

Topic: N03-202

STILMAN Advanced Strategies

RAID Technology Innovative Research, Predictive and Causal Modeling for NAVSEA

The complexity of the Battlespace has evolved to the point that it is no longer possible to manually maintain awareness of, and optimally allocate all resources in real-time. Accelerated decision-aiding coupled with dynamic, optimal sensor and weapon target pairing (i.e., enhanced mission planning, battle management aiding and automated resource controllers) are urgently needed to maintain the initiative against near-peer and above peer threats. LG-RAID Enhanced Mission Planning capabilities address the acute lack of adequate, real-time, integrated, multi-resource planning tools. LG-RAID technology rapidly produces superior integrated plans providing warfighters the tools to create and evaluate the viability of their proposed integrated plans (space, air, surface, subsurface) against a broad range of enemy threat systems and courses of action.

Technology Category Alignment:

Human Computer Interfaces (HCI) for Decision Making

Synthesis/Analytics/Decision Tools

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SYSCOM: NAVSEA

Contract: N00178-17-C-7000

Booth: 202

Room: Club Room North

Presenting: Apr 11th at 10:00 AM

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVSEA #2018-0556

Topic # N03-202

RAID Technology Innovative Research, Predictive and Causal Modeling for NAVSEA STILMAN Advanced Strategies

WHO

SYSCOM: NAVSEA

Sponsoring Program: AEGIS

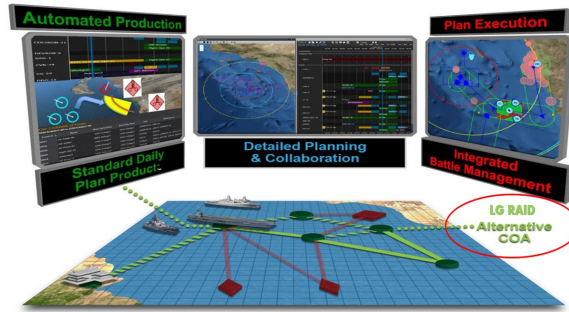
Transition Target: Maritime Planner Environment

TPOC:
(202)781-4932

Other transition opportunities:

Special Operations, Law Enforcement, First Responders, and Homeland Security Planners -- this technology is domain agnostic.

Notes: Overlays for tactical displays and commercial displays such as Google Maps provide the end user with real-time adversarial intelligence via an animated estimate of Enemy Location and Intent. This information is deterministic. It is based on the Intelligence provided and can be shown to be mathematically optimal for the input parameters and threat data provided. In this fashion, sensitivity analyses can be conducted by quickly adjusting inputs (automatically or manually) and executing the estimation process in real-time. This provides the commander with a heretofore unavailable level of tactical planning and in-execution adaptability.



Copyright STILMAN Advanced Strategies - LG RAID Provides Predictive Battlespace Awareness

WHAT

Operational Need and Improvement: Adaptive, cross-domain web-enabled planning and optimal resource allocation, LG-RAID produces optimal sensor and weapon target pairing that is based on the current intelligence information and internal estimates of threat forces. This allows the commander to assess and prioritize resources in a rapid and quantitative fashion. Mission additions (adds) and deletions (drops) can be made quickly based on quantitative metrics such as target servicing sequence and delivery times. LG-RAID's animated Enemy Course of Action (ECO) can be produced in real-time on hand-held (tablet), desktop, stand-alone server, or cloud-based server applications. Estimation of Enemy location and intent (ECO) enables rapid operational planning, mission execution and supervised autonomy of Automated Resource Controllers and Battle Management Aids including: Integrated Air & Missile Defense of Ships and Littoral Forces, C2 & Decision Aiding, Combating Asymmetric and Irregular Threats, Naval Platform and Systems Operational Availability Training

Specifications Required: Host Application Interface Control Documents or Software Developer Kit (SDK).

Technology Developed: The underlying technology is an Artificial Intelligence-based cross domain LG-Hypergame. The LG-Hypergame provides an E-Commerce equivalent cost function. In this fashion, movements and actions in one domain are simultaneously evaluated (cost versus benefit) for their impact on other domains. This information is displayed in near real-time allowing the commander to visualize and quantitatively select and coordinate the most suitable cross domain and intra domain Course(s) of Action for their assigned mission(s).

Warfighter Value: The complexity of integrating forces has eclipsed the human's ability to make timely decisions, synchronize fires, and optimize allocation of resources. LG-RAID supports the volume and diversity of data required to make tactical decisions in a dynamic and uncertain environment. This capability improves the commander's ability to plan and quantitatively evaluate multiple "what if" analyses and adapt quickly to dynamic and evolving threats.

WHEN

Contract Number: N00178-17-C-7000 **Ending on:** August 20, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Transition to Maritime Planner Environment	Med	Integrated software	6	September 2018

HOW

Projected Business Model: LG RAID Software Application will be integrated into a Program of Record (AEGIS), STILMAN provides on-going enhancements, maintenance and technology support

Company Objectives: Transition LG-RAID into the Maritime and Cross Domain Applications that need automated planning and Battle Management Decision Aids

Potential Commercial Applications: Unmanned system control, planning for optimal employment of manned and unmanned Law Enforcement assets

Topic: N151-071

Daniel H. Wagner, Associates, Incorporated

Dynamic Minefield Operation (DMO)

Dynamic Minefield Optimization (DMO) evaluates and optimizes precision placement of maritime mines and sensors/effectors, and also evaluates and optimizes mine and sensor/effector delivery plans for multiple maritime minefields. DMO makes more effective use of scarce maritime mining resources, increases the military effectiveness of maritime minefields, reduces risk to friendly platforms and missions, and reduces operator time-on-task. Daniel H. Wagner Associates has over 55 years of experience in developing/transitioning complex software components to prime contractors and Department of Defense customers, and developed mission effectiveness evaluation and optimization, risk determination, and data fusion algorithms and software components for several U.S. Navy mine warfare systems, including the primary system for mine warfare planning and execution, MINEnet Tactical, and the MK18 Mod 2 Inc 2 unmanned underwater vehicle (UUV). Word Count: 124

Technology Category Alignment:

Human Computer Interfaces (HCI) for Decision Making

Synthesis/Analytics/Decision Tools

Undersea Weapons

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SYSCOM: ONR

Contract: N68335-17-C-0052

Booth: 203

Room: Club Room North

Presenting: Apr 11th at 10:30 AM

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-17-C-0052

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

ONR Approval #43-4388-18

Topic # N151-071

Dynamic Minefield Operation (DMO)

Daniel H. Wagner, Associates, Incorporated

WHO

SYSCOM: ONR

Sponsoring Program: PMS 495

Transition Target: MINEnet Tactical

TPOC:

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Other transition opportunities:

Harbor defense, facility protection,
System with distributed sensors

Notes: Figure shows Optimal Allocation of Mines and Ship Count Settings to Maximize Average Damage to Threat

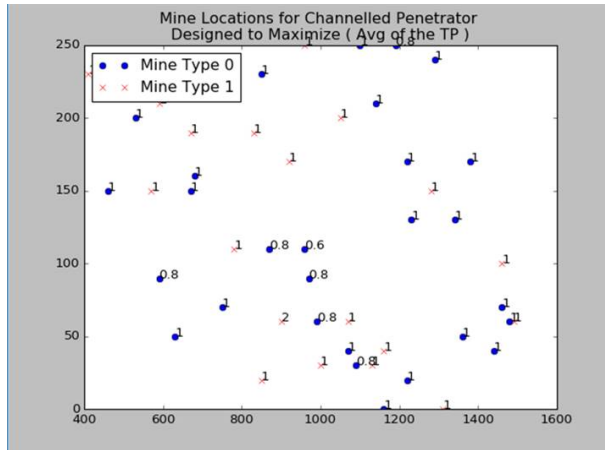


Image courtesy of Daniel H. Wagner Associates, Inc. Copyright 2018.

WHAT

Operational Need and Improvement: Fleet planners have no tools for determining how best to locate, utilize, and deploy precision and advanced maritime minefields in order to maximize their warfighting contribution. Current fleet tools only evaluate the effectiveness of randomly placed conventional maritime mines.

Specifications Required: Need to optimally locate, utilize, and deploy precision and advanced maritime minefields.

- 1) Current approaches randomly distribute mines in an area.
- 2) Need to evaluate and optimize precision placement of mines and advanced sensors/effectors for multiple maritime minefields.
- 3) Need to evaluate and optimize precision placed mine and advanced sensor/effector delivery plans for multiple maritime minefields.

Technology Developed: Dynamic Minefield Optimization (DMO) evaluates and optimizes precision placement of mines and advanced sensors/effectors for multiple maritime minefields. It also evaluates and optimizes precision placed mine and sensor/effector delivery plans for multiple maritime minefields.

- Warfighter Value:**
- 1) Significantly more effective use of precision placed mines and sensors/effectors.
 - 2) Significantly more effective use of precision placed mine and advanced sensor/effector delivery resources.
 - 3) Higher probability of defeating threat submarines and surface ships.
 - 4) Reduced vulnerability of friendly forces to threat submarines and surface ships.
 - 5) Reduced planner time-on-task and much faster response to operational changes.

WHEN

Contract Number: N68335-17-C-0052 **Ending on:** January 23, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Optimize precision placed mine locations/settings	Low	Successful test in Wagner lab	5	1st QTR FY18
Optimize precision placed mine delivery	Low	Successful test in Wagner lab	5	2nd QTR FY18
Joint optimization of precision placed mine locations/settings and delivery across multiple maritime minefields	Low	Successful test in Wagner lab	5	1st QTR FY19
Optimize precision placed advanced sensor/effector locations/settings	Low	Successful test in Wagner lab	5	1st QTR FY19
Optimize precision placed advanced sensor/effector delivery	Low	Successful test in Wagner lab	5	2nd QTR FY19

HOW

Projected Business Model: Daniel H. Wagner Associates designs, develops, markets, implements and provides training for custom decision support, resource optimization, and data fusion software. Our goal is to support Navy program offices and collaborate with defense contractors to integrate these advanced decision support, resource optimization, and data fusion solutions for ship and aircraft platforms. Examples of successful transitions include:

- 1) Computational modules for evaluating and optimizing mine countermeasures (MCM) operations and estimating risk in MINEnet Tactical.
- 2) Acoustic Mission Planner (AMP) in MH-60R avionics system and shipboard Mission Planning System (MPS).
- 3) Mission Optimization Configuration Item (MOCI) Web Service in Undersea Warfare Decision Support System (USW-DSS).
- 4) Net-Centric Data Fusion (NCDF) for USW-DSS.
- 5) Data Fusion Engine (DFEN) in USW-DSS.

Company Objectives: Rapidly and cost-effectively integrate operationally effective components into larger command and control system.

Potential Commercial Applications: Enhancements to commercial sensor placement systems (e.g., harbor defense, facility protection).

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Topic: N091-082

Charles River Analytics, Inc.

Replanning and Operator Situation Awareness Tools for Operation of Unmanned Systems in Complex Airspaces and Waterspaces

Charles River Analytics, a leading provider of innovative R&D solutions for increasingly complex human-systems challenges is addressing the need for planning resources and schedules for deployed unmanned logistics platforms that provide energy replenishment, data access and management, and communications capabilities to a heterogeneous suite of UUVs. Their system enables situational awareness of submerged unmanned platform health and status and then develops highly autonomous, multi-vehicle coordination and management algorithms to execute unmanned operations with limited remote supervisory control access. To date the software has been successfully exercised in a series of government-managed Limited Objective Experiments, including in-water operations, simulation-based laboratory tests, and benchside hardware testing. They seek transition into a deployable fleet of platforms to support longer-range and longer-duration UUV missions.

Technology Category Alignment:

Human/Autonomous System Interaction and Collaboration

Machine Perception, Reasoning and Intelligence

Human Computer Interfaces (HCI) for Decision Making

Survivability

Unmanned Ground and Sea Vehicles

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SYSCOM: ONR

Contract: N68335-17-C-0169

Booth: 200

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Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-4521-18

Topic # N091-082

Replanning and Operator Situation Awareness Tools for Operation of Unmanned Systems in Complex Airspaces and Waterspaces

Charles River Analytics, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Not specified

Transition Target: Innovative Undersea Prototype Development Consortium (IUPDC) OTA

TPOC:

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Other transition opportunities:

Potential for integration of the software with an unmanned air system control station or some other unmanned docking platform.

Notes: As an example of an alternate SBIR transition path successfully pursued on another program, Charles River developed a tool to guide the warfighter through a formalized approach to assessing, analyzing, and forecasting human behavior (Contract Number FA8650-04-C-6403). The tool eventually underwent a successful Military Utility Assessment in 2008 and an Extended User Assessment with a Joint agency; it is now in use by DoD war-fighters worldwide.

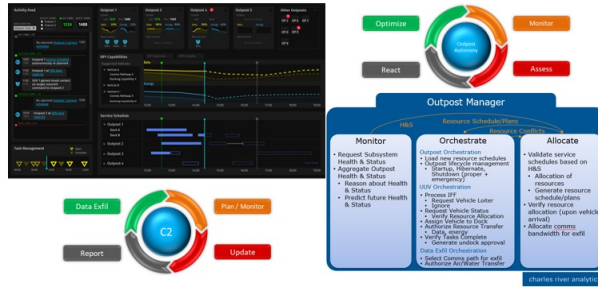


Image owned by Charles River Analytics

WHAT

Operational Need and Improvement: The technical capabilities of unmanned surface, subsurface, ground, and aerial vehicles continues to develop, leading to an impressive array of agile assets capable of accomplishing a wide variety of tasks. However, one key limitation is the endurance of the assets. One solution is to develop unmanned logistics platforms to periodically provide energy replenishment, data access and management, and communications capabilities to support unmanned vehicles over longer-range and longer-duration missions.

Specifications Required: The solution needs to operate for extended periods of time without communication with a human operator and adapt to unpredictable events (e.g., uncertainty in vehicle arrival times, environmental changes, tolerance to hardware failure, evolving mission needs). The software must integrate effectively with the larger platform hardware and software system and support a series of Limited Objective Experiments (LOEs), assessing the capabilities and features.

Technology Developed: Charles River Analytics is addressing the need for planning resources and schedules for deployed unmanned logistics platforms by assessing the status of the assets and developing algorithms to execute operations with limited remote supervisory control access. The primary objective is to design, develop, and test a hierarchical C2 structure, process, and implementation to manage autonomous operations. Charles River Analytics is building a suite of tools that will enable dynamic planning and re-planning of service schedules and resource allocation for a scaled collection of unmanned docking platforms and unmanned vehicle clients; building real-time, highly autonomous, multi-vehicle coordination and management algorithms; and building a suite of unmanned vehicle orchestration services guiding unmanned vehicle clients through the ingress, docking, charging, data transfer, and egress phases of a servicing evolution.

Warfighter Value: The work can increase the DoD's capability to more effectively deploy unmanned vehicles and reduce the exposure of personnel to high-risk situations (e.g., removing the man from the minefield, increasing the standoff range of personnel from adversary positions).

WHEN

Contract Number: N68335-17-C-0169 **Ending on:** April 6, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Unmanned Docking Platform Integration Test	N/A	Successfully dock, service, and undock an unmanned vehicle in a bench test	6	3rd QTR FY18
Prototype Unmanned Docking Platform Demonstration	N/A	Successfully dock, service, and undock an unmanned vehicle in a representative environment	6	4th QTR FY18
Communications Adaptation Simulation Test	Low	Successfully adapt behaviors based on availability of communications	5	1st QTR FY19
Autonomy Simulation Test	Med	Unmanned docking platform can autonomously adjust service schedules without human intervention	6	1st QTR FY20

HOW

Projected Business Model: Charles River Analytics is a leading customer-focused provider of innovative R&D solutions for increasingly complex and important human-systems challenges. The technology developed by Charles River Analytics under the Replanning and Operator Situation Awareness Tools for Operation of Unmanned Systems in Complex Airspaces and Waterspaces effort is slated for transition to the Innovative Undersea Prototype Development Consortium (IUPDC) OTA, managed by Battelle Memorial Institute. The technology will be further developed, tested, and improved. In that timeframe, a large system integrator will be necessary to transition the technology.

Company Objectives: Charles River would like to meet with government agencies and companies involved in unmanned vehicle logistics, unmanned platform deployment and operations, and unmanned vehicle mission planning.

Potential Commercial Applications: This capability could be used in a broad range of civilian applications of unmanned systems including use by first responders and homeland security and in other applications involving management of automated systems, such as industrial applications to include the oil and gas industry.

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Topic: N141-019

Charles River Analytics, Inc.

Intuitive User Interfaces for Task-Tailored Planning (INTUIT)

Charles River Analytics, a leading customer-focused provider of innovative R&D solutions for increasingly complex human-systems challenges, is developing Intuitive User Interfaces for Task-Tailored planning (INTUIT) to provide a set of efficient and effective mission planning user interfaces for the Navy's Joint Mission Planning System (JMPS). These role- and task-tailored user interfaces increase the usability of planning systems and efficiency of operators with varying skill levels across a range of vehicles, mission contexts, and unique tasks. Formal analysis efforts have identified task and information requirements for the mission planning process within the targeted environment, driving the design of a set of display concepts and the prototyping and demonstration environment used to validate INTUIT. Ultimately, INTUIT's user interface will be integrated into JMPS and other DoD systems.

Technology Category Alignment:

Human/Autonomous System Interaction and Collaboration

Test, Evaluation, Validation, and Verification

Human Computer Interfaces (HCI) for Decision Making

Information Collection/Management

System Interfaces & Cognitive Processes

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SYSCOM: NAVAIR

Contract: N68335-18-C-0015

Booth: 200

Room: Club Room North

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-645

Topic # N141-019

Intuitive User Interfaces for Task-Tailored Planning (INTUIT)

Charles River Analytics, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Strike Planning and Execution Systems Program Office (PMA 281)

Transition Target: Joint Mission Planning System (JMPS)

TPOC:
(301)757-1884

Other transition opportunities: Any mission planning system, such as the Navy's Common Control System (CCS), Distributed Common Ground/Surface System (DCGS), the Global Command and Control System (GCCS), and other DoD mission planning systems.

Notes: As an example of an alternate SBIR transition path successfully pursued on another program, Charles River developed a tool to guide the warfighter through a formalized approach to assessing, analyzing, and forecasting human behavior (Contract Number FA8650-04-C-6403). The tool eventually underwent a successful Military Utility Assessment in 2008 and an Extended User Assessment with a Joint agency; it is now in use by DoD warfighters worldwide.



Courtesy of US Navy 090406-N-7090S-402 APR 2009
(http://www.navy.mil/view_image.asp?id=73943)

WHAT

Operational Need and Improvement: The mission planning process is labor and time intensive, complicated, and requires considerable training and proficiency. Current mission planning interfaces are difficult to understand and cumbersome to use, resulting in few operators utilizing the full power of advanced planning systems. Innovative workflows are needed to allow operators to tailor specific planning processes to optimize their output for the time and materials required.

Specifications Required: Effective interfaces must guide mission planners in a streamlined approach through highly complex and detailed mission planning procedures. The developed interface must also effectively simplify data entry and uploading process through intuitive human-computer interactions and visualization techniques. These interfaces should be highly adaptive to accommodate mission planning for new and enhanced weapon systems and platforms.

Technology Developed: INTUIT provides a set of efficient and effective mission planning user interfaces (UIs) for the U.S. Navy's Joint Mission Planning System (JMPS). These interfaces are grounded in the development of operator, task, and workflow models to structure behaviors for tailored UIs. These interfaces provide targeted support to novice and expert mission planners by adapting to unique operator, task, and mission needs, as well as fluidly exposing opportunities for advanced planning functionality when appropriate.

Warfighter Value: INTUIT's role- and task- tailored UIs provide consistent and relevant structures for mission planning across contexts, effectively streamlines system presentation and accelerates the ability of novice operators to plan missions across a range of vehicles, mission contexts, and unique tasks. Expert operators are also supported through efficient interaction mechanisms. In addition to effectively increasing the usability of planning systems and efficiency of operators across skill levels, INTUIT also reduces cognitive workload and increases the efficiency of mission planning systems for manned and unmanned vehicles, such as the JMPS.

WHEN

Contract Number: N68335-18-C-0015 **Ending on:** March 12, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Integrate proof-of-concept component UI functions with JMPS	Low	Demonstration of technical integration approach within JMPS	5	February 2017
Develop isolated software prototype of mission plan functionality	Med	Demonstration of single mission planning component	6	August 2017
Release targeted component functionality with JMPS	Med	Deployed target component with JMPS	6	October 2019
Demonstrate targeted mission planning functions through INTUIT interface integrated within JMPS	High	Interface subset integrated for mission planning within JMPS	7	November 2019

HOW

Projected Business Model: Charles River has over 30 years of steady growth providing innovative, cost-effective solutions through intelligent systems R&D. Over 100 Charles River projects have produced a wealth of advanced-technology prototype software that can facilitate the rapid integration of critical technology into operational systems. Charles River plans to develop the software and pursue either direct development for the government or license agreements with a Prime Integrator for the Program of Record.

Company Objectives: Charles River Analytics is seeking relationships with prime systems integrators for mission planning systems to support the transition of INTUIT to JMPS and other mission planning systems, as well as for opportunities to demonstrate INTUIT during live or training events to further support the value added of implementing this technology.

Potential Commercial Applications: Commercial applications of INTUIT include providing interfaces for commercial flight planning systems, such as those developed by Jeppesen or Foreflight, to improve adaptive spatial, temporal, and relational visualization capabilities of mission planning displays.

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Topic: N161-015

Daniel H. Wagner, Associates, Incorporated

Collaborative Airborne Anti-Submarine Warfare (ASW) Mission Evaluation and Optimization (CAMEO)

Collaborative Airborne Anti-Submarine (ASW) Warfare Mission Evaluation and Optimization (CAMEO) provides web-based collaborative mission planning tools, applications, and services to synchronize mission execution, help communicate commander's intent, substantially shorten the mission planning process, and improve the effectiveness of multi-platform, multi-sortie, multi-sensor airborne ASW and Surface Warfare (SUW). CAMEO is intended for use in the Navy's Joint Mission Planning System (JMPS), to coordinate and plan tactical and operational details of airborne ASW and SUW combat missions. CAMEO Phase II prototyping has extended and enhanced Phase I operational concepts. For 50+ years, Wagner Associates has developed/transitioned complex software components to prime contractors and Navy warfare systems, such as USW-DSS and MH-60R avionics. Our products include mission effectiveness evaluation and optimization, risk determination, and data fusion algorithms.

Technology Category Alignment:

Fixed Wing Vehicles (includes UAS)

Rotary Wing Vehicles

Human Computer Interfaces (HCI) for Decision Making

Synthesis/Analytics/Decision Tools

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SYSCOM: NAVAIR

Contract: N68335-18-C-0148

Booth: 203

Room: Club Room North

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 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0148

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-281

Transition Target: Joint Mission Planning System (JMPS)

TPOC:
(301)757-1884

Other transition opportunities:

Aircraft Carrier Tactical Support Center (CV-TSC), Littoral Combat Ship (LCS), Undersea Warfare Decision Support System (USW-DSS), Surface Ship Combat Systems

Notes: The image to the right shows a bistatic sonobuoy laydown pattern for a P-8 aircraft, in a gridded, sample test environment. Each '+' sign represents a "post" (a co-located pair of MAC/ADAR sonobuoys). There are 23 posts, deployed starting in the bottom left of the figure. The circles provide an indication of detection range, as measured by the monostatic half sweep width at that location. The MAC sources ping in cycles, two minutes between pings. The Cumulative Detection Probability (CDP), after six hours of search, against a slow-speed (5-knot), random patrolling submarine is 90.2%.

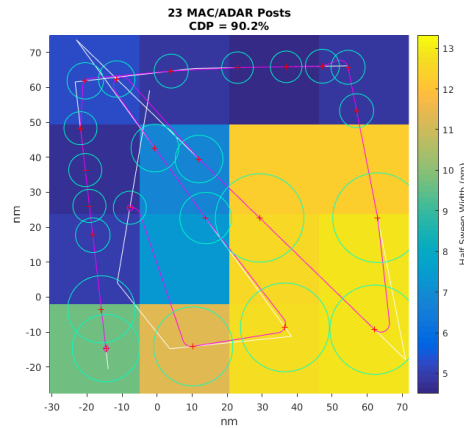


Image courtesy of Daniel H. Wagner, Associates, Copyright, 2018, .

WHAT

Operational Need and Improvement: Increasingly stealthy and capable submarine and surface ship threats pose significant challenges for planning effective airborne Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) missions, and thus a collaborative, integrated multi-platform, multi-sensor approach for ASW and SUW mission planning is needed. To assist ASW and SUW mission planners with this complex mission planning process, and reduce lengthy planning times, advanced mission planning tools are needed to develop optimal manned/unmanned airborne ASW search plans.

Specifications Required: Need open architecture optimal airborne ASW and SUW mission planning tools and software components that integrate with existing Navy mission planning systems and databases.

Technology Developed: Using genetic algorithms (GAs) CAMEO recommends militarily effective, executable, jointly optimized, and integrated airborne ASW and SUW search plans utilizing all available and relevant assets and their synergistic acoustic and non-acoustic, passive and active sensors; and quantitatively evaluates their effectiveness using operationally relevant metrics. CAMEO also provides visualization techniques that enable mission planners to (i) see the complete mission timeline, (ii) display search plans, and (iii) view the battlespace with depth-dependent target-density, sensor coverage, and search effectiveness plots.

Warfighter Value: The expected benefits of CAMEO are: (1) Significantly improved airborne ASW and SUW search and surveillance effectiveness, (2) Better exploitation of search system synergies, (3) Significantly reduced risk to friendly platforms, (4) Enhanced Situational Awareness (SA) and threat assessment, and (5) Reduced airborne ASW and SUW planner/operator time-on-task.

WHEN

Contract Number: N68335-18-C-0148 **Ending on:** December 19, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Preliminary CONEMP & JMPS Integration Plan	Low	Positive NAVAIR Review	5	September 2018
Preliminary CAMEO Software Prototype	Low	Successful tests in Wagner lab	5	June 2019
Detailed JMPS Integration Plan	Low	Positive NAVAIR Review	5	June 2019
Full Scale Prototype CAMEO System	Low	Successful tests in Wagner lab	5	September 2019
CAMEO Demonstration	Low	Successful demonstration of operational capability with real-world and simulated data	6	December 2019

HOW

Projected Business Model: Since 1963 Daniel H. Wagner, Associates, has provided innovative and cost-effective technical solutions to complex problems in Naval Operations Analysis and commercial/government applications. We design, develop, market, implement, and provide scientific software, training, and support for custom resource optimization, decision support, multi-target tracking, and data fusion systems. Examples of successful transitions and deployments include:

- 1) Acoustic Mission Planner (AMP) in MH-60R avionics system and shipboard Joint Mission Planning System (JMPS)
- 2) Mission Optimization Configuration Item (MOCI) Web Service in Undersea Warfare Decision Support System (USW-DSS)
- 3) Net-Centric Data Fusion (NCDF) for USW-DSS
- 4) Data Fusion Engine (DFEN) in USW-DSS
- 5) Computational modules for evaluating and optimizing mine countermeasures (MCM) operations and estimating risk in MINenet Tactical

CAMEO is targeted for direct integration into JMPS, although additional marketing opportunities include other naval systems that could benefit from CAMEO technology and software components.

Company Objectives: To use our operational experience and technical skills to address challenging problems in defense analyses and provide solutions and computational components that enable warfighters to reduce their vulnerability and conduct successful and operationally effective military operations.

Potential Commercial Applications: CAMEO algorithms and methodology have potential applications to border surveillance and port/facility security.

Topic: N162-133

Charles River Analytics, Inc.

Smart Weather InstruMentS (SWIMS)

Smart Weather InstruMentS (SWIMS) system has a blimp that moves up/down in the air-sea boundary, collecting in-situ data up to 1km from the sea surface, tethered to an autonomous surface vehicle (ASV), enabling autonomous deployment to any location on the surface; improving data quality/quantity. It has a satellite communication link to remote command and control (C2) stations to stream real-time field data as well as receive any mission instructions, can operate unattended for 3-4 months with its onboard adaptive behavior based autonomy architecture enabling it to track and follow weather patterns, and can be fitted with sensor suites to fit with customer requirements, and Charles River Analytics, maker of intelligent systems solutions is targeting the Navy's Meteorology & Oceanography (METOC) office, Coast Guard, and NOAA.

Technology Category Alignment:

Lower Atmosphere Battlespace Environments

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SYSCOM: ONR

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Department of the Navy SBIR/STTR Transition Program

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Topic # N162-133

Smart Weather InstruMentS (SWIMS)

Charles River Analytics, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Proposed FNC on the EM effects in near surface conditions; also EM Railgun for over water targets

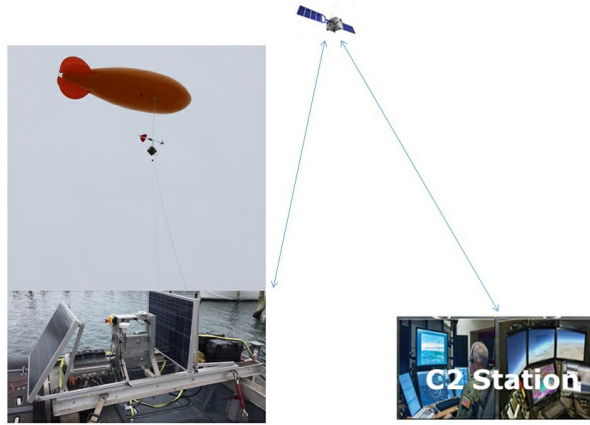
Transition Target: ONR Monsoon Intra-seasonal Oscillations in the Tropical Indian Ocean and the Bay of Bengal (MISO-BOB) Program

TPOC:

Jean McGovern
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Other transition opportunities: This leap-ahead technology would also have tremendous utility to other agencies that support at sea-operations such as the Coast Guard, NOAA air-sea boundary measurements program, and the Navy METOC community.

Notes: We are working on transitioning SWIMS to the ONR MISO-BOB program; we're planning to attend the 2019 at sea experiments in the Bay of Bengal to demonstrate the capabilities of the SWIMS platform for Monsoon measurements.



SWIMS first prototype in operation (Copyright 2018 Charles River)

WHAT

Operational Need and Improvement: For air-sea interaction measurements, it is important to measure the atmospheric boundary layer at the same time that we measure the ocean wave boundary layer and the ocean mixed-layer parameters. Because we have moved field measurements in the ocean to autonomous vehicles, we now have a mis-match between the measurements of the ocean wave-boundary layer and ocean mixed layer and the atmospheric boundary layer. The present methods of measuring boundary layer data and fluxes at sea are very rough and crude with a large loss of accuracy - this will improve the quality as well as quantity of the data.

Specifications Required: The following parameters are desirable: real-time reporting; steerable, stable platform with navigational accuracy to 1 meter over 1 hour; duration of 2-6 months; retrievable (desirable but not a hard and fast option); and deployable from surface vessels. Operating conditions: operational up to Beaufort Scale 4 [winds 13 - 17 mph; wave height 3.5 - 6 ft; small waves with breaking crests; fairly frequent whitecaps], and functional at storm conditions is desirable but also needs to be examined as a trade-off.

Technology Developed: Smart Weather InstruMentS (SWIMS) system an autonomous mobile surface buoy measures the ocean surface and a tethered blimp that measures the adjacent air layer. A novel, wave-generated jet propulsion system propels the SWIMS buoy, and an automated winch system inside the buoy deploys the blimp. SWIMS transmits geo-registered meteorological data to a command and control (C2) station via a satellite communication link, makes decisions using a behavior-based autonomy software architecture, and maintains power during long missions by recharging its batteries with solar panels. SWIMS can provide the DoN with data on the complex interface between the ocean mixed layer, ocean surface, and adjacent air layer that is critical to the genesis of meteorological phenomena, data required to accurately predict global weather, climate, and the evolution of greenhouse gases.

Warfighter Value: Deploy SWIMS platforms in regions of interest to obtain in-situ data updating environmental forecast models, tuning weaponry to operate in these regions and for mission planning.

WHEN

Contract Number: N68335-18-C-0173 **Ending on:** February 10, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Version 1 - Well tested data collection platform	Med	High	5	4th QTR FY18
Prototype Version 2 - Well tested data collection platform which can operate for longer period	Med	High	5	1st QTR FY19
Prototype Version 3 - Software upgrade with adaptive behaviors	Low	High	6	1st QTR FY19
Prototype Version 4 - Platform tested for short period deployments	Med	High	6	3rd QTR FY19
Full first Prototype - Complete first prototype tested at sea for long duration deployments	Med	High	7	1st QTR FY20

HOW

Projected Business Model: We see two possible approaches to commercializing the SWIMS technology developed under this program. First, our Autonomous Mobile Marine Meteorological station design can be licensed to other commercial entities that will use it directly or incorporate it as added functionality to their commercial products. In particular, Liquid Robotics® has expressed interest in transitioning SWIMS technology onto their products (see attached Letter of Interest). SWIMS' novel, wave-driven propulsion system directly benefits the Wave Glider—it can improve the efficiency of their wave-based propulsion by replacing the current wing rack with the SWIMS novel propulsion system or it can combine both wave energy harvesting mechanisms to improve the propulsion system. SWIMS' automated, tethered blimp system can be used as an additional sensor suite for air-sea boundary layer measurements as required. Second, we can use SWIMS novel technology as a key building block in an adaptive marine observation system product, which we are currently designing and for which we are beginning to explore possible markets.

Company Objectives: Charles River would like to meet with those that are interested in conducting a full-scale scenario operational demonstration of the Phase II prototype for the purposes of weather monitoring, communication gateway, aerial surveillance, and wave generated propulsion systems. Also interested in meeting with those that would integrate the technology into the broader FNC programs or DRI programs to provide an operation use evaluation and to demonstrate viability across the naval force.

Potential Commercial Applications: There commercial potential in industry, other governmental, and NGO organizations engaged in weather forecasting, climate-change assessment, marine condition forecasting, oil spill assessment and response, disaster response, disaster relief and recovery, maritime recovery, and marine science and exploration conducted in countries/regions possessing or lacking developed maritime infrastructure will benefit from this product.

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