than 500kg.

Theoretically, such eye-in-the-sky capabilities can help to fight piracy, as well as spot and track deployment of troops.

But defence analyst Bernard Loo said Singapore had "no strategic need" for such tracking by a sophisticated satellite. In other words, a satellite to watch the weather suits Singapore fine.

Space ambitions and spy satellites may be fodder for speculation. In fact, what is

more relevant is how Singapore can leverage on its expertise to grow its nascent space and satellite industry.

The Defence Ministry's chief defence scientist Quek Tong Boon said revenue for the global aerospace industry was US\$200 billion (\$247 billion) last year and there would be "many opportunities" in Singapore.

The global space industry is also growing. According to the United States' non-profit organisation The Space Foundation, it was worth US\$257 billion in 2008, and has been growing at a compounded average growth rate of more than 8 per cent since 2006.

Asian nations are ramping up space exploration efforts. China has completed its first space station module, while India aspires to put a man in space by 2015.

Singapore's Economic Development Board has an industry identification and innovation department that is trying to woo space and satellite companies to set up shop here.

Already, French aerospace giant European Aeronautic Defence and Space (Eads) wants to make Singapore a launch pad for commercial space flights. Part of the deal would include designing, building and testing a "demonstrator" model of the space plane.

NTU's provost-designate Freddy Boey has said more projects are in the pipeline – including plans to build a "constellation" of satellites launched into space with the help of foreign space agencies.

The challenge is to make the satellite "smaller but doing the same applications or even more", Professor Boey said.

This could generate economic spin-offs when the expertise is commercialised and marketed to other South-east Asian countries, or to countries in South and Latin America that do not have satellite capabilities.

Also important is that the launch of X-Sat can fire the imagination of young space scientists and engineers.

The father of rocketry and astronautics, Konstantin Tsiolkovsky, wrote in one of his books: "Earth is the cradle of the mind but one cannot live in the cradle forever."

The world's first man-made satellite, Sputnik 1, was launched by the Russians on Oct 5, 1957. It marked the start of the Space Age. Since then, thousands of man-made satellites, big and small, have been launched with some 560 still orbiting Earth.

Singapore's own satellite launch is a humbler beginning. But it may be a harbinger of more to come, if X-Sat sparks not only the start of a new industry, but also interest in space science in a young generation.

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PUNCHLINES



27 apr
2011

Ayes all round for S'pore eye in the sky

First locally developed satellite invaluable in helping to monitor environmental change

Jermyn Chow
Defence Correspondent

One year in space, and Singapore's first locally designed and built satellite has not only captured images of Sumatra's forest fires and the Bangkok floods, but also had a few near misses with floating debris.

Since last May, X-Sat, which hovers 800km above ground, has taken and beamed back more than 1,000 satellite images from space to help researchers on the ground monitor the effects of environmental changes.

Associate Professor Low Kay Soon, one of X-Sat's team leaders, said the National Environment Agency and environmental consultancy Sentinel Asia have benefited from X-Sat's images.

The red-and-black photographs – with red denoting vegetation and black representing bodies of water – can be used to measure soil erosion, sea pollution and environmental changes within an area of 50km by 30km.

The 105kg fridge-size microsatellite has also had seven close shaves with space debris – mostly remnants of satellites that have been decommissioned or fragments chipped off from other satellites.

The most recent encounter was on April 13, when the solar-powered X-Sat, which circles the Earth once in 100 minutes at a speed of 7.5km a second, came as close as 200m to one of the fragments.

"It is harrowing because even debris the size of a five-cent coin can inflict a lot of damage on the satellite," said Prof Low.

The success in beaming back images to Singapore capped more than nine years of work by more than 40 scientists and engineers from Nanyang Technological University (NTU) and Singapore's defence research body, DSO National Laboratories.

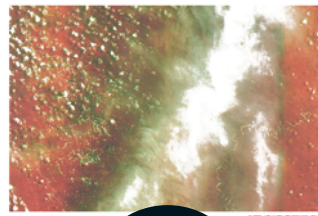
The experience so far has been invaluable for Prof Low and his team who run NTU's Satellite Research Centre.

Lessons learnt will be applied to Singapore's second locally made satellite – but the first to be made by students – scheduled to be launched next April.

Called Velox-I, the nanosatellite is smaller than the X-Sat and is being put through its paces by NTU engineering students in the Undergraduate Satellite Programme that began in April 2010.

NTU hopes to launch four smaller satellites in the next 10 years.

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Small satellite image of a forest fire in Sumatra, Indonesia, captured by X-Sat. The image shows a large area of red, representing the fire, and black areas representing water bodies. The satellite is the first locally developed and built satellite in Singapore.

22 apr

2012

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THE STRAITS TIMES

NTU satellite marks two years in space

Built by uni and DSO Labs, X-Sat will be aloft for at least another year

By FENG ZENGKUN

SINGAPORE'S most well-travelled two-year-old has gone to space and seen Madrid, Venice, Paris and Dubai.

The traveller has also survived solar storms, radiation and 15 near-collisions with large chunks of space debris.

And today, the Republic's first locally-built satellite, the X-Sat, celebrates its second anniversary in space.

It will not be the last, as the device is due to continue its work 800km above Earth for at least another year.

Built by Nanyang Technological University (NTU) and DSO National Laboratories, the X-Sat has taken almost 5,000 photographs of Earth, helping researchers to monitor sea pollution, forest fires and other environmental changes.

The 105kg satellite is about the size of a mini-fridge but can zip around the globe at 7.5km per second, many times faster than an F-15 fighter jet.

With a camera resolution of 12 metres, it has produced images in which even swimming pools in Singapore are visible.

NTU Satellite Research Centre director Low Kay Soon on Thursday said the X-Sat has completed two important experiments in space.

"These include the testing of a new and better Global Positioning System, which can pinpoint



NTU Satellite Research Centre director Low Kay Soon standing next to the component parts of a satellite. ST PHOTO: NURIA LIN

space objects' locations to within centimetres," he said. This could help scientists better coordinate groups of satellites in future.

The NTU team also designed a parallel processing unit and put it through its paces. This allows the satellite's computer system to keep functioning even if some computing processors fail.

In February, Singapore set up a new Office for Space Technology and Industry to build up the space-satellite industry here.

Its director, Mr Gian Yi-Hsen, said the nascent industry in Singapore will focus on manufacturing small satellites, weighing less than a tonne, that have commercial applications. It will also concentrate on a chain of other activities that include receiving, processing and analysing satellite data.

In 2011, the global space economy was worth US\$290 billion (S\$358 billion) – 12.2 per cent more than that in the year before.

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22 apr

2013

THE AFFIRMATION


The Defence Technology Prize (DTP) is a hallmark of excellence which recognises the technological innovations that enhance Singapore's defence capabilities. Presented by the Ministry of Defence, the prestigious award was established in 1989 and our people have won the award each year since.

Meet Lim Mei Lan and Ng Kuan Kuan from the Advanced Electronics Lab (AEL) - multiple DTP team award recipients who hold a total of 7 awards between them. With such an illustrious track record, we speak to them to find out their formula for innovating game-changing defence technology.

Total awards
between them



Lim Mei Lan

A portrait of Ng Kuan Kuan, a woman with short dark hair, wearing glasses and a black top with a teal patterned collar. She is smiling and looking slightly to the left. The background is white on the left and transitions into a blue area with a white dot pattern on the right.

Ng Kuan Kuan

“

Our Chief Defence Scientist,
Mr Quek Tong Boon once said,
“Dare to dream, do and deliver”.
To that, I like to add “Persevere”
as well!

”

THE AFFIRMATION



Lim Mei Lan



Ng Kuan Kuan

⦿ How did it feel when you won your first DTP award?

It was really fantastic! It felt good to be part of an award-winning team where everyone gave 100% and worked towards the singular goal of making the project a success.

My first DTP award was memorable but what felt really special was to have been able to work with a great team.

⦿ How do you ensure that innovation is part and parcel of your work?

I think that it's important to look for situations that will trigger you to think about innovating. For example, I try to interact more with colleagues who are working on different projects as they may be able to share useful information or expertise that can be applied in my project. I also find that keeping myself up to date with the latest trends in my field of work to be beneficial.

Innovation isn't a walk in the park! But one of the most important things you can do in the pursuit of innovation is to surround yourself with the right mix of people. People who can walk into the room, challenge what you're doing, give you valuable feedback and inspire you with the right energy. These people make the work I do more creative, diverse and rewarding!

⦿ Both of you hail from the same lab. Is there a certain lab culture that contributes to the innovation process?

Yes. In AEL, there are minimal restrictions on trying out new ideas and plenty of encouragement when developing unique solutions. We also have great leadership in the lab. Leaders who are able to motivate you to overcome the hurdles you inevitably face in projects.

I completely agree. Our supervisor, Chin Heng, leverages on our strengths, shores up our weaknesses and empowers us to make decisions and learn from mistakes. Moreover, interaction between AEL members is more cooperative than competitive. There is a sense that everyone is equal and has a voice. This culture motivates one to do better because you don't feel like you're just a cog in the wheel. In fact, the culture has become a conscious driving force behind our behaviour.

home.

THE STRAITS TIMES SATURDAY, OCTOBER 30 2010 PAGE 83

Mini device bags big defence prize

Tiny radio frequency unit among winners

By CHONG ZI LIANG

BIGGER is not always better, especially in modern warfare.

So when a palm-size device is able to pack as much punch as equipment more than 100 times larger, it spells good news on the battlefield – allowing armies to carry less load without compromising on capabilities.

The miniaturised radio frequency (RF) module was one of the top winners at yesterday's Defence Technology Prize Ceremony – the Defence Ministry's annual event to honour the finest in defence research and engineering – held at the Biopolis Auditorium.

The brainchild of Dr Tan Guan Leng and his team at the DSO National Laboratories, the device, which receives and transmits information, is crucial in radar electronic and communication systems.

An example of the possible use of these locally designed RF units is in the SAF's unmanned aerial vehicles, where it serves as receiver to facilitate controlling of the craft remotely and the wireless video download and transmission from its camera.

The lightness of the device means the drone can carry more fuel and remain in the air to gather information for a longer period of time.

Although RF technology is not new and is available off the shelf, it is still critical for militaries to develop their own systems, Dr Tan said.

Building its own RF devices also means the military can ensure its encryption capabilities are up to scratch.

The secret behind the success of Dr Tan's team's decade-long project was the designing of miniature components to replace the clunkier originals.

Then comes the careful, yet creative process of laying them out on the chassis.

"Attention to the tiniest of details is needed. Even a slight misalignment is not allowed," said Dr Tan, DSO's assistant director of electronic systems.

Such innovation, said Deputy Prime Minister and Defence Minister Teo Chee Hean, the event's guest of honour, bodes well for the SAF's transformation into a third-generation fighting force.

Mr Teo also took the opportunity to underline the importance of bringing together defence agencies, industry, academia and research institutes to work as a "defence technology ecosystem".

He said: "At the core of the defence ecosystem is people, for it is their interactions that breed the creativity and energy needed to sustain it."

Among the individual winners yesterday was Mr Loh Heng Fong of Singapore Technologies Kinetics, who was awarded for his contributions in building up the military's tracked vehicle capabilities over the last 30 years.

Also honoured yesterday was an information fusion programme which allows the better policing of Singapore's waters.

The Comprehensive Maritime Awareness system gathers information from different databases before presenting security analysts with data to sieve out anomalies in the waters around Singapore.

For example, an analyst can choose to flag ships according to the type of cargo they carry and their country of origin.

The Terrax Infantry Carrier Vehicle, an armoured battlefield taxi that carries 13 soldiers and has the ability to network with other vehicles, was another winner.

Yesterday's three individual winners were the top 1 per cent of about 5,000 engineers and scientists while the five team prizes were awarded to the top 1.5 per cent of more than 300 projects, said the Defence Ministry's Chief Defence Scientist Quek Tong Boon.

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(From left) Mr Lim Han Tan, Chief of Staff, Defence Science and Technology Agency; Mr Lim Han Tan, Chief of Staff, Defence Science and Technology Agency; and Mr Lim Han Tan, Chief of Staff, Defence Science and Technology Agency with their winning Communications Maritime Awareness system.



(From left) Mr Tan Guan Leng, Head of Singapore Technologies Kinetics; Mr Lim Han Tan, Chief of Staff, Defence Science and Technology Agency; and Mr Lim Han Tan, Chief of Staff, Defence Science and Technology Agency with their winning Terrax Infantry Carrier Vehicle.



(From left) Mr Koh Teck Lye, Mr Koh Teck Lye and Dr Tan Guan Leng, who are from DSO's electronic systems division, showing the difference between the award-winning RF module and its much clunkier predecessor. The device, which receives and transmits information, is crucial in radar electronic and communication systems. PHOTO: DSO NATIONAL LABORATORIES

30 oct

2010

THE STRAITS TIMES

SATURDAY, SEPTEMBER 22, 2012

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Machines may take a step back in defence tech

Science awards highlight importance of rapid analysis of data to help SAF make quick decisions

By LIM YAN LIANG

FUTURE strides in Singapore's defence technology will increasingly depend on human intellect rather than on machines, as internally developed software integrates a multitude of hardware platforms.

The core message of yesterday's Defence Technology Prize ceremony is that rapid analysis of complex data, helping Singapore Armed Forces (SAF) personnel to make quick and informed decisions in the field, is vital.

The annual Ministry of Defence (Mindef) event to honour the finest in defence research and engineering was held at the Biopolis auditorium.

This year's winners include a team that used mathematical algorithms to improve the transmission reliability and speed of the army's existing wireless communications networks by about 50 per cent.

Another team won for unifying the SAF digital mapping system, which accelerated map transmission to multiple recipients while using half the number of servers.

A third team won for creating a threat assessment model that can better spot vulnerabilities, and which has been used to identify weaknesses in Singapore's maritime lanes and in the island's infocomm infrastructure.

"The gist of the 3G SAF is about transforming into a fighting force that is more integrated than what we were in the past," said Mindef chief defence scientist Quek Tong Boon.

"Increasingly, all of us, both in defence and non-defence, have access to lots of information. How do we translate that information into knowledge that is usable, and knowledge that we can use to make decisions?"

"You'll find that among our winners today, almost all of them are involved somewhat, somehow, in this 3G transformation effort."

“**INTEGRATED FIGHTING FORCE**

The gist of the 3G SAF is about transforming into a fighting force that is more integrated than what we were in the past.

— Mindef chief defence scientist Quek Tong Boon



From left, Defence Minister Ng Eng Hen and Mindef chief defence scientist Quek Tong Boon with Dr Loh Heng Fong, who won a team prize for his work on the Terrax Infantry Carrier Vehicle. PHOTO: LAI CHENG FOR THE STRAITS TIMES

Minister for Defence Ng Eng Hen agreed, and said in his speech that this is why the SAF is "on a continuous quest" and has invested "considerable amounts" in technology.

"We can't ask others, 'Can you teach me this technology?' Because they themselves are looking for it and trying to develop it," said Dr Ng.

The one exception – for hardware – was the Individual (R&D) award, which went to Dr Loke Weng Keong of DSO National Laboratories.

The programme director of DSO's chemical, toxins, radiological and nuclear programme and his team successfully created a field testing kit to check if a person has been exposed to pesticides or nerve agents like sarin gas.

Unlike the previous laboratory test, Dr Loke's test required just a drop of blood instead of a test-tube's worth, was more sensitive and delivered results in an hour instead of 16 hours.

The kit has been patented in Singapore and the United States.

Dr Loke said DSO is in talks with partners to bring the testing kit to market.

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INCUBATOR OF POSSIBILITIES

If the Defence Technology Prize is an acknowledgement of our efforts, then the annual DSO Big Ideas (dBi) competition is the incubator of our innovation. Launched in 2006, the dBi is part of the Innovation & Knowledge Management (iKM) department's drive to promote and facilitate the creation and utilisation of DSO's knowledge.

Thinking back, Sim Sok Hian, Head of iKM, said, "CEO launched the dBi as a means to ensure that DSO remains a vibrant organisation. He wanted to keep the organisation alive and on its toes."

But there were obstacles to overcome. The very nature of defence science made sharing a real challenge. De-sensitisation of content is necessary before it can even be presented. More crucially, it may also appear too daunting for

our scientists and researchers who are hard-pressed to find time for award-winning ideas.


"To harvest the best possible ideas, one needs to have a strong grasp on potential technologies, cross-domain solutions and in-depth knowledge of user problems," Sok Hian explained. "All these require time, and it is a luxury that our people do not have as their critical work to enhance our nation's defence capabilities takes precedence."

Still, Sok Hian was heartened by the support from the management and her passionate team of four. The DSOMC has consistently led by example by sharing evergreen operational issues via the annual Big Ideas Session since the advent of dBi.

"When dBi first started, we only received a single-digit number of

proposals. We soldiered on, and the number of entries leaped to 36 in 2010. The following year, it soared to 47," Sok Hian beamed. "The level of participation has definitely increased but the best part is the quality of ideas – they keep getting better every year."

Sok Hian also pointed out that the newer staff are surprisingly keen to participate. Some of the participants were junior staff who had joined DSO for less than two years. With the support of their more experienced colleagues, they stepped forward for the challenge and some have succeeded in clinching an award. "When the dBi was initiated, I was actually worried that it would be difficult for the newer staff to participate as they would be new to defence science and technology. But I'm glad that my worries were unfounded," mused Sok Hian.

 **362**
Number of unique participants

 **235**
Number of dBi submissions

 **59%**
Percentage of winning dBi submissions that transitioned to externally funded projects from 2006 to 2012



Sim Sok Hian

HOME OF INNOVATION

Come December 2013, Phase 1 of DSO's brand-new complex will be ready, and everyone from Maxwell and Mendel will be moving in. More than just a milestone, it also symbolises a new beginning for DSO as we take the next leap into the future.

Tasked to work on the requirement analysis and planning of the new building, Dr Koh Cheng Heng, Assistant Director of Procurement and Corporate Services, recounted, "The vision was to have our people who were situated across different locations in Science Park to be under one roof."

home.

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DSO to get new, bigger campus next year

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Defence scientists from 6 sites come under one roof

BY JERMYN CHOW
DEFENCE CORRESPONDENT

THE agency which does research into technology for Singapore's defence arsenal will move to a new and bigger home in Buona Vista next year.

The new campus of the DSO National Laboratories will have state-of-the-art laboratories, sky terraces and roof gardens.

It is understood that the labs will be large enough to develop technology for unmanned systems like Unmanned Aerial Vehicles and guided weapons.

But more than just providing more space, the complex will unite under one roof most of DSO's current 1,700 employees, who are now scattered over six locations, and make room for 300 more.

The complex, owned by property developer Ascendas, will give the defence science research outfit 50 per cent more space than what it now has in its multiple locations; these include its 23-year-old headquarters and offices spread around Buona Vista, and offices in the National University of Singapore's Kent Ridge campus.

Its researchers have been shuttling between the six offices.

DSO chief executive Quek Gim Pew told The Straits Times that the integrated research complex will enable staff to work more closely together on projects.

"With more open spaces, there'll be more opportunities for staff to congregate,



An artist's impression of the DSO National Laboratories' new Buona Vista campus. It will feature high-tech laboratories, sky terraces and roof gardens. PHOTO: DCA ARCHITECTS

discuss and gain inspiration for ideas," he said.

A brainchild of the late former deputy prime minister Goh Keng Swee, DSO was launched in 1972 as a three-man outfit called the Electronic Test Centre. Its mission was to develop home-grown technology primarily for the Singapore Armed Forces (SAF).

Today, DSO has gone beyond research on electronic warfare into areas such as radar, sonar, biological and chemical security and, more recently, unmanned-vehicle capabilities and satellite systems.

Eight in 10 of its current 1,700 employees are scientists or researchers. Mr Quek said he intends to grow the staff strength by 3 per cent every year until DSO is 2,000 strong.

The organisation is famously hush-hush. It has declined to say how many of its top-secret, or "black box", projects have been put into use by the SAF.

But Singapore's land, sea and air troops are all known to have benefited from DSO's innovations. These include, for example, surveillance systems and tools used by the Republic of Singapore Navy's stealth frigates, which make operations less manpower-intensive, and the army's Skyblade III, a portable unmanned surveillance plane which beams real-time video images beyond a soldier's line of sight.

DSO has worked with global research outfits such as the United States Air Force Research Laboratory and the European Aeronautic Defence and Space Company.

Senior researcher Khoo Wai Gea said: "As our work becomes increasingly cross-disciplinary, the closer physical proximity will definitely make the collaborative process much easier."

Mr Quek said that, facilities aside, the heart of the DSO is still its people – their passion and knowledge have made a difference to the nation's defence capabilities.

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Leading a team comprising staff from three departments and representatives from the R&D divisions, the planning and execution of the building development went into full swing in June 2010. The idea was to construct a new building at the redeveloped site consisting of the Maxwell, Mendel, Pascal and Pasteur. This would also enable our facilities at Marina Hill to be connected to form a single, integrated complex.

However, it was an uphill task. "I did not have prior experience in the construction industry, and there were so many details to consider for a building full of non-standard items and unique requirements. It did not help that our R&D and security needs are ever-evolving," said Cheng Heng. "I also had to ensure the building fulfilled all statutory codes, including the new ones that were implemented during the building's development."

With help from her team and numerous days of brainstorming, she overcame many obstacles and even gave a Midas touch to it. "The interior designs have been enhanced and it reflects DSO's work, aspirations and dynamism. Even the work space is specially configured to empower greater interaction and encourage more collaboration. Wi-Fi will also be enabled for non-classified work. Sky terraces and a green wall have been installed to provide a more conducive environment," she grinned.

And the team's efforts have not been in vain. The new building was awarded the Green Mark Gold^{Plus} Award by the Building and Construction Authority. Buoyed by the award, she said, "It meant a lot to the team. We went through thick and thin together for three years and counting. It was a great lesson learnt and we are definitely ready for the next and final phase of the new complex!"

Dr Koh Cheng Heng



BEFORE WE GO

Now that we know what defines DSO, have you ever wondered what DSO could otherwise stand for? Here's a creative list from our people!

- Damn **S**iao **O**n
- Don't **S**tress **O**ut
- Don't **S**how **O**nly
- Don't **S**tay **O**rdinary
- Daily **S**ecretive **O**bjectives
- Defending **S**ingapore **O**nly
- Developing **S**ecret **O**bjects
- Decisive, **S**mart, **O**rganised
- Diligent, **S**uperb, **O**rientated
- Definitely **S**ecurity **O**bsessed
- Definitely **S**omething **O**utstanding
- Discovering **S**pecial **O**pportunities



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