# Department of the Navy SBIR/STTR Transition Program

STATEMENT A. Approved for public release; distribution is unlimited. ONR Approval # 43-1256-16

Topic # N121-082

A Cognitive Architecture for Replanning and Execution (CARPE)

Knexus Research Corp.

## WHO

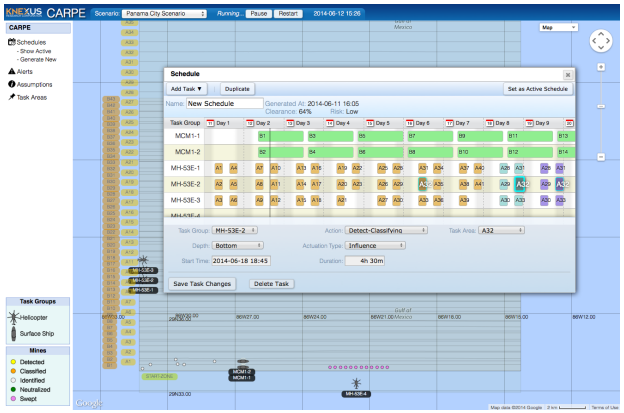
**SYSCOM:** ONR

**Sponsoring Program:**

**Transition Target:** Program Executive Office Littoral Combat Ships (PEO LCS)

**TPOC:**
Dr. Jason Stack
jason.stack@navy.mil

**Other transition opportunities:** PEO LCS Mine warfare Environmental Decision Aid Library (MEDAL) Program ; ONR Future Naval Capabilities (FNCs) related to Mine countermeasures (MCM) or undersea warfare




Copyright 2015 Knexus Research Corp.

**Notes:** Knexus Research Corporation is developing a cognitive architecture for re-planning & execution (CARPE). The CARPE Enterprise System is a collaborative MCM operations management decision support system that significantly reduces the time required to re-plan and plan with a measurable decrease in warfighter risk through improved uncertainty management.

## WHAT

**Operational Need and Improvement:** MCM Commanders (MCMCs) and their staff must routinely plan for and task a variety of assets in a volatile environment while balancing risks against operational objectives. Such decision making is predominantly manual, which limits the ability to explore candidate courses of actions and the ability to respond to disruptive events once the operation begins.

**Specifications Required:** A cognitive architecture for MCM mission planning and replanning requires real-time capabilities for situation assessment and mission status evaluation for replanning decisions, fluid interaction with operators to enable better decisions and increased trust in computer-generated solutions. The technology will reduce mission re-planning time; better articulate uncertainty, context, and constraints; and provide a transparent interpretation between the MCMC's intent and unit-level orders.

**Technology Developed:** CARPE is a decision support system that integrates all MCM operations management decision tasks including preliminary scheduling, situation assessment, and rescheduling. It includes a modular web decision support architecture interoperable with 3rd party systems, an accurate and justifiable conversational root cause analysis for disruptive events and algorithms for real-time schedule repair. CARPE evaluation has demonstrated effective situation analysis and real-time replanning response to several disruptions and triggers with minimal disruption to ongoing operations.

**Warfighter Value:** CARPE is expected to dramatically streamline MCM operations and improve mission effectiveness by reducing risk to the warfighter. It will improve the warfighter's ability to detect subtle but important anomalies hours earlier than is currently possible. Early detections combined with rescheduling effort reductions from hours to seconds will lead to better asset utilization and reduced mission time. The efficiency and effectiveness gains will be even greater with unmanned platform operations.

## WHEN

**Contract Number:** N00014-13-C-0212 **Ending on:** June 30, 2015

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|---|---|---|---|
| Feasibility of planning, monitoring, and replanning | N/A | Proof of concept prototype | 3 | November 2013 |
| Interim prototype for disruption analysis and rescheduling | N/A | Proof of concept demonstration on SME generated clearance mission | 3 | May 2014 |
| Interim prototype with non-interactive disruption analysis and plan repair | N/A | Simulated testing with 4 events and 1 SME walkthrough on program provided scenarios | 4 | October 2014 |
| Web prototype with conversational analysis and minimally disruptive rescheduling | N/A | Testing with 100s of test cases covering 6 events and 3 SME walkthroughs on a reference scenario | 4 | June 2015 |

## HOW

**Projected Business Model:** CARPE algorithms and the advanced web prototype are covered under SBIR data rights and a patent disclosure has been filed. The CARPE reasoning engine comprising scheduling, analysis and rescheduling algorithms will be available for licensing, development, and maturation. Knexus Research is looking for prime partners for co-developing, testing and transitioning the CARPE algorithms to Programs of Record (PORs) calling for automated and collaborative mission and operations planning, situation assessment, and rescheduling in dynamic and uncertain environments.

**Company Objectives:** Knexus Research's objective is to identify additional PORs for application of CARPE and its derivative technologies to improve warfighter and mission performance. We plan to develop partnerships with primes and integrators in these programs and continue to develop, mature, test and evaluate, and certify CARPE technology to transition it to the warfighters.

**Potential Commercial Applications:** CARPE technology can be applied to improve and streamline operations planning and management not only in the DoD but also in civilian and other national agencies that operate in dynamic and uncertain environments. These include crisis management, forestry and fire fighting operations management, state and local law enforcement operations planning and management. CARPE technology could also be embedded in operations planning training systems within DoD and civilian agencies.

**Contact:** Kalyan Moy Gupta, President
kalyan.gupta@knexusresearch.com 855 569 7373 x700