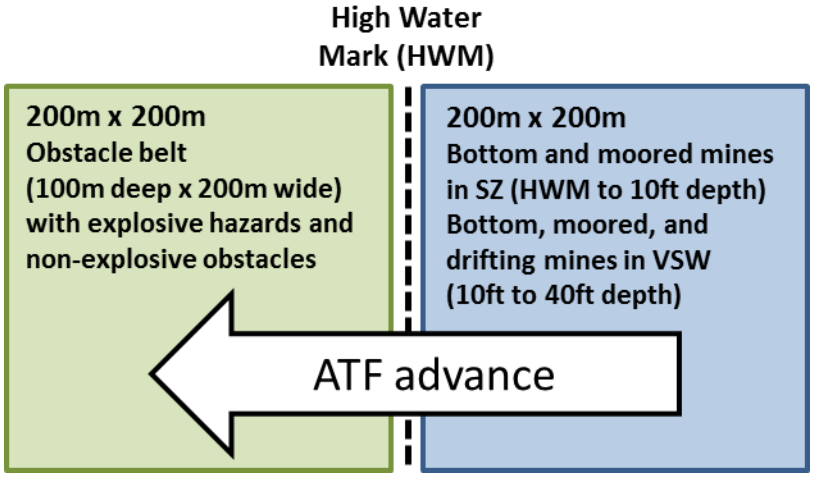
Marine Corps Warfighting Laboratory
Statement of Need
for

Amphibious Environment Explosive Hazard Mitigation System

1. Problem. The Marine Corps surface assault (mechanized) task force (ATF) wishes to improve its capability to navigate mined littoral waters, from very shallow water through the surf zone, and maneuver against explosive hazards (EHs) across the breach zone. The breach zone, diagrammed below, is defined as a 200 meter wide area that extends from the point in the sea to where the water is 40 feet deep to approximately 200 meters inland from the high water mark (HWM). EH locations include surface, sub-surface (buried), subterranean (culverts and tunnels), and submerged (coastlines and rivers).



Note: VSW = Very Shallow Water

2. Background. The current capability to breach or bypass EHs is in need of improvement during amphibious operations. Current methods can be slow and/or manpower intensive. Improvement in reducing operational timelines to address EHs will further reduce landing force exposure and vulnerability.

3. Desired Endstate. The Marine Corps landing force is able to navigate through mined littoral waters and rapidly maneuver through a mined beach landing site.

4. Physical Environment.

a. Sea conditions: Significant wave height of up to 3 feet with wind in any direction.

b. Air conditions: Basic climatic conditions as defined in military standard documents MIL-STD 810 and AR 70-38.

c. Littoral conditions: Perform EH mitigation in tidal conditions that support ATF landing between mid and high tides.

d. Threat conditions: On the landward side of the breach zone, there is typically found a complex obstacle belt that is approximately 100 meters deep and within 200 meters of the HWM. This belt usually contains explosive (conventional anti-tank and anti-personnel mines) and non-explosive obstacles (concertina wire fences, tetrahedrons, concrete blocks). The seaward side of the breach zone is usually comprised of bottom, moored, and drifting (VSW only) mines from the HWM out to sea.

5. Desired Solution. An unmanned system is desired to mitigate explosive hazards in the breach zone (which requires navigation through the complex obstacle belt) during an amphibious assault. Ideally, the solution will resemble a miniaturized unmanned and/or autonomous system of systems that swarms to (1) detect explosive hazards, (2) mark and report explosive hazards, and (3) reduce or destroy explosive hazards. The overall goal is to enable Marines to maneuver quickly on foot or by vehicle through the entire designated breach zone without being injured or otherwise hindered by explosive hazards that may exist in the breach zone. Solutions that only partially address the foregoing needs, but do so effectively are also of potential interest to the Marines.

6. Possible Alternative Concepts for Implementation

a. Coordinates for amphibious assault breach lanes are transmitted to unmanned sea surface vehicles with payloads comprising lightweight autonomous vehicles capable of delivering charges that defeat EHs. The unmanned sea surface vehicles are launched from amphibious ships at a range of 25 nautical miles and sense arrival at the front end of the breach lanes. Upon arrival, the unmanned vehicle transmits breach lane coordinates to the autonomous vehicles, which are discharged with swarming capability to find and fix one vehicle to an EH within the breach lanes. Once each vehicle is fixed to an EH, defeating charges are delivered remotely or, preferably, autonomously. A second wave of vehicles with the same technology is launched to follow the first wave and proof breach lanes of EHs.

b. Coordinates for amphibious assault breach lanes are transmitted to unmanned sea surface vehicles. The unmanned sea surface vehicles are launched from amphibious shipping at a range of 25 nautical miles and sense arrival at the front end of the breach lanes. Upon arrival, the unmanned vehicle transitions from sea movement to ground movement along the coordinates of the breach lane in order to detect, map, and report EH location. Once locations have been received, an amphibious assault force launches miniaturized unmanned aerial vehicles with swarming capability to find and fix one vehicle to an EH within the breach lanes from 5 nautical miles. Once each vehicle is fixed to an EH, defeating charges are delivered remotely or, preferably, autonomously. A second wave of vehicles with the same technology is launched to follow the first wave and proof breach lanes of EHs.

7. Action. MCWL is seeking technologies exhibiting the following characteristics:

a. Physical

(1) Size and weight. An unmanned or autonomous system employment must be miniaturized and lightweight to (1) enable dismounted operations (less than 10 pounds of additive combat load per person) and (2) enable stealth operation through reduced signature (no louder than the surf). In dismounted operations, system components are carried by Marines prior to being released for autonomous function and function collectively (as in swarming) when employed.

(2) Speed. An unmanned or autonomous system must be capable of performing functions to detect, mark and report, or disrupt or neutralize EHs at a speed of at least 5 miles per hour ahead of advancing Marines and/or before assault of the breach zone begins.

(3) Delivery. An unmanned or autonomous system must be capable of delivery near its intended operating area via air, ground, sub-surface (subterranean), sea surface or submerged methods. System components must be capable of cross-domain operation, i.e., a submerged or subsurface system capable of continuing operation in the air or on land.

(4) Endurance. An unmanned or autonomous system must be capable of 8 hours of operation through battery power or other energy supply. System function must support stealth operation. Solutions may also utilize multiple systems overlapping operations to extend time required to complete functions.

(5) Function. The system of systems must be capable of detecting, marking, reporting, disrupting, and neutralizing EHs in all domains: surface, sub-surface (buried), subterranean (culverts and tunnels), and submerged (coastlines and rivers).

b. Control. For purposes of this market research, autonomous operation means that systems that are designed to function autonomously must also be able to relinquish that autonomy to an operator for remote operation.

(1) System components must be capable of employment control from a different domain, i.e. aerial system controlling a ground system.

(2) For amphibious applications, an unmanned system must be capable of autonomous operations from 25 nautical miles. For mounted operations ashore, an unmanned system must be capable of autonomous and remote operation from 5 kilometers. For dismounted operations, an unmanned system must be capable of autonomous and remote operation from 100 meters.

(3) The autonomous system of systems must be capable of marking and reporting EHs in a denied or degraded spectrum environment through other physical signaling.

(4) The miniaturized unmanned or autonomous system of systems must be capable of swarming to find and affix its components to EHs or their immediate proximity.