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DEPARTMENT OF THE NAVY

NAVY SBIR/STTR SUCCESS STORY



COBRA AUTOMATIC OBSTACLE DETECTION (AOD)

Real-time automated detection of discrete medium-to-heavy obstacles in the beach zone, giving the warfighter an essential edge in amphibious assault breaching missions.

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THE CHALLENGE

To develop a real-time automated capability to detect mission-relevant discrete medium-to-heavy obstacles from AN/DVS-1 Coastal Battlefield Reconnaissance and Analysis (COBRA) airborne passive multispectral imagery of the beach zone.

THE TECHNOLOGY

As with minefield detection (MFD) within the AN/DVS-1 COBRA system, AOD requires the collected multispectral imagery to be initially aligned by the auto-registration algorithm before any multispectral processing can be performed. Additionally, AOD uses a modified version of the MFD obstacle cueing algorithm optimized for obstacles. The cueing process provides an initial list of likely obstacle detections to the discrete obstacle false alarm mitigation (FAM) for processing. The discrete obstacle FAM processing rejects false obstacle detection cues and provides a filtered obstacle detection list to processing. This provides the ability to automatically detect, classify, and precisely locate obstacles in the beach zone while reducing false alarms.

THE TRANSITION

The transition strategy was to integrate the SBIR-developed real-time AOD algorithms and software into the COBRA system, preserving and enhancing both COBRA's airborne sensor hardware and its Post Mission Analysis (PMA) ground station. This provided COBRA with advanced automated discrete medium-to-heavy obstacle detection capabilities to supplement its core minefield detection mission. This capability has been integrated and demonstrated in the COBRA Block I system. Arété was awarded a Phase III contract from Program Executive Office (PEO) Unmanned and Small Combatants (USC) on a sole source basis to serve as the prime contractor on the COBRA program Block I Low Rate Initial Production (LRIP) and has delivered five operational systems to the fleet.

THE NAVAL BENEFIT

The previous COBRA obstacle detection process was performed solely by the operator, through visual inspection of collected MFD data tracks. These data tracks could consist of hundreds of multispectral image spots, which the operator would manually review, resulting in extended PMA timelines and additional burdens on the operator. The combined real-time AOD/MFD processing achieved during this effort exceeded initial expectations and threshold requirements. The algorithm updates were implemented into the COBRA Block I Real-Time Processor (RTP). The RTP output of the AOD algorithm can be processed by the COBRA Command and Control, Data Display and Dissemination (C3D3) software for viewing and dissemination of obstacle threats. This provides a new automated obstacle detection, classification and geo-location capability in support of military operations from unmanned airborne platforms. The COBRA Block I system is currently fielded for Navy missions in mine warfare.

THE FUTURE

Ongoing upgrades to improve the resolution of the COBRA multispectral sensor will allow for improved detection of smaller and continuous-type obstacles. Additionally, ongoing algorithm improvements will expand the AOD capabilities into the surf-zone, and augmentation of the AOD algorithms utilizing deep learning will make dramatic improvements in the probability of detection / probability of false alarm (Pd/Pfa). The recent Navy awards of \$28.4M and \$17M will support Arété in producing an additional six COBRA systems by 2022. Arété and the U.S. Navy are continuously exploring SBIR technologies to enhance COBRA missions, including expansion of the mission into the surf zone, very shallow water, and shallow water, including nighttime detection and operations.