Topic: N151-020

Bevilacqua Research Corporation

Command and Control of Multiple Unmanned Air Vehicles in Anti-Access Area-Denial or Highly Limited Communication Bandwidth Environment
Semiotic Digital Encoding (SDE) is a technique to transform information from the data domain to the knowledge domain. Knowledge can be transmitted using significantly less bandwidth. The original information can be recovered by transforming it back to the data domain. The resulting communication is lossless, secure, and platform independent, using as much as 80% less bandwidth than the original requirement. The concept enables the command and control of multiple UASs in a degraded or denied communications environment by utilizing the ultra-low bandwidth space allowing mission critical information to transition remaining available bandwidth without loss of mission capability. The SDE capability, as a platform-independent capability to reduce the bandwidth dependency for structured messages, will have a broad application across platforms, platform types and, missions. Initial applications may include data links for control systems such as the Common Control System (CCS) for unmanned air platforms and air vehicles such as the Fire Scout.

Technology Category Alignment:

Autonomy
Networks and Communications
Cognitive/Adaptive Capabilities
Unmanned Ground and Sea Vehicles
System Interfaces & Cognitive Processes

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-720

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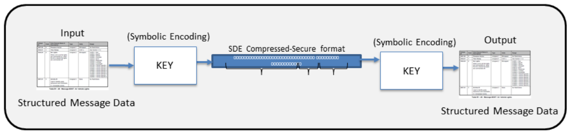
WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 281

Transition Target: Common Control System (CCS), Multi-vehicle Control System (MVCS)

TPOC:
(760)939-1176



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Other transition opportunities:
Semiotic Digital Encoding (SDE) has an application in every instance that structured data is transmitted between nodes, specifically, there are operational concerns regarding the available bandwidth. Scenarios such as denied or degraded communications environments present a variety of bandwidth concerns that can be mitigated through an application of this technology. Reducing the bandwidth needed to transmit a specific amount of information provides more, operational flexibility regarding selection of a data link in bandwidth-constrained environments or to increase the number of messages that can be accommodated within a fixed bandwidth, a force multiplier.
In addition to gaining bandwidth efficiency through the application of SDE, the resulting message becomes natively secure without any loss of information.
The underlying technology provides a graphical representation of the information being transported. These graphical representations can be used to gain insight into the systems' behavior(s) and can further be used as a means to create a level of autonomy within the systems' operations.
Implementation of SDE into iNET telemetry at Edwards AFB CA, as funds are available.

WHAT

Operational Need and Improvement: Maintaining a stable and secure command and control (C2) link between the ground station and an unmanned air platform, regardless of the communications environment, is essential to mission success. In many circumstances, bandwidth available for sustaining the C2 link can be impacted by jamming introduced by the adversary or congestion where mission requirements exceed available bandwidth. This SBIR seeks to establish the technologies capable of providing structured, command and control messages, simultaneously, to multiple unmanned air systems (UAS) in these degraded or denied environments, without loss of performance.

Specifications Required: The requirements of the SBIR were to develop a technology/technique that provided ultra-low bandwidth communications, for the purpose of uninterrupted command and control of UAS, in an area or period of denied or degraded communications, regardless of the link being employed, the platform being controlled, or the implementation of the C2 messages. Specifically, this project required the implantation of a technology to reduce the bandwidth requirements for transmission of North Atlantic Treaty Organization (NATO) Standards Agreement (STANAG) 4586, Version 2, command and control messages to control multiple UAS in areas of degraded or denied communications.

Technology Developed: The Semiotic Digital Encoding technique provides the enabling technology to maintain secure, lossless communications in degraded or denied communications environments. The SDE technology is inserted into any structured data stream to significantly reduce bandwidth consumption without losses typically incurred using data compression approaches.

Warfighter Value: As the warfighter's reliance on the use of unmanned systems, and information in general, continues to grow, in numbers of systems employed and in the numbers and types of operations that use of these systems, the corresponding demand on available bandwidth will also continue to grow. The SDE algorithm provides the means to significantly reduce bandwidth consumption while providing lossless and secure communications. The resulting savings enable stable communications across a broader operational spectrum.

WHEN

Contract Number: N68335-16-C-0347 **Ending on:** December 31, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Development of the SDE	Low	Ability of the software to encode structured data into a binary bit stream.	7	July 2018
Development of data library	Low	Establishment of a library that represents all of the potential messages, within a specific protocol, to support a specific mission.	6	October 2018
Implementation of SDE software components within a specified ground station and unmanned system	Low	Operation of an unmanned system using an encoded C2 message set, across the full spectrum of mission activities required of that system	7	December 2018

HOW

Projected Business Model: Bevilacqua Research Corporation (BRC) will implement the SDE through distribution of BRC-developed applications tailored to specific communications challenges or licensing of the SDE proprietary processes to original equipment manufacturers (OEMs) requiring applications that require reduction in bandwidth and/or implementation of techniques to ensure secure transmission of structured data.

Company Objectives: BRC envisions that the SDE be recognized as a revolutionary communications capability and this technique become the preferred method of reducing bandwidth consumption for communication of structured messages.

Potential Commercial Applications: The SDE works in any communications requirement that utilizes structured messages and offers the same level of bandwidth reduction whether for command and control of unmanned systems in degraded or denied combat environments or command and control of a fleet of commercial vehicles in a congested communications environment in a dense, urban environments. Potential beneficiaries include telecom companies such as Verizon, Sprint, etc., fleet management companies such as commercial shipping and distribution companies like FedEx, UPS, etc., and first responder networks at the local, state and federal level including US Coast Guard and other agencies of the Department of Homeland Security.

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