



Joint News Release

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Rolls-Royce and NTU extend their research partnership with new S\$88 million investment

Singapore's first Corporate Lab, the Rolls-Royce@NTU Corp Lab has successfully completed phase one with 53 joint projects

Singapore's first corporate laboratory in a university, the **Rolls-Royce@NTU Corporate Laboratory** was jointly set up by Nanyang Technological University, Singapore (NTU Singapore), Rolls-Royce and the National Research Foundation (NRF) in 2013. It has successfully completed its first five years of research partnership and is now moving into its next phase with a joint investment of S\$88 million.

The Corp Lab was the first to be supported under the Singapore public-private research and development (R&D) partnership between universities and companies. In Phase 1, it managed 53 research projects in areas such as power electronics, data analytics, and repair and manufacturing technologies.

The research outcomes from these projects are now being used to help design and develop future power and propulsion systems and improve manufacturing operations in Singapore and in other global sites of Rolls-Royce.

The Corp Lab also developed digital solutions using artificial intelligence (AI). This has led to a new virtual engine emulator that uses AI to analyse decades of engine design data to harvest new insights. This greatly reduces the design cycle time as the system can automatically generate design options based on desired features, allowing engine designers to select promising candidates that can be further optimised to create future aircraft engines.

Riding on the success of Phase 1, NTU and Rolls Royce are renewing their partnership in the lab's second phase with 29 ambitious projects focused on developing novel technologies that will power the future of aircraft propulsion.

NTU President Professor Subra Suresh, said, "The Rolls-Royce@NTU Corp Lab is a fine demonstration of NTU scientists working with the industry to develop relevant solutions to meet real-world issues. The first phase of research has achieved remarkable success with more than 50 research projects that can create significant impact in the aerospace industry. Building on that success, we are now moving into the second phase with renewed commitment and new projects that will elevate our

collaboration to the next level. We will build on NTU's core strengths, in areas such as alternative energy storage solutions, machine learning, artificial intelligence, and big data analysis."

Rolls-Royce President for Southeast Asia, Pacific & South Korea, Dr Bicky Bhangu, said, "The Corp Lab is an excellent example of the virtues of collaboration, as championed by Rolls-Royce, of seeking diversity to better understand problems when approached with different mindsets and harness the best ideas to come up with the best solutions. Conversely, it provides academic minds with a valuable window into industrial problems and be able to work together for a common good. It provides a dynamic platform as we move towards a new way of learning and a new way of working."

NRF CEO Professor Low Teck Seng, said, "The launch of Phase 2 of the Rolls-Royce@NTU Corporate Laboratory is testament to the good outcomes produced through academia-industry-government partnerships in corporate laboratories in our universities. NTU researchers have worked alongside Rolls-Royce scientists and engineers on R&D that has direct relevance to the aviation industry. The next stage of their partnership will build on the good progress made, and look into integrating digital technologies and sustainable solutions into flight systems and aerospace parts. I am excited as these new technologies have the potential to transform the aviation industry."

By setting up corporate laboratories in our universities, industry partners can tap the latest scientific and technological resources of the universities to develop new products and services while universities stay abreast of industry's needs with advance research that creates new and innovative solutions that improve our world tomorrow.

Ramping-up innovations in electrification, digitalisation

The 29 new projects will make use of Industry 4.0 technologies – connecting computers, machines and engines, generating valuable data that will enhance design, manufacturing, maintenance, services, and operations.

For example, to predict an aircraft's performance and its need for maintenance, projects will use **AI and Data Science** to process large amounts of data spanning product design specifications, and material quality and durability, including equipment degradation and the environmental conditions during operation. This data-driven approach will streamline and optimise design and manufacturing processes and ensure that the final products have high levels of safety and reliability.

A key objective of the projects is to develop technologies that are eco-friendly, efficient, and sustainable. For example, the team will look at developing **innovative energy storage solutions** to enable hybrid-electric aircraft. This will accelerate the adoption of alternative energy systems in the aerospace industry.

To support manufacturing, the Rolls-Royce@NTU Corp Lab will focus on enhancing efficiency in some of the key **manufacturing processes** such as “vibratory finishing” or “vibropolishing” – a mass finishing process used to deburr, burnish, clean, and brighten large quantities of relatively small work pieces. The team is exploring ways to combine “vibropolishing” with ‘vibropeening’ – a process that hardens the surfaces of components, further increasing the material’s durability.

The lab will also address challenges involved in **3D printing** and additive manufacturing technologies, such as finishing and polishing processes for internal 3D-printed components. It aims to enhance and streamline manufacturing involving 3D printing in order to open up more room for creativity and innovation.

Overall, the projects will address problems that are faced by the aerospace industry through five key pillars: i) Electrical, ii) Manufacturing Technology, iii) Advanced Repair and Materials, iv) Data Analytics and Complex Systems, and v) Internet-of-Things.

The Rolls-Royce@NTU Corp Lab provides an industry-driven platform for university students at all levels – PhD, Masters and undergraduate – to become next-generation engineers. In the first phase, the Corp Lab trained 40 PhD students and more than 200 Masters and undergraduate students.

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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, Humanities, Arts, & Social Sciences, and Graduate colleges. It also has a medical school, the Lee Kong Chian School of Medicine, set up jointly with Imperial College London.

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

Ranked 11th in the world, NTU has been placed the world’s top young university for the past six years. The University’s main campus is frequently listed among the Top 15 most beautiful university campuses in the world and it has 57 Green Mark-certified (equivalent to LEED-certified) building projects comprising more than 230 buildings, of which 95% are certified Green Mark Platinum. Apart from its main campus, NTU also has a campus in Novena, Singapore’s healthcare district.

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

About Rolls-Royce Holdings plc

1. Rolls-Royce pioneers cutting-edge technologies that deliver the cleanest, safest and most competitive solutions to meet our planet's vital power needs.
2. Rolls-Royce has customers in more than 150 countries, comprising more than 400 airlines and leasing customers, 160 armed forces, 70 navies, and more than 5,000 power and nuclear customers.
3. Annual underlying revenue was £15 billion in 2018, around half of which came from the provision of aftermarket services.
4. In 2018, Rolls-Royce invested £1.4 billion on research and development. We also support a global network of 29 University Technology Centres, which position Rolls-Royce engineers at the forefront of scientific research.
5. The Group has a strong commitment to apprentice and graduate recruitment and to further developing employee skills.

For more information, visit www.Rolls-Royce.com

About the National Research Foundation, Prime Minister's Office, Singapore

The National Research Foundation (NRF) is a department within the Prime Minister's Office. The NRF sets the national direction for research, innovation and enterprise (RIE) in Singapore. It seeks to invest in science, technology and engineering, build up the technological capacity of our companies, encourage innovation by industry to exploit new opportunities that drive economic growth, and facilitate public-private partnerships to address national challenges.

Under RIE2020, NRF is committed to create greater value in Singapore from our investment in research, innovation and enterprise through 1) closer integration of research thrusts, 2) stronger dynamic towards the best teams and ideas, 3) sharper focus on value creation, and 4) better optimised RIE manpower. Visit www.nrf.gov.sg/RIE2020 for more details.