Topic: N171-035

Creative Technologies Inc.

Gamification for Combat System Employment
Maintaining operator skills on the Navy's AN/SQQ-89A (V) 15 (SQQ-89) sonar system requires supervised training with instructor feedback. Creative Technologies Inc. 's (CTI) SQQ-89 Gamification Capability (SGC) will automate this with software combining three features. Experts train a machine learning (ML) expert module which measures student performance interpreted by a second ML module. A synthetic ocean, Just Add Water Simulation (JAWS), is used to create training scenarios. Phase II proof-of-concept prototypes have validated the ML technical approach. CTI specializes in serious game and ML algorithm development. SGC is intended for the SQQ-89 program of record. SGC modules can be used to measure performance in tactical systems and training aids; JAWS can serve as a simulation driver in a broad range of virtual environments throughout the DoD.

Technology Category Alignment:
Machine Perception, Reasoning and Intelligence
Personalized Assessment, Education, and Training
System Interfaces & Cognitive Processes
Acoustic, Seismic and Magnetic
Undersea Weapons

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SYSCOM: NAVSEA
Contract: N68335-19-C-0121

Department of the Navy SBIR/STTR Transition Program

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Gamification for Combat System Employment
Creative Technologies Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: Navy Program Executive Officer (PEO) Integrated Warfare Systems (IWS) 5A

Transition Target: AN/SQQ-89A (V) 15 (SQQ-89) Sonar System

TPOC:
(202)781-4233

Other transition opportunities: Advanced training support for the U.S. Army, Air Force, Navy, and Marine Corps, and Coast Guard

Notes: The AN/SQQ-89A (V) 15 (SQQ-89) sonar system. Creative Technologies Inc.'s (CTI) SQQ-89 Gamification Capability adds a machine learning-based expert model, a student model, an after-action review component and the "Just Add Water Simulation" composable virtual ocean environment. The system is employed on surface ships and submarines.

Photo Courtesy of US Navy, 080126-N-7981E-830.jpg

WHAT

Operational Need and Improvement: The SQQ-89 Gamification Capability (SGC) addresses the concern that sonar operator skills can deteriorate during long periods at sea without tactical employment. It is believed that SGC will motivate operators to practice voluntarily. The machine learning technology in SGC can supply artificial intelligence (AI) non-player characters, to replace operators when the full crew complement is not available as well as provide granular feedback in after-action reviews. SGC will be equally valuable in a multiplayer, sonar game, now in the works as a separate SBIR effort.

Specifications Required: SGC will function in the Navy's Training and Learning Architecture (TLA), collecting real-time data, enabling trainees to work more effectively with Combat System tools and displays. Users employing SGC for SQQ-89 training are expected to demonstrate performance of 70% as compared to a human expert, with an aspirational goal of 80%. The SGC expert model is expected to be trained to perform within 20% of a human expert on novel scenarios SGC is expected to result in increased user engagement to maintain initial training levels over a three-month period. SGC is required to have a system usability score exceeding the 75th percentile.

Technology Developed: SGC includes machine learning (ML) technology to develop expert models efficiently, by observing the behavior of experts playing training scenarios. These models are robust to novel scenarios and situations. The SGC ML-based student model recognizes users' performance as 'state-spaces': the settings, configuration, and user actions throughout the exercise. The Just Add Water Simulation (JAWS) is a composable, virtual ocean environment used to develop training scenarios or to monitor and dynamically modify scenarios when observer/controllers are present.

Warfighter Value: Beyond increasing operator proficiency by maintaining engagement and providing realistic, challenging training experiences, SGC offers significant value in training, modeling and simulation (M&S), and tactical systems. SGC methods develop expert models that can be applied to myriad training aids and simulators. The same models could be adapted and trained to serve as decision aids in operational systems. Similarly, student models could be used to recognize state-spaces on a broad range of equipment and computational systems for training and to provide hinting or decision support operationally. JAWS could serve both as a training and M&S simulation driver: a composable ocean where vessels and marine life can be emplaced and assigned behaviors.

WHEN

Contract Number: N68335-19-C-0121   **Ending on:** November 23, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
System prototype demonstration with classified data	Low	Demonstrate expert model development, student state-space recognition, and JAWS functionality	TRL 6	February 2020
Advanced Capability Build Step 2 Test	Low	Demonstrate SGC in shore-based training	TRL 6	March 2021
Advanced Capability Build 23 - System Integration	Low	Integrate with operational system	TRL 7	September 2021

HOW

Projected Business Model: As SGC is a software system, there is no production per se beyond initial development and integration. CTI intends to offer the technology under license to the Navy for inclusion in the SQQ-89 system and in the sonar multiplayer game described in SBIR topic N192-094. With respect to further productization, CTI has established a relationship with Lockheed Rotary Mission Systems, intending to explore additional DoD opportunities beyond the SQQ-89 sonar system.

Company Objectives: CTI seeks to establish itself as a significant player in the ML-based expert model space and ML-centric user performance assessment technology. While the JAWS composable virtual ocean environment is domain-specific, the ML expert and user components, we believe, have a broad application both in government and industry.

Potential Commercial Applications: SGC capabilities are applicable to a wide range of functions in diverse industries. Knowledge workers, be they in banking and finance, pharmaceuticals, energy, or logistics and transportation - people who interact with information and develop solutions, analysis, or make decisions - are all candidates for SGC-enhanced training or operational enhancement. SGC has the potential to enhance user performance, both as a result of improved training and operationally, through decision-support processes.

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