

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-8691-21

Topic # N181-079

Continuous Interactive Learners for Mission Planning (CILEMP)

Knexus Research Corp.

WHO

SYSCOM: ONR

Sponsoring Program:

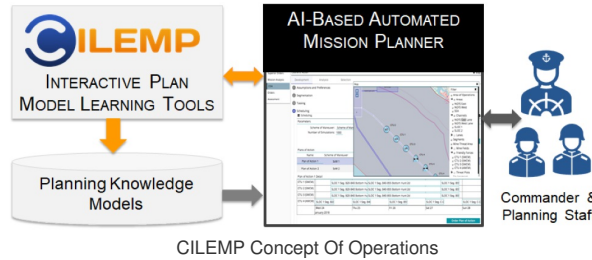
Transition Target: PMS-495 (MineNet Tactical)

TPOC:

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Other transition opportunities:

Department of Defense-NAVAIR PMS 298 (Joint Mission Planning System),
 Planning Support for Air Force Air Operations Centers (AOC),
 Government and Non Government Agencies- Crisis Action and Disaster Recovery Planning (e.g., FEMA)
 Commercial Industry - Construction Project Planning, Oil and Natural Gas, Mining Exploration Projects



CILEMP Concept Of Operations

WHAT

Operational Need and Improvement: Automated tools for mission planning operate with knowledge models comprising asset performance capabilities, behaviors, and environmental models. The state-of-the-art tools manually encode and test the planning models which is a slow, error prone process; and models can quickly become inconsistent and obsolete. Lack of complete and accurate models degrades the tool's ability to plan and puts the warfighters at a serious disadvantage.

Specifications Required: Develop machine learning methods for acquiring and updating planning models that exploit mission performance data and user feedback including after action reports, as well as planning decisions and critiques of system performance. Develop algorithms to learn and update asset performance models for predicting asset performance in novel situations and use this information to effectively allocate them and maximize mission measures of effectiveness. Demonstrate the robustness and scalability of methods on complex multi-domain, multi-asset, mission planning problems.

Technology Developed: CILEMP is a collection of advanced multi-strategy machine learning software tools that acquire and update planning domain models for AI-based hierarchical planning systems. It learns actions, tactics, and divide and conquer strategies from plans authored by commanders and their planning staff. It implements a modular architecture and interoperates with AI-based hierarchical mission planning software. Our tests on military and non-military mission planning problems show that it successfully learns planning models from just a few examples.

Warfighter Value: CILEMP will simplify the deployment, use, and the effectiveness of AI-based tactical and operational planning aids. It will overcome the knowledge modeling bottleneck and enable wide spread adoption of AI-planning technology across services. It reduces the effort and time to deploy AI-based automated planning aids for new mission types from months to days, and reduces the total cost of ownership of mission planning systems by an order of magnitude. It improves end user experience due to its ability to tailor its response based on continuous learning.

WHEN

Contract Number: N68335-19-C-0570 **Ending on:** September 13, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Integrated plan model learning concept	N/A	Validation with Subject Matter Experts	3	1st QTR FY19
Feasibility of action model learning	N/A	Action Model Learning on an unclassified Navy mission typen	3	3rd QTR FY19
Integrated CILEMP Software Framework	Low	Demonstration of end-to-end learning on one unclassified mission type	4	1st QTR FY22
Robust Planning Model Learning Services	Low	Successful demonstration and evaluation on multiple DoD mission types and test cases	5	4th QTR FY22
Integrated Learning for Transition Target	Med	Pass acceptance tests for mine warfare tactical planning aid	6	4th QTR FY23

HOW

Projected Business Model: CILEMP algorithms and software are protected under the SBIR data rights. Additionally, we will file multiple patents to protect the intellectual property. The CILEMP engine and its multi-strategy learning algorithms will be available for licensing and integration with automated mission planning systems. Knexus is looking for prime partners to co-develop, test, and transition CILEMP algorithms to additional Programs of Record (PORs) that need AI-based tactical planning and model learning.

Company Objectives: Identify additional PORs for CILEMP and related automated mission planning technologies to improve mission performance. Develop partnerships with primes and other technology integrators to extend, mature, test, and transition CILEMP technology. Develop applications for the non-DoD market segment and the commercial industry. We are looking for investments and partnership from commercial industry to develop a robust set of automated planning tools.

Potential Commercial Applications: CILEMP plan model learning as well as our automated planning software are widely applicable to not only DoD agencies but also to other governmental and non-governmental agencies such as those that perform crisis action planning, disaster recovery, or deliver humanitarian aid. They also apply to the commercial industry; for instance, they can streamline, accelerate, and improve project planning in the construction and oil and gas industries.

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