



Standoff Radar Imaging Detection System (SoRIDS)

Demonstration

Quicklook



Dr. Joong Kim
Program Officer, Explosive Hazard Defeat
Office of Naval Research, Code 32

Major Austin Brown
Branch Head, Explosive Hazards Defeat
Ground Combat Element Division
Capabilities Development Directorate
HQMC Combat Development and
Integration



Overview



Purpose. The Standoff Radar Imaging Detection System (SoRIDS) demonstration showcased candidate technologies in a non-test environment in order to show operational relevance to the mine countermeasure (MCM) / explosive hazard defeat (EHD) mission.

Background. Office of Naval Research (ONR) Code 32, Ocean Battlespace and Expeditionary Access, in support of the Commandant of the Marine Corps (CMC) and Chief of Naval Operations (CNO) guidance, is researching MCM and EHD technologies to support the warfighter and capability gaps that exist. These technologies support an integrated Naval MCM / EHD experimental concept. The technical concept experiments are designed to demonstrate the fusion, integration, and compatibility of multiple detection, neutralization, marking and reporting technologies onboard manned and unmanned vehicles to address explosive threats to Naval forces from the deep water (DW) to the objective.



Operational Context



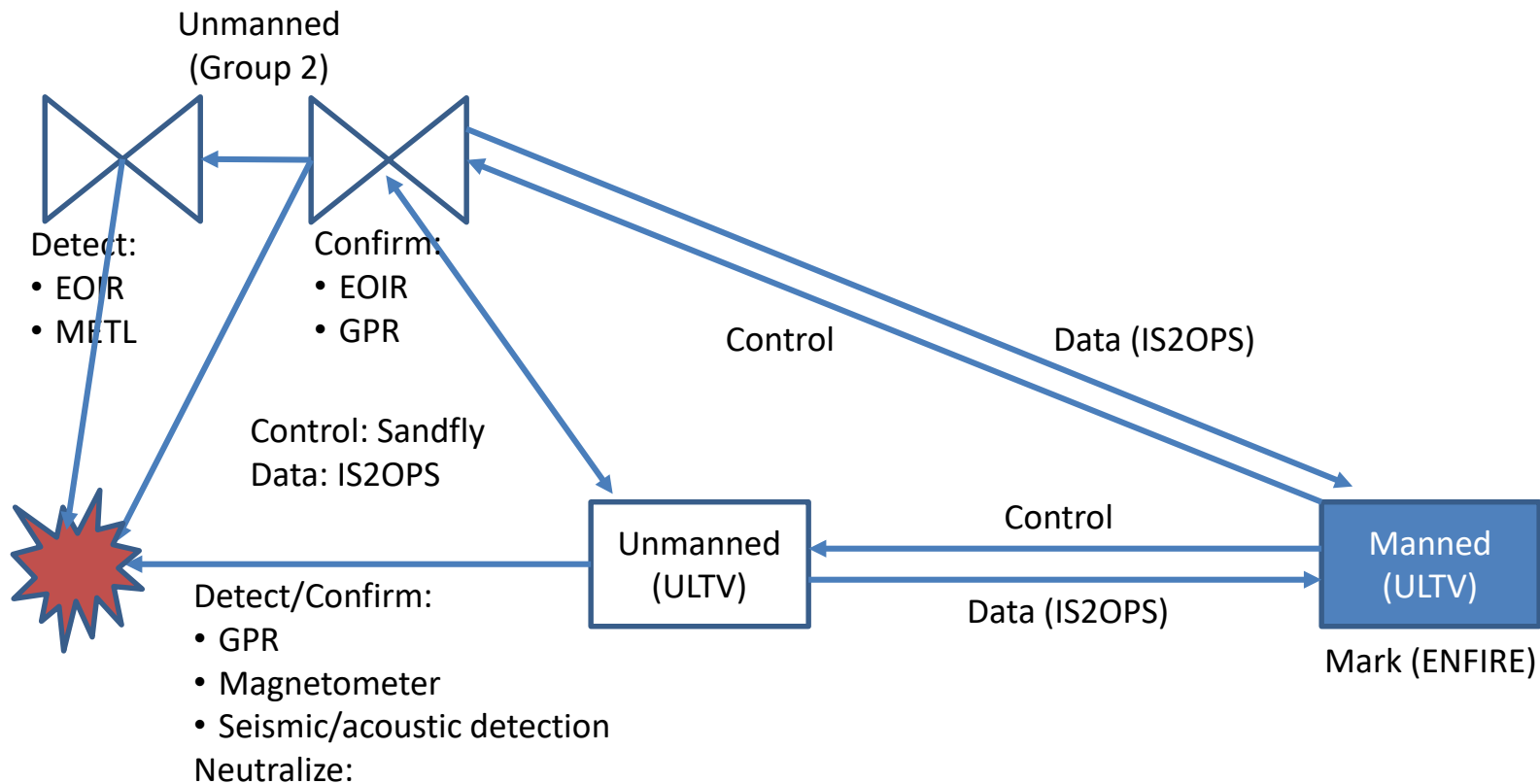
- Situation. MLR deploys to conduct EAB operations. LCT supports EAB operations with ASuW capability from two primary EAB sites, two alternate sites, and two survivability sites. Each site is established at a distance of three kilometers from any other site. Local threat of disruption is low, regional threat of disruption is moderate. Engineer reconnaissance surveys and maps each route – each route is three to five meters wide and trafficable for MLR ULTVs across hilly terrain. Natural (jungle) terrain restricts movements to routes only (restricted off-road mobility). There are no manmade features between two sites.
- LCT scheme of maneuver. Secure one active site, one alternate site, and one survivability site. Capabilities limit surveillance of mobility routes. Conduct ASuW operations at active site for specified duration (signature exposure), then displace to secured alternate or secured survivability site to maintain LPD. BPT conduct ASuW operations at secure alternate site.
- Task. Assess security, accessibility, and trafficability of displacement route in order to enable the rapid displacement of LCT elements.
 - Employ family of systems to scan one mobility route between two sites from the air and assess route accessibility (detect explosive hazards).
 - BPT employ family of systems to scan mobility route from the ground to confirm trafficability (confirm, mark, and report explosive threats).
 - Report route accessibility, identified explosive hazards, and recommended mitigating action (engage or avoid) within 20 minutes.



Technology Configuration



System sketch for a Family of Systems to Defeat Explosive Hazards at Standoff





Standoff Radar Imaging Detection System (SoRIDS)



Lawrence Livermore National Laboratories (LLNL)

- SoRIDS provides on-the-move standoff detection, virtual marking, and reporting of buried explosive hazards while maintaining operational tempo
- Uses multi-static ground penetrating synthetic aperture radar (GP-SAR)
- Enables a capability for on-the-move streaming of sub-surface images of buried explosive hazards with automated detection algorithms, based upon 3D volumetric feature extraction

Mirage(M)16 and M8

- Multi-static, ultra-wideband pulsed radar with versatile, modular arrays in a small form factors
- Real-time data acquisition, imaging, and detection
- M16: UGV based
- M8(Skyglass): UAS based

NSWC Dahlgren

Uomo Robot (Kairos Autonomy system)

- Provides teleoperation or autonomy to ground platforms





Information Support to Operations (IS2Ops)



Naval Research Laboratory – Stennis Space Center (NRL-SSC)

- IS2Ops is a MCWL-funded project tasked to provide the Marine Air-Ground Task Force (MAGTF) with a multi-echelon C2 environment that generates mission relevant actionable information and enables automated kill chains as low as the squad level while federating appropriate information between echelons
- All mine contacts are sent to IS2Ops to determine a safe route through the minefield with minimal neutralizations. The safe route through the minefield is distributed to the UGV



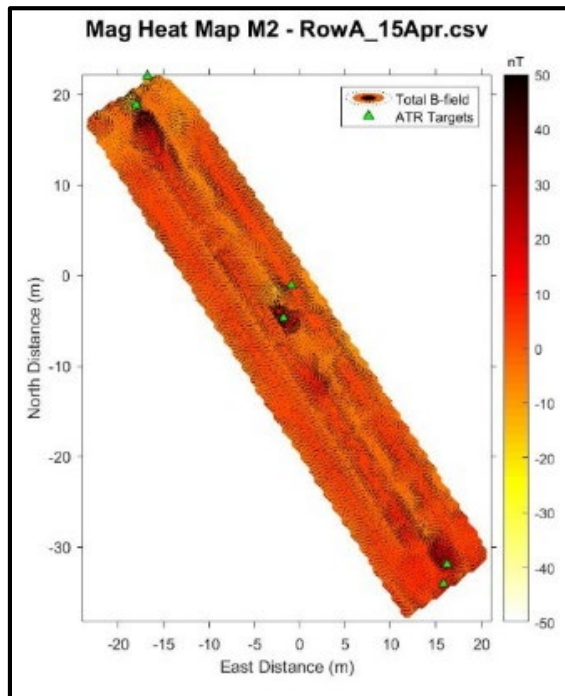


Magnetic Expeditionary Threat Localization (METL)



NSWC Panama City Division







- METL is a UAS with a gradiometer designed to detect ferrous objects from an unmanned aerial vehicle
- Supports operations with various networked manned and unmanned systems to detect, confirm, mark and report explosive hazards
- Semi-autonomous system with manned take-off and landing (currently)





Participants



	<p>Lawrence Livermore National Laboratory (LLNL). Responsible for the technological readiness and demonstration (incl. staffing, logistics, etc.) of SkyGlass and the standoff radar imaging detection system (SoRIDS).</p>
	<p>Naval Research Laboratory Stennis Space Center (NRL SSC). Responsible for ensuring all data and candidate systems are integrated and capable of communicating with the Marine Corps' information system-to-operations (IS2OPS) or simulated integration.</p>
	<p>Naval Surface Warfare Center – Dahlgren Division (NSWC DD). Responsible for the technological readiness and demonstration (incl. staffing, logistics, etc.) of the Kairos Uomo technology.</p>
	<p>Naval Surface Warfare Center – Indian Head Explosive Ordnance Disposal Technical Division Demonstration and Assessment Team (NSWC IHEODTD DAT). Responsible to ONR for venue coordination. In this capacity, DAT is responsible for personnel and equipment arrival / assembly management, infrastructure support, logistics coordination, range clean-up, etc. with MCB Quantico, VA.</p>
	<p>Naval Surface Warfare Center – Panama City Detachment (NSWC PCD). Responsible for the technological readiness and demonstration (incl. staffing, logistics, etc.) of the METL (Egret – E900 UAS).</p>
	<p>Office of Naval Research Ocean Battlespace & Expeditionary Access (ONR 32). Responsible for the technological readiness and demonstration (incl. staffing, logistics, etc.) of the SoRIDS technology.</p>



Vignette #1: Speed and System Cross-Country



- Highlighted the speed and the on-the-move hazard detection capabilities present in the SoRIDS system-of-systems - route was a cross-country pass, at variable speeds over a distance of 300 meters
- Three speeds:
 - 3 KPH: Legacy Marine Corps capability with the Husky Mounted Detection System
 - 8 KPH: Current SoRIDS system operating speed
 - 15 KPH: Future of the technology
- Polaris-mounted M16 system, driven autonomously by the Uomo, has the radar array mounted approximately half a meter above the ground, which allows operation in environments previously impassible by ground penetrating radar systems
- Detections from both Skyglass (UAS with GPR) and Mirage (Polaris with GPR) were passed into the IS2Ops ground station





Vignette #2: Detect, Cue, and Confirm



- Highlighted how METL and Skyglass are able to detect targets that are used to cue follow-on actions for the Polaris.
- The objectives of this vignette were to detect locations of hazardous objects, provide that intelligence to IS2Ops, and have the inherit routing and alerting capabilities within IS2Ops stop and start the Polaris





Vignette #3: Wide-Area Clearance



- Skyglass and METL surveyed the area using a lawn mower pattern as a sort of permission reconnaissance
- Intelligence was used to generate the path through the minefield, communicated through IS2Ops





Execution Schedule



20 SEP	21 SEP	22 SEP	23 SEP	24 SEP
<p>Site set-up and minefield emplacement – thirty metal and plastic targets emplaced in a 300’x 300’ execution area.</p> <p>System checks and ground positioning system (GPS) checks / verifications on the unmanned ground vehicle (UGV) and two unmanned aircraft systems (UAS).</p> <p>Data captured for ground penetrating radar (GPR) on the ground and GPS readings.</p>	<p>Continued system set-up and checks to support demonstration.</p> <p>Vignette dry-runs and narration rehearsals.</p>	<p>Weather impacted morning operations and demonstration rehearsals.</p> <p>Technologists continued to work on systems and DAT worked through visitor day set-up.</p> <p>Demonstration vignette rehearsals with narration conducted in the afternoon.</p>	<p>Demo set-up and rehearsal from start-to-finish.</p> <p>A small group of visitors attended the demonstration.</p> <p>Visitors from:</p> <ul style="list-style-type: none"> • Marine Corps Engineer School (MCES) • Marine Corps Warfighting Laboratory (MCWL) • Marine Corps System Command (MCSC) • Headquarters Marine Corps (HQMC) 	<p>Demonstration execution</p> <p>Thirty stakeholders and visitors attended.</p> <ul style="list-style-type: none"> • MCWL • MCSC • Combat Development & Integration (CD&I) • NSWC IHD EOD • DEVCOM • 2ndCEB • NECC • ONR • NWDC



20-22 SEP 2021 // Set-up



Landing Zone (LZ) Dove

- Prepped demonstration site (emplaced mines) and technologies set-up systems for accurate readings / operations checks for vignettes
- Dry runs of vignettes for visitor days





23 SEP 2021 // Visitor Day



TIME	EVENT	REMARKS
Thursday, 23 September - Visitor Day		
1300	Visitors Arrive at LZ Dove	Visitors Sign in
1305	<p style="text-align: center;">Welcome Aboard/Admin Remarks</p> <ul style="list-style-type: none"> • Maj A. Brown, CD&I • Dr. J. Kim, ONR 32 	Welcome guests and brief schedule of events
1315	<p style="text-align: center;">Integrated MCM/EHD Technology Briefs</p> <ul style="list-style-type: none"> • D. Sapp, ONR 32 (FNC Brief) • B. Wihl, LLNL (SoRIDS) • E. Hada, NSWC DD (Uomo) • LT Grondin, NSWC PCD (METL) • J. Dickens, NRL SSC (IS2Ops) 	MCM Familiarization Briefs/ Briefs given from participants on their respective technologies
1400	<p style="text-align: center;">SoRIDS Demonstration: Vignettes</p> <p style="text-align: center;">Q. Nash, DAT (Narrator)</p>	Walked the visitors through the (3) vignettes
1430	Technology Static Display	Q&A at tech tents





24 SEP 2021 // Visitor Day and Retrograde



TIME	EVENT	REMARKS
Friday, 24 September - Visitor Day		
0600	Participants on site	Rehearsals conducted
0830	Visitors Arrive at LZ Dove	Visitors Sign in
0845	<p style="text-align: center;">Welcome Aboard/Admin Remarks</p> <ul style="list-style-type: none"> • Maj A. Brown, CD&I • Dr. J. Kim, ONR 32 	Welcome guests and brief schedule of events
0900	<p style="text-align: center;">Integrated MCM/EHD Technology Briefs</p> <ul style="list-style-type: none"> • D. Sapp, ONR 32 (FNC Brief) • B. Wihl, LLNL (SoRIDS) • E. Hada, NSWC DD (Uomo) • LT Grondin, NSWC PCD (METL) • J. Dickens, NRL SSC (IS2Ops) • B. Amato, NSWC IHD (Neutralization System) 	MCM Familiarization Briefs/ Briefs given from participants on their respective technologies
1015	<p style="text-align: center;">SoRIDS Demonstration: Vignettes Q. Nash, DAT (Narrator)</p>	Walk the visitors through the 3 vignettes
1130	Technology Static Display	Q&A at Technology Tents
1200	Retrograde	All equipment and personnel clear of range by 1400



Static Displays



UAS Mine Neutralization System



- | |
|---|
| <p>NSWC IHD</p> <ul style="list-style-type: none"> • Release Mechanism • Charge Design • ATAK Development <p>NSWC Dahlgren</p> <ul style="list-style-type: none"> • UAS Platform • Release mechanism integration |
|---|

Key Elements

Charge - ATAK Enabled XM335

- Developed by DE Technologies for mine and IED neutralization
- Effective against proud and buried targets
- ATAK enabled fireset

ATAK RFD Plugin

- Optional integration with UAS GCS or standalone
- Flexible for use in other configurations and applications

Release Mechanism

- NSWC IHD developed light weight, 4 charge system ~ 4lbs

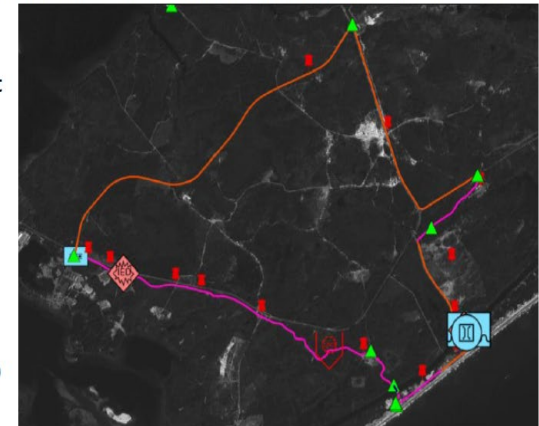
UAS Platform

- NSWC Dahlgren is providing initial UAS platform (Nibbler) and will support integration on the Skyraider R80D in FY22

ENFIRE

➤ Proper use of ENFIRE program and equipment peripherals can literally turn multiple day missions into just a few hours of work

- 28,437m Roadway/7 Separate Rd Segments w/comp Route Recon Rpt
- 1 Comp. Ford Recon Rpt
- 1 Comp. Bridge Recon Rpt
- 1 Comp. River Recon Rpt
- 3 Comp. IED Rpt's
- 3 Comp. LZ Rpt's
- 12 Radius of Curvatures
- 2 Constrictions (Obstacles)
- 11 Points of Interest (POI)
(Poss. Bridge Repairs, WP's, Fuel, Gravel, etc.)





Noteworthy



- Approximately 50 visitors over two days of demonstrations
- Maj Austin Brown introduced the visitors to the demonstration with compelling reasons for continuing to invest in standoff detection of EH, especially given the divestment of assets providing protected mobility.
- A community of Combat Engineer, EOD, Science and Technology, and USMC capability development stakeholders viewed and expressed interest in the sensors and systems

