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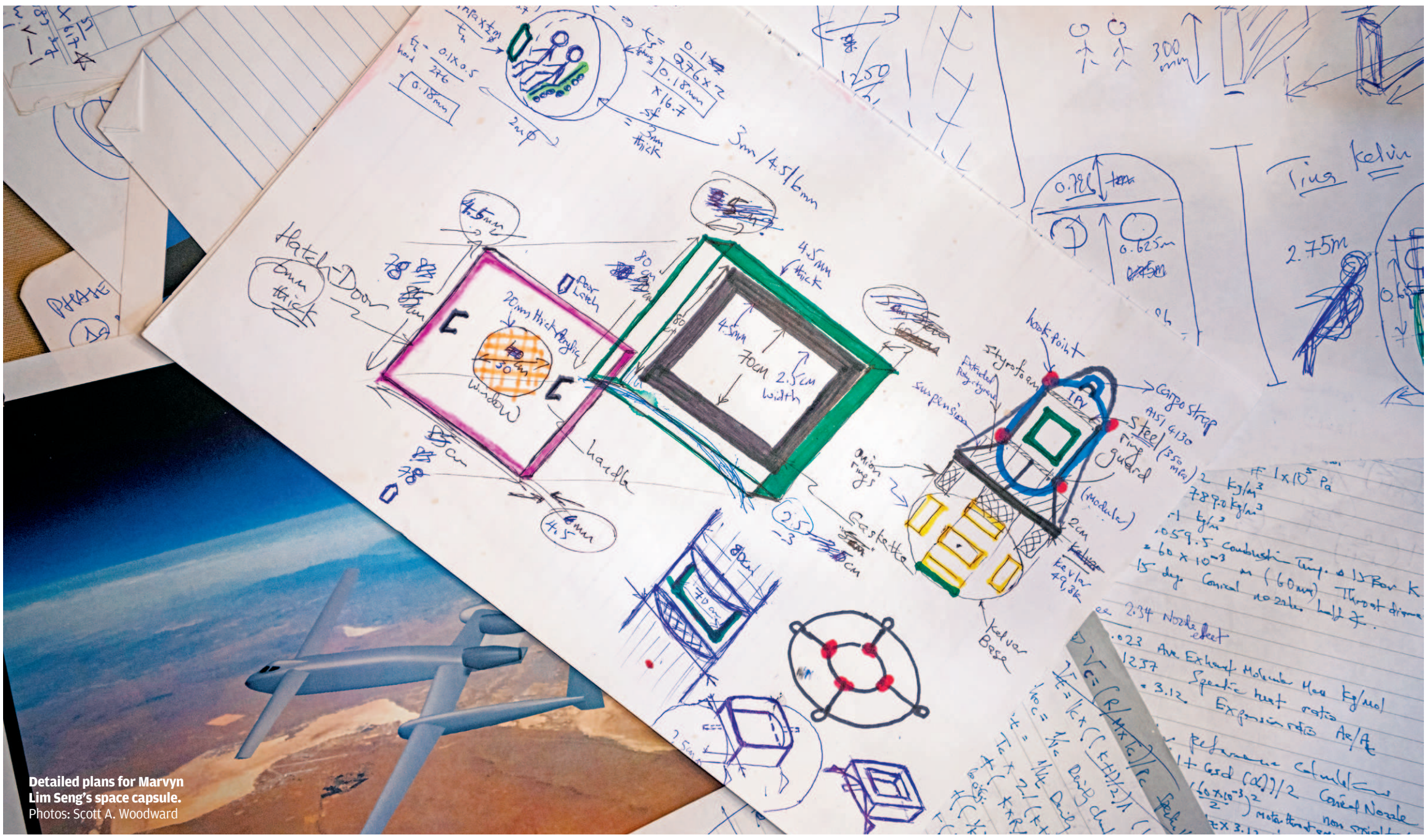

Detailed plans for Marvyn Lim Seng's space capsule.
Photos: Scott A. Woodward

Stars in their eyes

Space travel and satellites have become a focus of so-called astropreneurs, and Singapore has a growing list of scientists and inventors who are pushing extraterrestrial boundaries

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With Elon Musk's SpaceX shuttling Nasa astronauts to the International Space Station and Virgin Galactic planning to begin commercial flights next year, space has never been more accessible.

For the business-minded, it's never had more commercial potential. About US$3.25 billion was invested in space start-ups in 2018, while a 2020 report by Morgan Stanley predicted the space economy could be worth up to US$1.1 trillion by the 2040s.

Space was once the exclusive domain of superpower space agencies, but now entrepreneurs and tech-savvy start-ups are pushing the extraterrestrial boundaries.

The space industry is opening up new frontiers in Southeast Asia, with Singapore emerging as a regional hub for a growing tribe of scientists, inventors, designers and so-called astropreneurs with their sights set on the stars.

A recent arrival is Zero-Error Systems (ZES), which, in October, was funded to the tune of US$1.85 million by a group of investors that includes Airbus Ventures, the venture capital arm of European aircraft manufacturing consortium Airbus.

Suraya Shanmugam (left) and Jacob Tang of Starfleet, the winning team of the 2020 Singapore Space Challenge.

Founded in 2019, ZES is the commercial result of a six-year research project at Singapore's Nanyang Technological University. It has developed a microchip that reduces the cost and improves the reliability and capability of electronics used in satellites – an appealing option in an electronics-heavy industry that is worth about US$424 billion a year globally.

> **Singapore is home to the highest number of space-related organisations in Southeast Asia**
>
> LYNETTE TAN, ENTREPRENEUR AND CO-FOUNDER OF SSTL

"Our vision is to be in every satellite and autonomous vehicle," Shu Wei, ZES co-founder and chief technology officer, says.

Funds are pouring into Singapore-based space start-ups. Aliena, which develops electric propulsion solutions for nano-satellites, raised US$1.1 million last year, while in July Transcelestial raised US$9.6 million to develop technology using lasers and satellites to create a superfast internet.

"Singapore has a good ecosystem for entrepreneurship and it's in a unique position to approach both Western and Eastern markets," Wei says. "We're pleased to see the space industry booming; it gives us an opportunity to hop onto this trend."

Equally enthusiastic is entrepreneur Lynette Tan, who co-founded Singapore Space and Technology (SSTL) in 2007 to shine a light on the commercial potential of space.

"Singapore is now home to the highest number of space-related organisations in Southeast Asia," she says. "We're here to broker conversations between experts and those looking to move into the industry."

One of SSTL's first steps was to organise the Global Space and Technology Convention to kick-start industry interaction. Launched in 2008 with just 80 delegates, it is now arguably Asia's leading space tech conference. The latest event, held in February, hosted more than 800 delegates from over 300 companies and leading space agencies.

This year, SSTL launched a space-based accelerator programme that supports 23 global start-ups, including ZES and Aliena, and helps them find mentors, users and investors.

"People need to be astute and realise the seriousness of the industry," says Tan, who left the pharmaceutical industry to work full time with SSTL. "It's not a magic show; it's a business."

Despite the money flowing into space technology, it has taken years for even the biggest players, such as SpaceX and Virgin Galactic, to turn a profit. "People do get easily excited with space, but the financial aspect is harder to get right than the rocket technology," Tan says.

Simon Gwozdz is co-founder of Equatorial Space Systems, a member of the space accelerator programme. "At our heart we are a transport company," says Gwozdz, who was born in Poland. "It just happens we will be transporting satellites into space."

Equatorial Space Systems began as Gwozdz's hobby when he was studying at the National University of Singapore. Its aim is to design rockets that use a hybrid propulsion system to provide a safer, more reliable and cost-effective way to get small satellites into space.

After successful ground tests, the next step was to attract funding by capitalising on a low-altitude demonstration rocket flight in Malaysia in May. But the pandemic derailed plans for the flight, and Gwozdz was briefly sidelined with the virus.

The team is back on track and confident the prototype rocket demonstration will be completed before the end of the year, but it's clear getting the technology to work is not the biggest concern.

"We need this launch to attract prospective investors and launch clients by showing our system's functionality in flight," says Gwozdz, who says staying solvent, especially this year, has been a challenge.

The rocket's potential could be huge. A Euroconsult 2019 report predicts nearly 8,600 small satellites will be launched between 2019 and 2028.

The Equatorial Space team estimates US$30 million is needed to develop the orbital launcher and vie for a slice of this booming market. That might sound like a lot of money, but Gwozdz says it's a quarter of the budget of similar companies such as Rocket Lab in the United States.

Simon Gwozdz with the low altitude demonstration rocket; a microchip developed by ZES.

> **You can work out all the rocket equations you like, but at some stage you have to try**
>
> MARVYN LIM SENG, ENTREPRENEUR

The Equatorial rocket, dubbed Volans after a star constellation in the southern skies, will be 18 metres long and weigh about 20 tonnes. Capable of putting a 180kg payload in orbit, the rocket will be able to carry the new microsatellites. Its relatively small size should provide an opportunity for land-poor countries such as Singapore. "Our ultimate aim is to be able to establish sea launch operations in the region," Gwozdz says. "Bringing a sovereign launch capability to our host country will be a really big deal."

Entrepreneur Marvyn Lim Seng has already had some experience in the field of space. In 2019, in Alice Springs, Australia, his home-made space capsule, suspended from a stratospheric balloon, reached an altitude of 8km before a pressure leak aborted the mission.

It was his team's third attempt to put the first Singaporean above the Armstrong Line, an invisible marker 20km above Earth, seen by many as the edge of space.

Lim is preparing for another try next year if he and his team can raise about S$1.5 million (HK$8.6 million); small change in the realm of space travel.

To make the investment even more appealing, the team will design a two-man capsule this time, offering the chance for a wealthy benefactor to hitch a ride.

"I've done my part," says Lim, who funded previous attempts. "It's time for someone else to step forward, someone who wants to make history and leave a legacy for themselves and Singapore."

The scientist says he is trying to lead by example. "I have this knowledge and I want to use it to give something back," he says. "I also want to prove a point to myself and to Singapore. I want to show we might be small, but we can think big."

Lim's knowledge came from his work on drone technology for Singapore's Ministry of Defence and helping Airbus build hypersonic planes. He says the contacts he made during his career, especially with scientists in India and Australia, helped him get this far.

Pioneers need a can-do attitude, something he feels "risk averse" Singapore is not so good at. "No one dares do anything; you can work out all the rocket equations you like, but at some stage you have to try," he says.

Some young scientists are willing to try. Surya Shanmugam, 22, and Jacob Tang, 20, also known as Starfleet Command, won SSTL's annual Singapore Space Challenge this year. The pair's design for a method to deal with space junk won the S$10,000 first prize, ahead of 74 competitors from around the world.

Tang currently works as a logistics analyst for the oil and gas industry, and Shanmugam is about to start a mechanical engineering degree. Both are focused on a career in space in Singapore.

Tang believes Singapore has the potential to become the biggest space industry hub in the region, and says he and Shanmugam hope to eventually work on a start-up in the space industry.