Recognizing the decades-long dominance of U.S. land forces in the conventional close fight as demonstrated in Operation Desert Storm in 1991, near-peer adversaries have embraced evolving technologies and tactics in pursuit of tactical standoff against these formations. In the more than 17 years since 9/11, the U.S. Army has been heavily focused on waging counterinsurgency and counterterrorism campaigns against low-tech but lethal forces. During this timeframe, near-peer competitors have developed capabilities with the potential to degrade the U.S. advantage in close combat by disrupting U.S. forces before they can close with and destroy them. The U.S. Army is seeking to counter adversary standoff by addressing critical capability gaps and through the conduct of multi-domain operations that involve, in part, the use of robotics. The use of maneuver robotics and autonomous systems (MRAS) can increase the reach of U.S. Army forces from the battalion to the squad levels and addresses the threats of a more lethal battlefield enabled by technologies that are employed by near-peer competitors.

Near-Peer Threats and the U.S. Army’s Response
In 2014, during the Ukrainian revolution, Russian ground forces and Ukrainian separatists launched a devastating rocket artillery attack that annihilated two Ukrainian armor battalions in Zellenopillya (in the Luhansk region, near the Russian–Ukrainian border) in just over three minutes. Hours earlier, Russian unmanned aerial vehicles (UAVs) and cyber reconnaissance

During the 2017 U.S. Army Maneuver Warfare Conference, the commanding general (CG) of the Maneuver Center of Excellence (MCOE) asked who among the audience had any boxing experience. An officer raised his hand, and the CG asked him to share one of the most important factors that a boxer must consider when studying an opponent. The officer replied “reach.” The CG concurred, affirming that the boxer with greater reach has standoff, can strike first and has more options. This exchange underscores the Army’s intent to transform and extend its “reach” in the land warfare domain to regain tactical overmatch against near-peer adversaries.
had located the Ukrainian armored column’s position. The sophistication with which the Russian ground forces and Ukrainian separatists employed an effective sensor-to-shooter network, integrating tools from multiple domains, demonstrated a marked improvement in Russian military capabilities, illustrating Russia’s potential for achieving tactical overmatch against the U.S. military.

Integration of unmanned aerial systems (UAS), unmanned ground systems (UGS), special operations forces and equipped militia to enhance sensor-to-shooter networks have resulted in an improved Russian land force capability that potentially overmatches the Army’s tactical formations. According to the Army’s 2016 Russian New Generation Warfare Study, the goal of this integration is to enhance the reach and precision of attacks to degrade an opponent’s ground combat strength as it engages in the tactical close fight.

Army brigade combat teams (BCTs) lack the range, protection and reach that Russian ground forces possess; they could be overmatched should hostilities occur in the near term. The Army, through its Training and Doctrine Command, is addressing this shortfall by assessing lessons learned from the study and analyzing them in light of Army Warfighting Challenges. The three challenges most relevant to this issue are: (11) Conduct air-ground reconnaissance and security operations; (15) conduct joint combined arms maneuver; and (20) develop capable formations.

The assessment demonstrated the need for U.S. ground forces to increase time, space, protection, range, mobility and lethality to overmatch an adversary with similar capabilities. The doctrinal solution consists of operations conducted across multiple fighting domains (sea, air, land, space and cyber/electronic warfare), as described in Field Manual 3-0: Operations and in The U.S. Army in the Multi-Domain Operations, 2028. Autonomy-enabled systems can serve as force multipliers at all echelons from squads to BCTs by enhancing situational awareness, mobility and speed of action.

**Maneuver Robotics and Autonomous Systems (MRAS)**

In 2017, the Army published a robotics and autonomous systems strategy (RAS) that, when implemented, will increase survivability by providing greater standoff distance from enemy fires and place fewer Soldiers at risk during dispersed maneuver or convoy operations. It established five capability objectives for semi-autonomous/autonomous systems: (1) Increase situational awareness; (2) lighten Soldiers’ physical and cognitive workloads; (3) sustain the force; (4) facilitate movement and maneuver; and (5) protect the force.

One of the key components necessary to execute this strategy is MRAS. Its key technologies enhance movement and maneuver and extend tactical reach as units operate in mobile and dispersed formations, mitigating the effects of enemy standoff fires (including artillery, mortars, anti-tank guided missiles and drones).
According to the strategy, the use of MRAS in teemed formations can enhance lethality, situational awareness, force protection, survivability and mobility. Soldiers and robotic vehicles work together to protect the force, identify the enemy and engage when necessary. This synchronization between Soldiers and unmanned platforms is described as Ground Manned–Unmanned Teaming (MUM-T).

Ground MUM-T envisions UAVs and UGSs working in support of Soldiers to extend their mobility and penetrate a denied environment.

Training and Experimentation

The Army is using training exercises to inform its plans about MRAS employment to enhance lethality, situational awareness, force protection and survivability. From simple UAS to terrain-challenged UGS, these developing technologies are part of a test and evaluation process that supports development of tactics, techniques and procedures for Soldiers to employ with robotic partners.

In June 2017, the Michigan National Guard participated in Exercise Northern Strike at Camp Grayling to experiment with emerging tactics employing autonomous systems. The Army’s Tank Automotive Research, Development and Engineering Center (TARDEC) and Armament Research, Development and Engineering Center (ARDEC) partnered to employ robotic systems to assist Soldiers in the field. TARDEC served as the lead system integrator and mobility provider, and ARDEC served as the lethality lead.

A squad employed a remote reconnaissance vehicle with a tethered hover UAV and an unmanned M113 personnel carrier outfitted with a remote M240 machine gun for support. This enabled the squad to engage the enemy from a protected position, demonstrating the potential for equipping units with armed robotic partners to increase range, reach and situational awareness and decrease risk.

Although it was the first Army exercise to pair humans and shooting ground robots, it was not the first time that an armed robot has been sent out to work next to Soldiers. Shortly after the United States invaded Iraq in 2003, units deployed a mini-tank bot called SWORDS (Special Weapons Observation Reconnaissance Detection System) that allowed a Soldier to remotely direct the bot to fire a mounted, crew-served weapon.

During the MRAS demonstration at Fort Benning, Georgia, in August 2017, the Maneuver Center of Excellence (MCOE) tested integration of UAS and UGS to enhance combat vehicle lethality. TARDEC and ARDEC paired manned and unmanned vehicles in a simulated attack. In the TARDEC demonstration, manned and unmanned high-mobility, multi-purpose wheeled vehicles (HMMWVs) paired with an unmanned light reconnaissance vehicle, conducted reconnaissance with smaller tethered vehicles and attacked a target. The demonstration showed the practical use of MUM-T in that it limited the risk of exposure of the manned tanks and HMMWVs to lethal fires. During ARDEC’s Abrams Lethality Enabler demonstration, one unmanned vehicle provided a smokescreen for the tanks while a second

RAS CAPABILITY OBJECTIVES

- Increase situational awareness;
- lighten soldiers’ physical and cognitive workloads;
- sustain the force;
- facilitate movement and maneuver; and
- protect the force.
unmanned vehicle fired its long-range mortar. The tank crew controlled both unmanned vehicles from its protected reverse slope location.10

The importance of MRAS is demonstrated by the Army’s analysis of the outcomes of these experiments. This has been precipitated by the development of a modernization strategy to provide a pathway to the future maneuver force enabled by MRAS. This strategy—the maneuver force modernization strategy (MFMS)—has established a requirement to develop the Next-Generation Combat Vehicle that can leverage five critical enabling technologies. Ultimately, MRAS is informing science and technology efforts, capabilities development and investment in robotics in the battlefield.11

The Way Ahead

The Army plans to test the reach provided by MRAS over three timeframes: (1) near-term (current–2020); (2) mid-term (2021–2030); and (3) far-term (2031–2040). Newer technologies, maintenance solutions and better weapon systems are likely to emerge during these periods. Potential advantages, among others, may include: extending sensor range; capitalizing on system-specific efficiencies (e.g., the UAS is quieter with greater loiter time, but the manned system carries more firepower); enhanced survivability; target engagements at longer stand-off ranges; and better actionable intelligence for commanders and pilots.12

Conclusion

Regaining tactical overmatch against near-peer adversaries is an imperative. MRAS, with both current and leap-ahead technologies, can mitigate adversaries’ advantages by enhancing reach, range, dispersion, mobility, maneuver, lethality and protection for friendly Soldiers.

To achieve overmatch, the Army will use MRAS and MUM-T to provide joint force commanders with enhanced capabilities to operate across all domains and present enemies with multiple dilemmas. MRAS, by exploiting breakthroughs in technology applied to maneuver, will be a key contributor to how U.S. ground forces will fight and win future conflicts.

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