PROJECT EXAMPLES

TOWER ESCAPE SAFETY SYSTEM (TESS) – CLASS 209 1400 MOD SUBMARINES

Submariners need to successfully escape from a stricken submarine on the seabed. Various means are available, depending on the depth at which the submarine came to rest. A popular option is using the TESS – used up to a depth of about 100 metres (m) – which allows for two crew members at a time to climb into the conning tower of the submarine.

The TESS was initiated by the South African (SA) Navy, in conjunction with ARMSCOR, the Institute of Maritime Technology and the CSIR. Typically, in case of an emergency, submariners can escape via the submarine tower. The submariners climb on to a ladder fixed inside the tower, taking position below each other. The tower is flooded for their escape. However, the safety suits they wear are inflatable and cause the submariners to rise to the surface, causing members to get stuck at the hatch opening. The new system sees a special mechanical rail system fitted on the inside of the tower. Each submariner hooks onto this rail system, below each other. As the tower floods, the rail system keeps the submariners fixed in position, despite the air in their suits. The submariners are released by means of a hold-trigger and release mechanism that is automated upon opening the tower upper hatch. This system works even if the submariners are unconscious. The entire procedure takes approximately 3 to 10 seconds for both submariners to surface at a depth of 10 m. The escape cycle is repeated until the entire crew has escaped.

The prototype underwent stringent and successful testing on the SA Navy submarine SAS *Manthatisi* at a depth of 20 m. It is envisaged that the TESS will eventually be incorporated into all SA Navy submarines and its operational use will form part of qualification as a submariner.



Images and text courtesy of SA Navy. Photographer: Byron Lombard, Deputy Editor of Navy News: Warrant Officer Class Two.



Requirement: *Pilot or paratrooper needs to land in any terrain – without detection.*
Solution: *Mobile landing lights, droppable from the air or deployable at night. Infrared not detected by others with the naked eye. Operated by remote control.*

Requirement: *Operators need to manage several devices – with no access to electricity points.*
Solution: *Power management system. One unit for various devices; solar chargeable.*

Requirement: *Operators need rapid solutions to operational needs – often manufacturing of a component, casing, mechanical part, etc.*
Solution: *CSIR-established 3D-printing facility to make once-off items, print elevation maps, even whole buildings or cities.*

CSIR TECHNOLOGY FOR SPECIAL OPERATIONS

science, technology & innovation
Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation

Rapid development and application of a technology to meet the unique requirement of special operations organisations

Includes research, design, development, manufacturing, testing, simulation, operational support and professional services.

Technology know-how is supplemented with experience in military domains and top security facilities.

The group has strategic relations with South African and regional special operations organisations and focuses on land, air and maritime applications.

The CSIR has a track record in providing technology support and innovation to special operations forces in defence and security environments. Its independence, scientific and engineering expertise, rapid response to requirements and comprehensive understanding of the challenges facing these forces put the CSIR in an exceptional position to be the technology partner of choice.

Specialist capabilities include mechanical, electronic, mechatronic and systems engineering; explosives, ballistics and chemistry; quality and project management; rapid prototyping; product development; and small-scale manufacturing. Skills from across the CSIR can be harnessed, and access granted to specialist facilities, such as wind tunnels; simulation environments; radar, optronic, robotic and photonic laboratories; fourth industrial revolution and product development centres; materials and manufacturing facilities; and ICT or cybersecurity systems.

SPECIALIST AREAS

- Integration of special operations systems (systems-of-systems conceptualisation, definition, design, modelling, development, production and evaluation);
- Naval systems and logistics engineering capability – including counterpiracy;
- Interoperability design, development, evaluation;
- Situational awareness technologies and techniques – e.g., counter poaching;
- Geospatial operational intelligence systems;
- Electronic and mechanical production capabilities – including 3D rapid prototyping/direct manufacturing of custom products;
- Improvised explosives research capability;
- Test and evaluation of commodities (smart buyer/smart user support); and
- Quick reaction tasks – e.g., for civil unrest and/or disaster management.





REMOVABLE DAVIT SYSTEM CARRIES AND RELEASES FAST SURFACE CRAFT FROM NAVY SHIPS IN COUNTERPIRACY

The palletised davit system is a removable unit for use on ships, fitted with a container footprint. The system increases functionality by allowing the large ship to carry a variety of fast surface vessels within the lifting capability of the davit system. Expanding the ship's capability offers more strike force to rapidly deploy antipiracy and other maritime security operations. The system enables fast surface vessels to be launched and recovered from the host ship, while being underway. The davit system can be installed and removed in minutes and is used on naval supply vessels, as well as frigates.

The system comprises a wave-compensating hydraulic davit system mounted on a load vector-compensating base. The base also houses the hydraulic drive system with its electronic and manual controls; stored energy to move the boat between the stowage point and the water; as well as the logistic support equipment needed for the boat. The complete system fits onto an ISO container footprint mounted and adapted on the ship's deck. The davit system can accommodate boats of various hull shapes weighing up to five tonnes. The boats and the crew can be lowered and retrieved safely by the davit system with the hosting ship underway. Two of these davit systems are normally fitted to a ship, with another two boats housed in the ship's boat bay on CSIR-developed cradle systems.

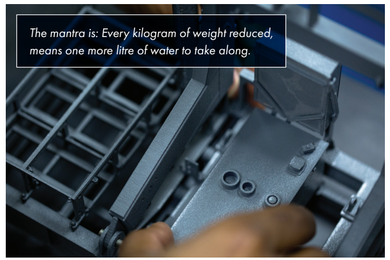
The system potentially offers good business opportunities for a commercial partner for small and medium enterprises to maintain the manufacturing processes involved and stimulate the engineering environment that assists shipbuilding and support within South Africa.





QUICK REACTION TASKS

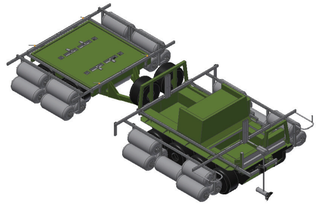
The CSIR is called at any time to perform so-called quick reaction tasks – i.e., urgent operational requirements with a turnaround time of 12 to 72 hours. These could include creating a custom item through 3D printing, to specialised geographical information system and map data for smart phone navigation systems, or technology adaptations to tools or ammunition – i.e., making it smaller, bigger, collapsible, wearable, waterproof, airborne, camouflaged, or configured to resemble a completely different object. The CSIR absorbs these requests with an agile engineering and technical capability, as well as an understanding of the precision, pressure and confidentiality needed to support special forces operators. Despite the speedy work, the CSIR follows a disciplined and formal engineering and design approach that is documented and quality controlled.



The mantra is: Every kilogram of weight reduced, means one more litre of water to take along.

THE ADVANCED DESIGN AND MANUFACTURING INNOVATION CENTRE

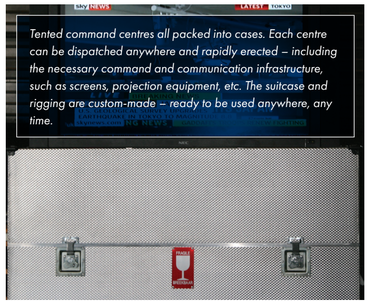
The CSIR has established an advanced manufacturing facility that offers capabilities such as additive manufacturing – using polymers and powders – 3D scanning and product lifecycle management to a range of clients in both the military and civil sectors. The Advanced Design and Manufacturing Innovation Centre (ADMIC) also provides ongoing research into new manufacturing techniques, technologies and materials, as well as specialised design and manufacturing training for local and international industries. The centre is dedicated to the complete process, from conceptualising or designing a solution, through to material selection, prototyping, testing, manufacturing and delivery. Firm security measures are in place at the centre, making it ideal to serve defence clients, as well as companies performing pre-competitive prototyping, conceptual design and low-volume manufacturing of new products for testing. This ensures the security of clients' intellectual property and confidentiality. With the new equipment barely in place, ADMIC found itself at the heart of the fight against Covid-19 in South Africa. The centre was used for the rapid design and production of face shields for use by soldiers deployed to infection hotspots at the start of the pandemic. A number of other projects have since been initiated for the defence industry. Clients in the aerospace, automotive, agricultural, maritime and medical sectors are set to benefit from the technologies at the centre, in future, as part of the CSIR's commitment to supporting industry competitiveness and accelerating industrialisation



Geckos were fitted with flotation devices and additional propulsion so that they could go from the road into the water. These adapted vehicles were used to rescue flood victims who are stranded in trees and on top of buildings.







Tented command centres all packed into cases. Each centre can be dispatched anywhere and rapidly erected – including the necessary command and communication infrastructure, such as screens, projection equipment, etc. The suitcase and rigging are custom-made – ready to be used anywhere, any time.