Annex: Key Transport Research, Innovation and Enterprise Achievements under RIE2025 to Secure Singapore's Hub Status in Global Connectivity

Under RIE2025, the Civil Aviation Authority of Singapore (CAAS), Maritime and Port Authority of Singapore (MPA) and Land Transport Authority (LTA) launched three major research programmes to support transformation in their respective sectors. These sought to ensure Singapore's continued competitiveness as a supply chain hub amidst increased global competition and geopolitical uncertainties.

Aviation Transformation Programme

The Aviation Transformation Programme launched by CAAS, under RIE2025, centred on various areas, including R&D in Next-Generation Air Navigation Services.

For example, CAAS collaborated with the MITRE Asia Pacific Singapore (MAPS) and A*STAR to develop and test a What-If Capability (WIC) that supports fast-time evaluation of potential air traffic management strategies across varying air traffic scenarios with different constraints and demands. To enable air traffic controllers to plan and route aircraft more precisely and efficiently to better manage situations where demand for airspace exceeds capacity within Changi Airport, a Terminal Manoeuvring Area (TMA)/runway practical capacity estimation tool was also developed and integrated with the WIC trajectory optimisation tool.

Maritime Transformation Programme

MPA's Maritime Transformation Programme (MTP) is supported by the National Research Foundation to grow maritime R&D capabilities and transform the sector. Under RIE2025, the MTP prioritised three key thrusts including next generation port, smart ship, and green technologies with the objective to strengthen Maritime Singapore's competitive edge in connectivity, resilience, efficiency, and sustainability.

For example, to sustain Singapore's position as a major maritime bunkering hub amidst the energy transition, research was carried out to study safe handling of next-generation fuels such as ammonia and methanol. While ammonia and methanol are cleaner fuels, they have different safety characteristics from conventional marine fuels and require robust risk assessment and handling procedures. MPA and the Singapore Maritime Institute (SMI) collaborated with the research community[1] led by A*STAR on the Dispersion Analysis and Simulation for Handling of Future Fuels project. The project developed a predictive planning tool to model ammonia and methanol dispersion in the event of a potential leak, which was used to support MPA's bunkering trials with the industry.

Another example of MPA's MTP key thrust is the Next Generation Port and Smart Ship project. As part of efforts to enhance efficiency across port activities, A*STAR developed AI-driven optimisation models and predictive planning tools to improve coordination between vessel navigation and ship operations to reduce the waiting

[1] The research consortium includes the NUS Tropical Marine Science Institute (TMSI), Technology Centre for Offshore and Marine Singapore (TCOMS) as well as A*STAR Institute of Sustainability for Chemicals, Energy and Environment and the National Metrology Centre

time and turnaround time of vessels at our ports. In its prototype stage, simulated trials using real-time Automatic Identification System data (such as the vessel number and real-time GPS location) has shown up to 7% fuel savings through improved voyage planning and vessel arrival coordination, as well as a 3-to-4-hour reduction in waiting time.

Urban Mobility Innovation

The Urban Mobility Innovation (UMI) programme under RIE2025 serves as a platform to co-create and test advanced, data-driven, and commuter-centric transport solutions in Singapore. UMI focuses on addressing the technological gaps in supporting the increased adoption of electric vehicles (EVs), improving the cost-effectiveness of roads and rail maintenance, and enhancing road safety through connected and intelligent transport technologies.

One key area of research is the development of more resilient and sustainable road infrastructure. Singapore's roads are facing a growing range of challenges, including rising temperatures and heavier rainfall due to climate change, the increased weight of EVs which places greater stress on road pavements, and evolving supply chains that affect the availability and quality of construction materials.

To address these challenges, LTA is working with Institutes of Higher Learning to develop new generation road pavement designs that incorporate locally sourced recycled materials and more sustainable construction methods. This aims to reduce our reliance on local and regional supply chains and lower our environmental footprint. In addition, it also aims to improve the efficiency and productivity of road construction and maintenance, while meeting the required standards for performance and environmental sustainability.