MINDEF
SINGAPORE

FACT SHEET

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Background

1. As part of the ongoing efforts by the Ministry of Defence (MINDEF) and the Singapore Armed Forces (SAF) to embark on digital and data transformation, the SAF is partnering with the Defence Science and Technology Agency (DSTA) to realise the potential of autonomous platforms for peacetime logistics and transportation operations. The trialling of autonomous platforms has allowed the SAF to gain valuable insights on existing technologies to better meet the SAF's needs for optimising manpower resources and enhancing organisational effectiveness.

Autonomous Transportation of Logistical Supplies and Personnel

2. The Singapore Army and the Republic of Singapore Air Force (RSAF) are collaborating with DSTA to leverage commercial off-the-shelf Autonomous Vehicle (AV) technology in developing dual-role AVs for the unmanned transport of logistical supplies and personnel. The AVs will perform scheduled ferry services along pre-programmed routes and on-demand ferry services through a mobile application along ad-hoc designated stops within the military compound. The Army and the RSAF are conducting pilot trials of the AV at Kranji Camp and Paya Lebar Air Base respectively.

Increased Efficiency and Manpower Optimisation for the SAF

3. Better Optimisation of Manpower Resources. By integrating self-driving technologies, the employment of AVs in the SAF reduces manpower overheads required to support administrative transport tasks. This allows MINDEF/SAF to better optimise manpower resources to support operations and training.

4. Greater Convenience and Time-savings. The AVs will be used to provide shuttle services from the entrance of military camps or bases to various locations within the compound. This will bring greater convenience and time-savings for users.

5. Contributes to Sustainability Efforts. The AVs are fully electric and powered by rechargeable batteries. The AVs do not release any carbon emissions, serving as a greener and more sustainable form of transport.

Safety Features

6. The safety features of the AV include:

a. On-board Sensors and Obstacle Detection. The AV uses a suite of on-board sensors to detect potential obstacles in its nearby surroundings. Upon sensing any obstacle/human that encroaches into the detection zone of the vehicle, the AV will sound a warning bell to alert both the external obstacle and the safety operator on board, while slowing down automatically to cater reaction time for the obstacle to move away. Details of the technical specifications of the AV are at **Annex A**.

b. Emergency Stop. The AV is equipped with two emergency stop (e-stop) buttons, easily accessible by the safety operator or passengers on board. As soon as the e-stop button is pressed, the vehicle will come to an immediate stop.

c. Locking Mechanisms. The AV's cabin is integrated with locking mechanisms to secure the logistical loads when the AV is in motion.

d. Service Optimisation and Back-end Monitoring. The Autonomous Vehicle Management System provides close oversight of the AV fleet status and the locations of all AVs for real-time monitoring and management. The system utilises route optimisation and planning algorithms to optimise the service.

e. Vehicle-to-Infrastructure System. The RSAF will also be testing an additional Vehicle-to-Infrastructure (V2I) system at selected road junctions in its airbase. With this system, as the AVs approach the road junctions, signals will be transmitted to the V2I-equipped traffic lights to prioritise the traffic flow for the AVs, enhancing the safety of passengers and other road users.

Autonomous Shore Logistic Distribution System

7. The Republic of Singapore Navy (RSN) is collaborating with DSTA to develop and trial the usage of an Autonomous Load Transporter (ALT) to facilitate the movement of spares between the ship's crew and the naval warehouse and workshop. The trial at Changi Naval Base will help to validate the technology enablers required for the ALT to operate in complicated outdoor environments, along long and sparse open stretches in the base, which is interspersed with large water bodies.

8. Increased System Effectiveness and Manpower Savings. The automated transportation of spares serves to reduce the manpower required in the transfer of spares, and minimise the waiting time required to process the delivery and return of spares. After raising an indent for spares through a mobile application, the ship crew's order will be picked from the inventory at the warehouse, and packed for delivery in a storage box. The ALT then picks up the storage box from the warehouse and delivers it to the wharf. The ship crew will be notified to pick up their order via the mobile application, cutting down administration time required to arrange for collection.

Annex A

Technical Specifications of the Autonomous Vehicle

Drive Type	Two Wheel Drive
Size	4.7m (Length) x 2.3m (Width) x 3m (Height)
Maximum Load Capacity	1000kg (designed to ferry up to 9 seated commuters)
Unladen Vehicle Weight	2400kg
Motor/Battery	Electric Motor Lithium-ion Phosphate Battery (5 hours battery life with air-conditioning)
Maximum Operating Speed	18km/h
Mode of Operations	• Manual • Autonomous
Autonomous Technology	• Two 360° multi-layer Light Detection and Ranging (LIDAR) sensors • Six 180° single-layer LIDARs • Odometry sensors coupled with wheel encoders and inertial sensor • Real-time kinematic navigation using Global Navigation Satellite System

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