



A Soldier wears an exosuit while on a three-mile outdoor course at an Army Research Laboratory facility at Aberdeen Proving Ground, Md. The suit, part of the Army's Warrior Web Program, has pulleys and gears designed to prevent musculoskeletal injuries caused by dynamic events that typically occur in the warfighter's environment. (Photo by Rob Carty)

Sustaining Multi-Domain Battle Through Science and Technology

■ By Maj. Gen. Cedric T. Wins

In the Army's modernization effort, the role of the Research, Development and Engineering Command (RDECOM) at Aberdeen Proving Ground, Maryland, is to develop the capabilities the force needs to rapidly transition to Multi-Domain Battle (MDB) while also discovering technologies the future force will need to maintain dominance as information, events, and weapons system advancements accelerate.

RDECOM has a global network of partners in academia, industry, and government agencies. This network positions the command to meet its goals by maintaining a balance between near-, mid-, and far-term development efforts and the organizational agility required to rapidly shift focus to meet new challenges. Institutional continuity is required in order to conduct the ongoing research and development that yields the technologies of tomorrow.

Improving Capabilities

RDECOM's internal efforts to meet the chief of staff of the Army's mandate to streamline and rationalize capability development have been focused into a campaign to improve the command's four main mission areas: integrated technology development and engineering services, human capital and infrastructure, business process and resource optimization, and strategic communications.

Delivering these capabilities quickly and effectively is key to empowering Soldiers in the MDB environment, and RDECOM is examining its posture to support that fundamental shift in how the Army fights.

In September 2017, the command participated in a MDB task force pilot program workshop at Schofield Barracks, Hawaii. During the workshop, participants from RDECOM's Communications-Electronics Research, Development and Engineering Center examined developmental technologies that could support task force exercises scheduled for the

summer of 2018.

The center will work with U.S. Army Pacific partners to finalize the network architecture and validate configuration for future training engagements. This is a positive first step as the Army begins to embrace and engage the MDB concept of operations.

RDECOM scientists and engineers continue to execute long-term efforts that have the potential to affect the Army's top priorities. These efforts include advanced helicopters, long-range precision fires, air and missile defense, unmanned vehicles, virtual training, and Soldier lethality and survivability technology.

Future Vertical Lift

RDECOM is working on the Future Vertical Lift (FVL) program to produce the next generation of vertical take-off and landing aircraft. These helicopters will fly farther and faster, carry heavier payloads, and team up with unmanned systems. With the range of capabilities now being developed, Army aircraft will provide increased flexibility for Soldiers facing near-peer competitors, insurgent forces, or combinations of these threats across multiple domains.

The search for FVL technology is routed through the Joint Multi-Role Technology Demonstrator. Army researchers conduct demonstrations to vet new air vehicle systems such as engines, transmissions, airframe structures, and rotors. They also focus on air vehicle design, which includes avionics, structures, weapons, and sensors. For tactical operations, researchers are looking to integrate the new FVL fleet for use by both manned and unmanned teams.

Battlefield Technologies

RDECOM researchers are focused on providing Soldiers and small units with technologies that deliver decisive advantages on the battlefield. These technologies will help Soldiers shoot with more accuracy, move faster, and communicate more securely. Soldiers will also

Through collaboration with academia, industry, and government agencies, RDECOM drives research, development, and engineering efforts to prepare the Army for Multi-Domain Battle.



The Research, Development and Engineering Command explores the relationships between humans and machines, such as autonomous vehicles. (Illustration by David Vergun)

be better protected and more easily sustained.

RDECOM is researching ways to sustain Soldiers on the battlefield with safe airdrop and dismounted energy. To give Soldiers optimized and advanced lethality in urban, complex, and open terrain, Army scientists are studying Soldiers' cognitive and physical performance. The command evaluates Soldier performance by monitoring and integrating nutrition and hydration.

To give the force assured and secure communications, Army scientists are developing sensors that monitor Soldiers' performance and power management tools that observe their activity. They have also developed Nett Warrior, a system that provides dismounted leaders

with situational awareness and mission command capabilities.

RDECOM scientists are developing body armor and integrated head protection to increase survivability. They are also working to protect Soldiers through signature management, concealment, and high-value asset decoys. Single- and multi-joint exoskeleton systems will give Soldiers enhanced mobility, endurance, and lethality.

Developments include an integrated warrior system that allows a Soldier to shoot, move, and communicate while wearing an enhanced mobility, load-sharing, life-protecting suite of technology. RDECOM is also delivering next-generation weapons with performance-enhanced optics.

Training Improvements

As an alternative to live training, the Army is using augmented reality to train Soldiers at all levels. For dismounted Soldiers, the augmented reality system is integrated into a kit worn during training.

Information such as navigation waypoints, potential enemy locations, and friendly unit locations are displayed through monocular head- or helmet-mounted displays that provide a clear view of the battlespace.

RDECOM is improving the synthetic training environment to prepare Soldiers for what they may encounter on the battlefield. This includes training a large number of Soldiers at the point of need through network- or cloud-based streaming.

Using various tools and algorithms that collect data for exploitation, terrain generation, storage, and distribution, RDECOM can create a virtual training environment that is almost identical to the environment Soldiers will enter when they deploy. In a few years, the Army will be able to train combined arms strategy and tasks through synthetic training in local training areas.

The NGCV

In the future, Army technology will deliver the next generation combat vehicle (NGCV) and other close combat capabilities in manned, unmanned, and optionally manned variants. Armed with the most modern firepower, protection, mobility, and power generation capabilities, the NGCV will ensure combat formations can fight and win against any foe.

In concert with industry, academia, and international partners, RDECOM scientists and engineers are designing a vehicle with next-generation capabilities. Smart, fast, lethal, precise, protected, and adaptable are the critical characteristics driving current NGCV concepts.

RDECOM's scientific underpinnings enhance the capabilities for future manned and unmanned platforms and provide the flexibility to adapt ground vehicles to ever-changing environments. The Tank Automotive Research, Development and Engineering Center plans to deliver two NGCV experimental prototypes by 2022.

The RDECOM workforce has the expertise and the network of partners to discover and develop these technologies. The command's campaign plan will create a more focused organization that can move at the speed required to support MDB.

Ready for Change

The need for speed imposes unique challenges on RDECOM in human capital and infrastructure, which are two areas of prime importance to its

current organizational improvement campaign.

Sustaining a technological edge in the face of increasingly fast technological change means researchers must not only lead in the scientific disciplines that are currently important to the Army; they must also identify emerging disciplines as well as the threats and opportunities they present.

Changes in the communications used to occur over the course of a conflict as adversaries adapted from battle to battle. Now the Army faces the possibility of cyber challenges evolving within a single engagement. The accelerating pace of change in that domain may forecast how change will emerge in other domains.

This means the Army must be prepared to hire or partner with people who have knowledge and skills that may not yet exist to work in facilities the Army may not yet have. The faster these challenges and opportunities emerge, the faster RDECOM must react, so it must be organizationally and intellectually flexible. This calls for a skilled and agile workforce, an organization flexible enough to support it, and the ability to collaborate quickly and effectively to meet mission requirements.

RDECOM has long had relationships with organizations working on modernization. The command has provided scientific advice to the requirements community in the Training and Doctrine Command, and it has provided engineering services to program executive offices and life cycle management commands. It also has advisers supporting major Army and joint warfighting commands and liaison officers within many other commands.

These partnerships are key to RDECOM's charter mission of technology integration, which will only grow in importance. By its nature, the MDB against adversaries with a range of capabilities will force Soldiers and commanders to consider more factors than previous

concepts of war entailed.

The Army cannot develop, field, and train for separate capability sets to use in different domain combinations against every potential adversary in every part of the world. It must integrate the necessary technologies into capabilities that Soldiers can use across the broadest possible spectrum of domains. This will impose new cognitive demands on Soldiers that must be recognized and mitigated if the Army is to remain the world's dominant land force.

The need to remain ready to achieve that goal drove the recent decision to form a task force led by the director of the Army's Business Office. The chief of staff of the Army and acting secretary of the Army will ultimately decide which task force recommendations they will implement to meet the goal of standing up a new command focused on Army modernization in 2018.

These decisions may make a considerable difference in how RDECOM scientists and engineers are tasked and how they report, but the underlying research, development, and engineering tasks are bound by physical laws as well as proven scientific and engineering methodologies.

Whatever changes MDB and future organizational alignments bring, the RDECOM team will continue to deliver technological capabilities that empower, unburden, and protect today's Soldiers while developing capabilities the future force will need to face the challenges it will encounter tomorrow.

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