Prototype Resilient Operations Testbed for Expeditionary Urban Scenarios (PROTEUS)

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Proposers Day

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DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.
Program Goal:

Create and demonstrate tools to develop and test agile expeditionary urban operations concepts based on composable force packages

Program Outcomes:

1) Integration and demonstration of a composable force package design and planning toolchain to enable agility and surprise
2) A novel development environment for evaluation of expeditionary urban operations across multiple domains (ground, sea, air, and spectrum)

Deliverables

- 2 software packages
- 3 USMC-focused demonstrations

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The urban fight is about being *agile* – innovating and adapting faster than the adversary in an uncertain, increasingly complex environment – calling for new task organization and new tools.
Program vision: rapid exploration of agile precision warfighting in a new interactive virtual testbed

Command-level view:
- What do I bring to fight and why?
- How do I deliver functions precisely where they are needed in fleeting windows of opportunity?

Tactical operator view:
- How can I adapt systems and task organization to mission needs on the fly?
- On-demand capability for warfighting functions composed real-time from systems and plans across multiple domains

New tactics, systems, and doctrines enabled by dynamic composition
Dynamic composition is the key to agility

Compose warfighting *functions* from interchangeable lowest level elements across domains: *individual* Marines, platforms and subsystems, and tactics.
The toolchain to dynamically compose warfighting functions exists, but it requires integration with principled foundations to enable the vision.
Overview of PROTEUS program elements

Technical Area 1: Composable Operations Development Environment

- Novel game mechanics coupled to an appropriately detailed, scalable virtual world with physics, including spectrum, and realization of systems and effects
- User interface for both command and tactical level, as well as underlying ground truth, including affordances for TA2 functional compiler
- AI implementation
- Test execution, to support friendly and opposing force players and automated civilian populace

Technical Area 2: Functional Compiler

- Dynamic composition toolchain to compose functions in time and space
- Provides the underlying capability for composition in the testbed as well as user interface
- TTP’s for new technologies seeded using testbed experimentation

Technical Area 3: Systems for Functions

- Characteristics of, and TTPs for, existing systems for both blue and red teams
- Initial composition concepts and TTPs for new technologies
- Second BAA to bring in additional elements

API: Application Program Interface  TTP: Tactics, Techniques, Procedures  UI: User Interface  BAA: Broad Agency Announcement

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TA1 proposers should describe the basic architecture & mechanics of their innovative test environment approach:

- **Test Environment Detail:** What level of detail is necessary to achieve quantitatively meaningful performance measures within the environment?
- **Assessment:** What is the approach to use the environment to assess agility and multi-scale phenomena?
- **Scale:** How will the various scales in the test environment be represented and managed?
- **Interaction:** How will interpersonal interactions be implemented and managed?
- **Architecture:** What underlying software architecture will be utilized to enable all of the system requirements?

Incremental extensions to or applications of existing Live-Virtual-Constructive (LVC) tools such as OneSAF, JSAF, MTWS, and VBS are explicitly not of interest.

As appropriate for the environment architecture and mechanics, proposers to TA1 should consider and discuss the following attributes:

- **User Interface/User Experience (UI/UX)**
- **Software architecture**
- **AI development**
- **Content management**
- **Scenario generation**
- **Instrumentation**

TA1 proposers should describe deliverables plan to include a GPR software deliverable and data collected during testing.
TA2 proposers should discuss their approach to provide an integrated dynamic composition capability, noting that a human is also in the loop and can potentially inject information or reasoning, including:

- **Problem representation:** Given an input of the state of the battlespace, what are the mission objectives, current state and constraints that define and constrain a functional composition?
- **System composition:** What is composed to provide the desired function in space and time on the battlefield? How “good” is the recommended system and plan and why?
- **System integration:** How do the elements communicate and convey state and actions to each other?
- **Adaptive execution:** How is the functional composition of Marines and systems used?

Incremental extensions to and/or federations of standard system analysis (e.g., SysML) and conventional planning tools or approaches are explicitly not of interest.
TA3: Systems for Functions

TA3 performers will have a single 18-month period of performance coinciding with phase 1 of the program.

For this BAA, TA3 proposers should only address the warfighting functions of **Command and Control, Fires, and Maneuver**.

TA3 proposers should select only a *single* warfighting function in their proposal.

TA3 performers will provide an inventory of systems that support these three warfighting functions. The TA3 technical library will include:

- Static and dynamic physical characteristics;
- Performance models and/or data (e.g., radio frequency ranges, vehicle fuel burn curves);
- A 3D model for visualization as appropriate in the TA1 environment;
- Data or models for the behavior of the system (e.g., loss of GPS signal in a subterranean operation);
- Aspects of the system which could affect how it is used with other systems to conduct tasks;
- Functional data, including type of tasks the system supports, starting from the USMC Mission Essential Tasks/Mission Essential Task Lists (METs/METLs);
- Tasks, Techniques and Procedures (TTPs) associated with the systems and combinations of systems for the warfighting function of interest.
Notional demonstrations

**Base phase: Kinetic Functions**

- **Example Scenario:** “Urban thrust” concept to execute a raid drawing on mounted, dismounted, air, and combat engineer capabilities

- **Example outcome:** Demonstrate that a lower echelon unit can execute this strategy with equal or better MoPs/MoE’s against a capable adversary

**Phase 2: Extended Battlespace**

- **Example Scenario:** Rotary wing evacuation followed by coordinated air-ground raid operations in a high-rise urban setting against a non-state actor with near-peer COTS capabilities

- **Example outcome:** Demonstrate coordinated and resilient comms and SEAD delivered by mixed manned and unmanned assets, in addition to successful realization of kinetic objectives with composed systems and novel task organization

**Phase 3: All Functions**

- **Example Scenario:** 21st century Battle of Hue: sustained littoral combat using combined arms integrating 3 or more domains with realistic logistics

- **Example outcome:** Demonstrate composable logistics concepts enable superior persistence and agility of kinetic operations using composed systems and novel task organization

Specific demonstrations will be defined in close collaboration with USMC stakeholders

MoP: Measure of Performance  MoE: Measure of Effectiveness  SEAD: Suppression of Enemy Air Defenses  MUMT: Manned-UnManned Teaming  COTS: Commercial Off-The-Shelf  DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited
### Program schedule

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<th>FY2020</th>
<th>FY2021</th>
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<tr>
<td></td>
<td>Phase 1</td>
<td>Phase 2</td>
<td>Phase 3</td>
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<tr>
<td></td>
<td>18 months</td>
<td>9 months</td>
<td>9 months</td>
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<td>Kinetic Functions: C2/Fires/Maneuver</td>
<td>Extended Battlespace</td>
<td>All Warfighting Functions</td>
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#### TA1: Demonstration Testbed
- Benchmark multi-resolution scenario
- Benchmarking demonstrations to establish baseline performance at 6 months in phases 2 and 3
- Government team will coordinate interaction with USMC testing cohort and define scenarios for testing

#### TA2: Functional Compiler
- Demonstrate integrated functional compiler
- Testing for USMC demo
- Concepts for scalable testing
- Extend functional compiler to new functions

#### TA3: Systems for Functions
- Define blue and red capabilities of today
- Define blue and red capabilities of 2030
- 2nd BAA for TA3
- Define blue and red capabilities of today & 2030 for additional functions

#### Demonstrations
- Demonstrate standalone capability
- Integrated TA1/TA2 demo against USMC benchmark
- Dynamic composition demo with blue and red teams
- Increased complexity demo (e.g., spectrum, intel, logistics)
- Capstone demo (all warfighting functions)
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<th>Metric / Capability</th>
<th>Objective</th>
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<td><strong>TA1: Demonstration Testbed</strong></td>
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| Testbed results are believed and valued by the USMC | • Lethality/(area-cost) and resilience ($\Delta$MOE/MOE$_{base}$)  
• Replicates MOP’s/MOE’s (e.g., KIA/WIA, time and modality of achieving mission objectives) from benchmarks |
| Demonstrated value of dynamically composable warfighting concepts | Quantitatively demonstrate superior agility against capable red team (e.g. time to counter a new TTP developed using COTS technology) |
| **TA2: Functional Compiler** | |
| Demonstrated unified dynamic composition cycle | Demonstrate composition and adaptation loop at 6 months and integration into mission planning/execution cycle at 12 months |
| Blue and red team capabilities and tactics dynamically captured | • Blue/peer Red team: Toolchains validated against known combined arms task organization and tactics at 6 months  
• Non-state Red: human teams successfully adapt technology in testbed |
| **TA3: Systems for Functions** | |
| System definition enables composition | Define systems using TA2-defined API to realize “mix and match” capability including structures, TTP’s and behaviors |
| System definition leads to realistic standalone and integrated performance in testbed | Represent behaviors with sufficient detail that benchmarking in testbed meaningfully replicates real-world effects |