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FACTSHEET

DTP 2013 Team (Engineering) Award Winner

MULTI-MISSION RANGE COMPLEX (MMRC) TEAM

Defence Science and Technology Agency, The Singapore Army – Headquarters 9th Division

CITATION

The Multi-Mission Range Complex Team from the Defence Science and Technology Agency (DSTA) and Headquarters 9th Division of the Army, has developed an indoor multi-storey live-firing facility to support the Singapore Armed Forces' (SAF) live-firing training needs. By leveraging simulation and acoustics technologies, the team conceptualised a facility comprising seven indoor ranges within the footprint of an earlier 100m outdoor range. The result is a facility that not only meets existing shooting requirements more efficiently but also allows our soldiers to train under more challenging scenarios. In recognition of the team's achievements, the Multi-Mission Range Complex Team is awarded the DTP 2013 Team Engineering Award.

ABOUT MULTI-MISSION RANGE COMPLEX

The Multi-Mission Range Complex (MMRC) is the first-of-its-kind, one-stop marksmanship excellence training hub for the Third Generation SAF. Since February 2013, more than 32,000 soldiers (Full-time National Servicemen and Operationally-Ready National Servicemen) have trained at the facility.

The MMRC is equipped with state-of-the-art technologies and incorporates best practices in the complex's suite of live-firing, simulation, information technology and automation systems. With this new facility, soldiers can now focus on training and sustaining their core live-firing skills, with all routine non-core administrative functions outsourced.

TECHNOLOGICAL INNOVATIONS AND ENGINEERING SOLUTIONS

a) Leveraging technologies for training realism and effectiveness

The MMRC provides the SAF with realistic, day/night and all-weather marksmanship training to meet diverse training needs, ranging from traditional shooting practices to advanced marksmanship programmes. The MMRC is packed with a suite of advanced systems and innovative features:

Video Targetry System

The team successfully adapted and integrated the Video Targetry System (VTS) to accommodate weapons of different calibres, shot trajectories, impact and distances. With the VTS, MMRC is able to conduct long distance marksmanship training of up to 1,000m indoors and within a 50m range, which is 20 times the distance of the range. The VTS also enables Judgemental Shooting – a new type of training capability where trainees are taught to make a shoot-no shoot decision swiftly and accurately.

- **Simulation software** enhances training realism with each shooter's simulated mission unfolding differently depending on their reaction, judgement and shooting accuracy.
- Each shot is determined with millimetre precision by the **precision acoustic technologies** installed behind the target screen.
- With the aim of minimising maintenance efforts, the team set stringent requirements for the VTS screens which house the acoustic sensors. Large live-fire box targets of 2 by 2.7 metres made of **synthetic rubber** were introduced, where the heat generated from shots passing through will cause the holes to be resealed.

Multi-Tier Range

In the multi-tier range, which comprises static and moving targets, the team co-invented the **single-rail moving targetry system** with the contractor to eliminate any potential line-of-sight issues for trainees located on lower levels firing on higher-level targets. It creates an equal line of sight for all shooters in multi-tier ranges as targets on a single rail would appear the same in size. Unlike conventional moving targetry systems¹, the new design requires a shorter installation depth and utilises only one motor to drive the single rail of targets. This saves an average of about 70 square metres of area per range.

Reconfigurable Urban Operations Range

Movable partition walls and electronic targets allow the urban operations range to be easily configured to simulate different training settings. Made from robust steel plates and rubber panels, the movable partition walls also provide ballistic protection for soldiers to train in a safe and yet challenging environment.

b) Ensuring training safety in an indoor environment

At the MMRC, safety is of the utmost priority. All ranges in the MMRC are fitted with robust ballistic protection in the form of steel plates and rubber panels located on their walls and ceilings, which were subject to strict and rigorous validation prior to installation.

Ventilation System

The MMRC's ventilation system was designed to prevent the accumulation of contaminants within the ranges and reduce the risk of inhaling contaminants. To ensure the system's efficiency, **numerical modelling using computation fluid dynamics** was used to verify the design of the system. The team introduced a **building automation system** that provides real-time monitoring and adjustment of exhaust and supply fan speeds to maintain a pressure differential at all times.

Additional Ballistic Protection for the Multi-Tier Range

Unlike conventional single-storey ranges, the safety design considerations for a multi-tier indoor range pose a number of challenges. For instance, bullet strikes may

¹ Conventional moving targetry systems utilise one motor per moving target, which requires a larger installation area.

affect the structural beam supporting the upper-tier platform. The team overcame the challenge by relocating the beam and putting in place a **cantilever platform** with a “beak-shaped” ballistic protection system as an additional safety precaution. Comprising steel plates placed at specific angles, the platform re-directs errant rounds into a bullet catcher, hence preventing any damage to the beam. This elegant, yet cost-effective solution augments range safety, and reduces maintenance efforts to replace the structural beams regularly.

c) Flexible lighting control to meet dynamic training needs

The team behind the MMRC has introduced a **lighting system** that realistically simulates various light conditions. By segregating the lights into controllable “blocks” which can be controlled individually or collectively, daylight, moonlight, starlight and silhouette environments can be simulated depending on the training requirement.

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PROFILE OF TEAM LEADER

Name	Appointment	Organisation
Lim Peter (Mr) 林彼得 (先生)	MMRC Programme Manager (Networked Systems) 室内弹射击靶场中心 项目经理 (网络化系统)	Defence Science and Technology Agency 国防科技局

FOR MEDIA QUERIES:

Contact:	Zoe Lim Yen Li	Tan Siang Yiong
Office No:	6879 5021	6879 5221
Mobile No:	9827 7794	9687 5045
Email:	lyenli@dsta.gov.sg	tsiangyi@dsta.gov.sg