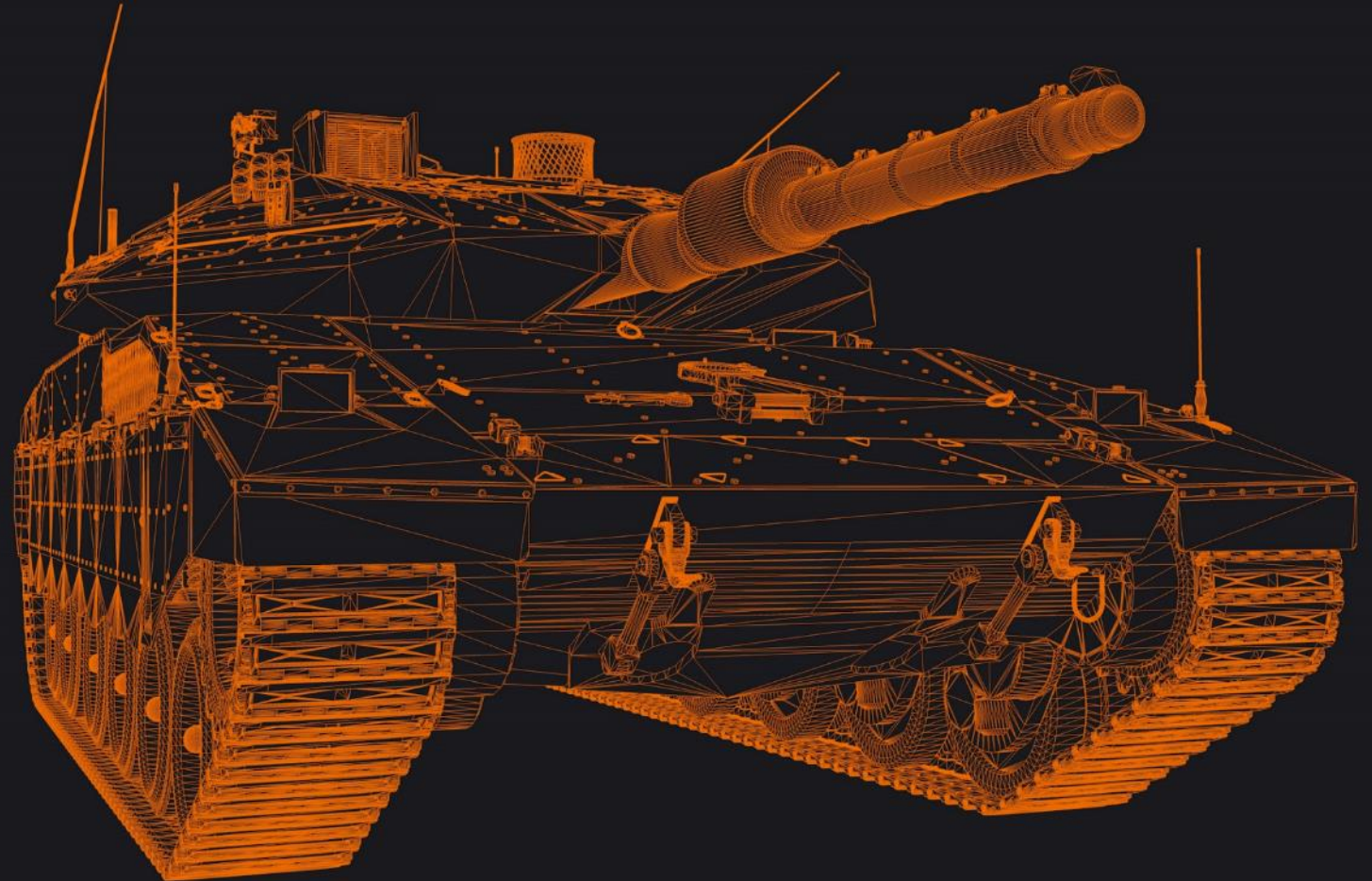


Future of Unmanned Ground Systems

Growing International Landscape



Combat UGV efforts worldwide

To date the following countries have developed combat UGVs

North America

Canada, United States

Europe

Armenia, Belarus, Czech Republic, Estonia, France, Germany, Italy, Netherlands, Poland, Russia, Serbia, Turkey, Ukraine and UK

Central Asia

China, Bangladesh, India, Kazakhstan, Pakistan, South Korea

Latin America

Brazil, Colombia

Middle East North Africa

Iran, Iraq, Israel, Jordan, Saudi Arabia, Syria, UAE

South-East Asia

Australia, Indonesia, Malaysia, Singapore, Thailand, Vietnam

With the high commercial value in producing platforms and mounting them with weapons along with a range of operational benefits in fielding them, rapid proliferation will subsequently follow

Chinese RAS exercises

- In August 2019 Chinese armoured units conducted high-altitude drills with unmanned systems.
- Armoured units worked alongside RAS in the first military exercise of its type in altitudes of up to 4,200 m.
- Exercises were held over several days.
- Tactics exercised by the PLAGF included MBTs launching attacks on identified targets, remote ground clearance operations, MUM-T, live fire drills and operating UAVs in swarms.
- Remotely operated mine-clearing robots were used to open routes, during surrounding fire. Images and data was transmitted back to a control centre within a Type 99A MBT.
- The data gained from the various platform's sensors was exchanged with combat UGVs and a swarm of quadcopters conducted reconnaissance. Some carried bombs and explosives to co-ordinate attacks with ground forces.
- Bombs dropped were reported as successfully hitting their targets.



A Chinese Type 99A2 MBT leading an armoured column on the Qinghai-Tibet plateau in August 2019 when PLA armoured units conducted several days of exercises alongside RAS



A Chinese mine-clearing robot was also operated alongside the armoured units on the Qinghai-Tibet plateau

United States - Robotic Combat Vehicle (RCV)

- In July/August 2020 the US Army carried out its first robotic combat vehicle experiment focusing on cavalry and scout missions.
- Two manned MET-Ds, Bradley-based control vehicles, were used to manoeuvre four RCV surrogates (M113 APCs).
- Live fire exercises were carried out.
- A map interface allowed soldiers to see where the robot were and the software linking the robot to the control vehicle was successful.
- Aided target recognition worked well whilst stationary but was challenging when on the move due to the stabilisation across varied terrain.
- Experiment conducted at platoon level with future efforts in FY22 focused at company level and will concentrate on attack and defend.
- A decision on how to proceed with the program will be agreed in FY23 for the RCV-L and FY24 for the RCV-M.
- Next phase will concentrate on extending the line-of-sight and will include four RCV-L and four RCV-M.



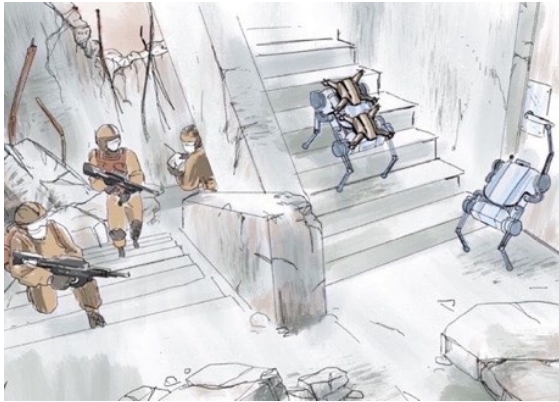
RCVs are optimised for urban warfare operations however challenges include difficulty in maintaining communications as well as navigating urban terrain.



Autonomous RCVs could provide a myriad of benefits compared with their heavier, manned counterparts and could mean a more affordable fighting force.

Ghost Robotics Mobile IoT Platform

Multi-Sensor Situational Awareness & Targeting (ISTAR) | CBRNE



- US Army
- US Navy Special Warfare
- US Air Force
- Australian Army
- Rheinmetall GmbH
- DARPA SubT (sub to Penn, AU CSIRO, FLIR)
- Singapore Ministry of Home Affairs
- Draper Labs (undisclosed US agency)

Chem, Bio & Radioactive Detection (CBRN)



- Rheinmetall GmbH
- DARPA SubT (sub to Penn, AU CSIRO, FLIR)
- Singapore Ministry of Home Affairs
- Draper Labs (undisclosed US agency)
- Undisclosed US agency

Heavy Asset Mounted Recon Robot



- US Army
- AU Army
- Rheinmetall GmbH
- BAE Systems

Ghost Robotics Mobile IoT Platform

Resilient Battlefield Communications Mesh



- Strategic Capabilities Office
- Navy Special Warfare
- US Airforce
- Undisclosed US Gov't Agency
- Undisclosed Allied Gov't Agency

Homeland, Airbase & FOB Patrol & Security



- Singapore Ministry of Home Affairs
- US Air Force
- Undisclosed US Agency
- Undisclosed Allied Govt Agency

Public Safety & Emergency Mgmt



- Singapore Ministry of Home Affairs
- US Dept Homeland Security
- Undisclosed US Agency
- Undisclosed Allied Govt Agency
- Undisclosed Defense Co.

TheMIS exercises and operations



- Participated in Annual Multinational exercise 'Spring Storm' 2017, 2018, 2019
- MoD ISR UGV development programme
- EDF Center of Applied Research and Science programme 2018-2019 (Automated Systems on the Battlefield)
- Deployed 'Operation Barkhane' in Mali 2019-2020
- French Army STAT and EMAT assessment in Estonia in 2018
- Battle Lab Terre 2019 technical trials
- Netherlands RAS programme in 2019 and 2020
- Participated in military exercises in Netherlands, Scotland, Austria and Germany

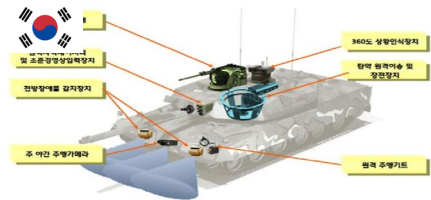


- Norwegian Defence Research Establishment (FFI) UGV procurements in 2019 and 2020
- United Kingdom ALMRS – system evaluation held from 2019/2020
- RPV – project initiated from AWE2018
- JTARR 2020-2023: (Joint Tactical Autonomous Resupply and Replenish)
- USMC Warfighting Laboratory MUM-T experiment
- US Army Robotic Combat Vehicle (RCV) programme
- Wireless Javelin live fire
- Cooperation with Thailand Defence Technology Institute (TDI) developing a TheMIS based RCV with 30 mm RWS (EOS)

THEMIS co-operation and collaboration



International efforts



Thank you

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