



NEWS RELEASE

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NTU Singapore showcases final test model of Singapore's latest satellite to President Tharman Shanmugaratnam

Nanyang Technological University (NTU Singapore) today unveiled the final test model of its latest advanced satellite, aimed at enhancing Singapore's space technology capabilities.

Named **Extremely Low Earth Imaging Technology Explorer (ELITE)**, the satellite is scheduled for completion by 2025 and will serve as a testbed for innovative technologies from local firm **LightHaus Photonics** and NTU deep tech spin-off **Aliena**.

This is NTU's 14th satellite and its largest and most complex to date, which is supported by **Singapore's Office for Space Technology & Industry (OSTin)**. The research collaboration between the partners was first announced at the 2022 Global Space and Technology Convention.

ELITE will validate new satellite technologies, paving the way for Singapore space tech firms to access the international space technology market worth US\$433 billion¹, and deliver significant socioeconomic benefits to the country.

Additionally, the satellite will study the unique conditions of Very Low Earth Orbit (VLEO) and the Earth's surface, advancing scientific knowledge which can be used to better understand space phenomena and the environment.

Singapore President Tharman Shanmugaratnam was briefed on the advanced technologies of ELITE during his visit to NTU's Satellite Research Centre, hosted by NTU and OSTin.

NTU President Professor Ho Teck Hua and **OSTin Board Chairman Mr Peter Ho** received President Tharman, who also spent time interacting with NTU scientists, academics, key players from Singapore's space industry, and students actively involved in space projects.

¹ Precedence Research. (n.d.). Space technology market. Retrieved May 27, 2024, from <https://www.precedenceresearch.com/space-technology-market>

“NTU’s deep expertise in artificial intelligence, data science and various engineering fields has enabled our faculty to tackle Earth’s final frontier – space. In the years since OSTIn started, we have accumulated extensive technological expertise in the space sector, from upstream research to downstream operations,” said Prof Ho.

“ELITE, NTU’s latest satellite, incorporates the best innovations from Singapore firms. It is a showcase of how advanced satellite technologies can benefit humanity in a more sustainable and cost-effective manner. Moving forward, we aim to help co-develop a “data lake” for the local space community, fostering collaboration and sharing valuable information, which will help the Singapore space industry achieve its maximum potential.”

Executive Director of OSTIn, Mr Jonathan Hung, said, “Through supporting the ELITE project led by NTU, OSTIn was able to foster collaboration between various space players from Singapore’s space ecosystem. ELITE showcases the advancement our ecosystem has made in furthering Singapore’s space tech capabilities. The project has also provided participation opportunities for our students and youths, furthering their passion for science, technology, engineering and mathematics (STEM) as a career choice.”

The ELITE project also saw the participation of more than 20 NTU students, whom are among a growing group of Singaporean youth actively participating in STEM efforts related to space technology. These students from secondary schools, junior colleges, polytechnics and universities have the opportunity to experiment and innovate in a multi-disciplinary manner, building their passion for science and engineering.

The ELITE satellite is a collaboration between **NTU Singapore, Aliena, LightHaus Photonics, NUS Temasek Laboratories** and **ST Engineering Satellite System Systems**, showcasing Singapore’s strengths in space technology through innovative research and strategic partnerships.

New satellite innovations from Singapore

The ELITE satellite weighs 180 kilograms and measures 129cm x 70cm x 73cm – the size of a small fridge. It is designed to operate in VLEO, approximately 250 kilometres above the Earth’s surface, much lower than the conventional 550 kilometres or higher altitudes for most small satellites.

Operating in VLEO, a relatively unexplored region of space, presents significant challenges, such as aerodynamic drag caused by traces of Earth’s atmosphere. This drag can reduce a satellite’s orbiting altitude, eventually causing it to burn up in the atmosphere. This phenomenon also helps prevent defunct satellites from becoming space junk.

To counteract this drag, ELITE is equipped with a special electric propulsion system, the **MUlti-Stage Ignition Compact (MUSIC) engine**, developed by Aliena. This sub-100 W class Hall effect thruster has a high thrust-to-power ratio and rapid firing capabilities, prolonging the satellite's operational life from days to years.

ELITE will also face the presence of atomic oxygen (ATOX) in VLEO, a highly reactive gas that corrodes and degrades materials.

To combat this, NTU Temasek Laboratories is implementing **a new sensor to study ATOX effects** and is working on a **new ultrathin, optically transparent nanotechnology coating to protect the spacecraft**.

Being closer to Earth at VLEO also means that ELITE can take higher-resolution images of the Earth with smaller camera optics. Conventionally, space cameras will require large telescopic lenses due to the distance of the satellite away from the Earth.

ELITE will be equipped with **LighHaus Photonics' Electro-Optical Camera, LEOCAM** in short, which is a new camera design featuring a Three-Mirror Anastigmat (TMA) telescope – having a 2500mm focal length and a 220mm pupil diameter.

LEOCAM is capable of delivering high-resolution images, as each pixel can capture more details from the ground (0.5 metre ground sampling distance at a 250km altitude).

The unique TMA design has mirrors positioned to the side of the primary mirror's central axis. This is unlike traditional telescopes that have secondary mirrors which can block part of the incoming light, thus leading to clearer and more precise imaging while correcting optical aberrations.

Other unique, made-in-Singapore technological innovations include a **satellite aerodynamics prediction model**. Designed to optimise performance in VLEO, the new model will be validated using operational satellite data in future and can be potentially applied in future VLEO satellite designs.

The satellite also has locally developed **tri-fold solar panels** that will deploy in space, using spring-loaded hinges with ultrasmooth bearings.

Currently, ELITE is undergoing an Engineering Qualification Model (EQM) phase, where the prototype design is rigorously tested at Thailand's **Geo-Informatics and Space Technology Development Agency (GISTDA)**. To date, ELITE has passed environmental tests, including vibration and thermal vacuum conditions.

Upon successful completion of the EQM stage, the team will build the Flight Model (FM), the actual satellite to be launched into space.

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About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Medicine, Humanities, Arts, & Social Sciences, and Graduate colleges.

NTU is also home to world-renowned autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Earth Observatory of Singapore, Nanyang Environment & Water Research Institute and Energy Research Institute @ NTU (ERI@N).

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

Ranked amongst the world's top universities, the University's main campus is also frequently listed among the world's most beautiful. Known for its sustainability, NTU has achieved 100% Green Mark Platinum certification for all its eligible building projects. Apart from its main campus, NTU also has a medical campus in Novena, Singapore's healthcare district.

For more information, visit www.ntu.edu.sg