DARPA ‘s urban combat software will allow commanders to compose force packages dynamically during the mission

Cities have become the new battleground and Hybrid or Urban Warfare the greatest threat being waged by ISIS to Boko Haram to Hamas to Ukraine rebels. Urban warfare is fundamentally unchanged since World War I in many regards: battle is human-centric, with most casualties resulting from discovering the enemy; a highly distributed defense requires combined arms tactics that incur high logistical and coordination costs; and the presence of a civilian populace means that indiscriminate force is not an option and precision effects are required. Historically, US forces have prevailed in the urban battlespace through the initiative and adaptability of lower echelon (company and below) commanders to overcome adversaries in highly tactical settings.

As nation-state and non-state adversaries adapt and apply commercially available state-of-the-art technology in urban conflict, expeditionary U.S. forces face a shrinking operational advantage in potential future military conflicts, which are most likely to be fought in littoral and coastal cities.

DARPA’s proposed software as the Prototype Resilient Operations Testbed for Expeditionary Urban Scenarios (PROTEUS) seeks to enhance battle management, command and control (BMC2) capabilities to maintain a U.S. advantage in future urban combat. DARPA under PROTEUS aims to create and demonstrate tools to develop and test agile expeditionary urban operations

concepts based on dynamically composable force packages.

DARPA's PROTEUS program was conceived to address the holes in the virtual BMC2 data provided by wargames and existing simulation platforms, according to DARPA's program context description. Wargames simulate warfighter decision-making and response on the ground, but offer limited ability to analyze cause and effect data. Meanwhile, existing simulation software programs are able to demonstrate the effects and capabilities of equipment and pre-planned tactics, but leave little space for human flexibility on the battlefield.

The PROTEUS software is projected to be available to warfighters in the field between 2030 and 2040.

Future anti-access and area denial (A2AD) scenarios involving conflicts against peer- and near peer adversaries in coastal and littoral urban settings severely challenge existing MAGTF task organization and force package concepts. The high dimensionality of urban terrain – time, three dimensional physical space with complex geometry, including air and subsurface levels, and spectrum – makes maneuver difficult and standoff tactics ineffective, absorbs large numbers of combatants, and particularly in an A2AD setting, negates air superiority advantages traditionally enjoyed by US forces.

To succeed in the more complex peer and near-peer battlespace of the 21st century, new task organization and force package concepts are needed to enable Marines to rapidly identify fleeting opportunities in a fluid and ever-changing environment, adapt force packages to exploit them, and achieve disproportionate impact relative to unit size. This enhanced agility may be enabled by dynamically composing individual task-appropriate Marines, assets (platforms and subsystems), and tactics to provide a desired warfighting function (e.g., fires) to achieve tactical goals. "Agile expeditionary urban operations" are Marine operations in urban terrain (cities)

that can rapidly adapt to changing circumstances and provide disproportionate effects through precise combined application of warfighting functions.

“The urban fight is about delivering precise effects and adapting faster than the adversary in an uncertain, increasingly complex environment,” said John Paschkewitz, DARPA program manager. “For U.S. forces to maintain a distinct advantage in urban coastal combat scenarios, we need agile, flexible task organizations able to create surprise and exploit advantages by combining effects across operational domains. Through PROTEUS, we aim to amplify the initiative and decision-making capabilities of NCOs and junior officers at the platoon and squad level as well as field-grade officers commanding expeditionary landing teams, for example, by giving them new tools to compose tailored force packages not just before the mission, but during the mission as it unfolds.”

Prototype Resilient Operations Testbed for Expeditionary Urban Operations (PROTEUS) program

The program, dubbed Prototype Resilient Operations Testbed for Expeditionary Urban Scenarios (PROTEUS), seeks to deliver a software platform for use on a tablet or other personal device that would enable dynamic and adaptive composition of battlefield elements—including dismounted forces, vehicles, unmanned aerial vehicles (UAVs), manned aircraft, and other available assets—simultaneously across multiple command levels as the fight is evolving. The second focus area of the program is to develop an entirely new interactive virtual testbed, using novel mechanics built around multiscale decision making, to evaluate operational concepts spanning multiple domains, such as ground, sea, air, and electromagnetic spectrum.

The goal of the program is to enhance battle management, command and control (BMC2) capabilities to maintain a U.S. advantage in future urban combat, states DARPA. The vision for the battle management/command and control (BMC2) software is to enable agile precision warfighting, so tactical operators can quickly design, compose, and recompose force packages on the fly to surprise the enemy.

“We aim to develop a tool to enable Marines to adapt their systems and tactics faster than the adversary,” Paschkewitz said. “The tool would show all available air, ground, sea, and spectrum assets in an area and determine how they could best be combined—whether that means, for example, delivering combined arms fire support for a Marine in need or providing transportation for that Marine to escape.” In another example, a squad leader could use the tablet tool to coordinate combined reconnaissance support from several small UAVs organic to the unit, electronic warfare support from a long-endurance UAV like a Reaper in the vicinity, and combined arms fire support from a nearby attack helicopter and tank. As envisioned, the BMC2 tool would give the tactical operator real-time awareness of locally available assets and would share that view with higher command echelons, enabling the entire team to think “one step ahead.”

A second goal of PROTEUS is to create an interactive virtual testbed where new BMC2 tools and concepts can be integrated and tested at various levels of command, to demonstrate the agile composition of force packages.

“The idea for the interactive virtual testbed is to allow tactical and higher-echelon operators to explore and evaluate new tactics based on dynamic composition and then build ‘muscle memory’ by applying the most effective ones in an engaging virtual environment,” Paschkewitz said.

“We’re not trying to develop a massively multi-player online game like many popular commercial games that already exist,

nor is PROTEUS looking to mimic or advance existing DoD Live-Virtual-Constructive (LVC) software. Instead, we want developers to come up with innovative, decision-focused, virtual worlds that correctly capture the complex and non-linear consequences of choices made at both the command and tactical levels by both friendly and opposing forces. The urban fight has enormous uncertainty and the dimensionality of the battlespace is huge, which requires human judgment and decision-making that you can't automate away. We're looking for concepts with ease of use and demonstrable utility simulations similar to existing interactive tactical decision games used by U.S. forces, yet with greatly increased battlespace scale, complexity and detail."

The program seeks to:

- Develop software for simultaneous and dynamic real-time task organization, force package (i.e. platforms & weapons) combination and configuration, and tactics planning suitable for implementation in devices available to Marines in the 2030-2040 timeframe;
- Develop a purpose-built virtual test environment to exercise and demonstrate this capability with an appropriately detailed virtual representation of combined arms operations in a complex urban battlespace; and
- Exercise both capabilities in a series of benchmarking tests involving a participant cohort for both friendly and opposing forces drawn from active duty Marines. These tests will demonstrate that the ability to dynamically compose small unit organization, capabilities and tactics enables superior performance in the battlespace quantified using metrics such as lethality/(area-cost), resilience, and cost imposition.

The PROTEUS program will consist of three technical areas

Technical Area 1 (TA1): Composable Operations Development Environment

Performers in TA1 will develop the test environment used to explore functional composition and its impact on tactics across levels of command. The environment should focus on revealing the consequences of choices made in the environment within the complex dynamics of the adversarial contest between humans. The events simulated in the test environment will depend on the actions of 150+ people in each force, in addition to a civilian population, over the course of an operation that might last for 45 days. The test environment is a key enabler for the program and TA1 performers will Utilize innovative game mechanics and software architecture concepts to enable detailed assessment and exploration of the dynamic composition approach to combined arms operations in urban terrain

Technical Area 2 (TA2): Functional Compiler

Performers in TA2 will develop an integrated dynamic composition capability to construct adaptive force packages, task organizations, and tactics (TTPs) “on the fly” to meet rapidly evolving mission needs. This capability will be embodied in a software tool that integrates capabilities that identify constraints, mix and match systems to provide desired functional outcomes, integrate systems with novel interoperability approaches, and provide adaptive planning to maximize resilience using mathematically principled approaches and algorithms. This integrated functional composition tool should allow Marine users to compose functions in time and space. TA2 performers should define both friendly and opposing force instantiations of the tool, and define initial tactics

for new composed system concepts

Technical Area 3 (TA3): Systems for Functions

TA3 performers will define both Marine Corps and possible adversary systems and tactics to realize these functions at the unclassified level as described below. Performers in TA3 will provide models that define functional characteristics of systems being composed as well as tactics (TTP's) associated with groupings of these systems. As noted above, for purposes of this solicitation, this "technical library" only includes systems supporting the warfighting functions of Command and Control (C2), fires and maneuver, and TA3 proposers should select only one function to address in their proposal.

While the USMC definition of fires includes both lethal and non-lethal fires, only lethal fires are of interest at this time. The technical library will provide relevant inputs to enable virtual realization of the systems in the TA1 test environment as well as provide composable elements for the TA2 functional compiler.

TA3 proposers should define a palette of "ways to realize functions today" and "ways to realize functions in 2030." For the latter, these are restricted to systems that are currently under development and at TRL 3 or above. For adversary assets, notional technologies are acceptable with publically available understanding of TTPs

If successful, the software tools and concepts developed in the PROTEUS program will enable assessment and exploration of new approaches to combined arms operations involving coordination of effects in multiple domains.

Marine Air-Ground Task Force (MAGTF)

Expeditionary urban operations are a core responsibility of the Marine Corps, which employs an adaptable and scalable task organization, the Marine Air Ground Task Force (MAGTF). Since World War II in many crisis' the United States Marine Corps has deployed projection forces, with the ability to move ashore with sufficient sustainability for prolonged operations.

MAGTFs have long provided the United States with a broad spectrum of response options when U.S. and allied interests have been threatened and in non-combat situations which require instant response to crisis. Selective, timely and credible commitment of air-ground units have, on many occasions, helped bring stability to a region and sent signals worldwide that the United States is willing to defend its interests, and is able to do so with a significantly powerful force on extremely short notice.

The Marine Air-Ground Task Force (MAGTF) is a term used by the United States Marine Corps to describe the principal organization for all missions across the range of military operations. MAGTFs are a balanced air-ground, combined arms task organization of Marine Corps forces under a single commander that is structured to accomplish a specific mission.

The MAGTF accomplishes all six warfighting functions – command and control (C2), fires, logistics, maneuver, intelligence and force protection – as a single, integrated unit. The MAGTF has unity of command, simplifying cross- and multi-domain operations, with task organization and force package assets corresponding to pre-defined mission sets (e.g., raid or non-

combatant evacuation operation) enabling adaptability to variation in mission types.

The types of forces in the Marine air-ground task force (MAGTF) are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a combat service support element

The four core elements the Marine Air-Ground Task Force are:

The Command Element (CE), a headquarters unit that directs the other elements. The MAGTF commander is provided with an integrated staff and requisite communications to enable him to exercise command and control of MAGTF operations. The establishment of a single command element over the ground, aviation, and combat service support elements provides the command, control, coordination, computer, intelligence, and interoperability capability essential for effective planning and execution of operations.

The Ground Combat Element (GCE), usually comprising infantry, supported by armor (tanks), and artillery, but may also include special units such as scouts or Force Reconnaissance, snipers and forward air controllers.

The Aviation Combat Element (ACE), which contributes the air power to the MAGTF. The ACE includes all aircraft (both fixed wing and helicopters), their pilots and maintenance personnel, and those units necessary for aviation command and control.

The Logistics Combat Element (LCE), contains all of the support units for the MAGTF: communications, combat engineers, motor transport, medical, supply units, and certain specialized groups such as air delivery and landing support

teams

MAGTF Operations

MAGTF Operations are built upon a foundation of six special core competencies that define what Marines do and how they operate.

1. The first core competency, expeditionary readiness, defines an institutional mindset that is ready to respond instantaneously to world-wide crises, 365 days a year. This requires a force that can transition from peacetime to combat operations at a moment's notice, without critical reserve augmentation, and with certain success. Second, it demands a force ready to flourish under conditions of uncertainty. Expeditionary readiness is about being ready to adapt to whatever is "out there," improvising and finding unconventional solutions to unconventional problems. As a result, it demands a primary focus on the human rather than technological dimension of battle. And third, it means being ever ready to defeat the "opponent after next" – requiring a relentless commitment to innovation and change.
2. The next core competency is combined arms operations. As specifically demanded by Congress, the nation's naval crisis response force must be capable of acting on short notice and without immediate support from Army and Air Force warfighting forces. In other words, such a force in readiness requires an organic, combined arms capability. For over half a century, MAGTFs have trained so that their ground combat, air combat, and combat service support capabilities are directed by a single commander. Other services practice combined arms operations – MAGTF operations embody them.
3. Expeditionary operations are much more than military expeditions on foreign soil. Like expeditionary

readiness, expeditionary operations require a special mindset – one that is constantly prepared for immediate deployment overseas into austere operating environments. As a result, expeditionary operations consider host nation support a luxury, and are designed to bring everything necessary to accomplish the mission – from individual equipment up to and including airfields and hospitals.

4. The Marine Corps' naval character is an indispensable attribute for a force in readiness, and forms the basis for its fourth core competency, sea-based operations. Sea-based operations provide for extraordinary strategic reach, and give the nation an enduring means influence and shape the evolving international environment. In addition, sea-based operations provide units with a large measure of inherent force protection. A highly ready, combined arms MAGTF, operating from a mobile, protected sea base, provides the NCA with unimpeded and politically unencumbered access to potential trouble spots around the world.
5. The Marines are perhaps best known for their fifth core competency, forcible entry – from the sea. A key requirement for unilateral action is the ability to project power ashore in a theater without forward bases, and in the face of armed opposition. In the past, forcible entry from the sea was defined by amphibious assaults, focused on establishing lodgments on the beach and then building up combat power for subsequent operations. It is now defined as an uninterrupted movement of forces from ships located far over the horizon directly against decisive objectives.
6. Although a force in readiness cannot afford to pause to call up its reserves in order to respond to an emerging crisis, MAGTF operations still demand a sixth core competency, reserve integration. Marine Reserves routinely practice carefully crafted reserve integration plans to augment or reinforce crisis response missions,

and to add combat power for operations, especially at the high end of the conflict spectrum.

References and Resources also include

http://www.26thmeu.marines.mil/About/MAGTF/

http://www.globalsecurity.org/military/agency/usmc/magtf.htm

https://www.ecnmag.com/news/2017/06/transforming-how-troops-fight-coastal-urban-environments

https://connectedwarrior.com/articles/2017/06/21/darpa-marines.aspx