# NASA SBIR/STTR Technologies

## T5.01-9945 - Bio-Inspired Autonomous Communications Systems with Anomaly Detection Monitoring


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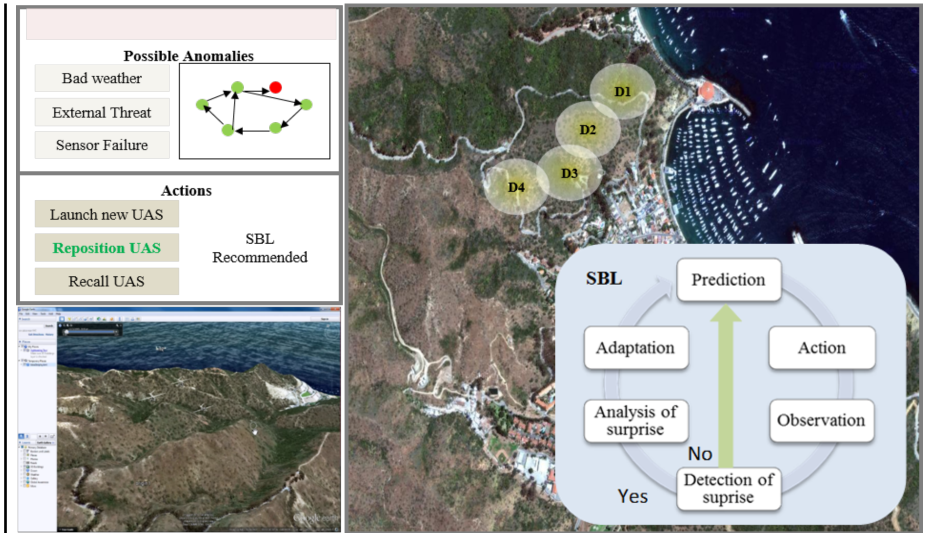
## Identification and Significance of Innovation

Develop, prototype, and demonstrate BioComm, a bio-inspired autonomous communications system (ACS) aimed at dynamically reconfiguring and redeploying autonomous communication assets in accordance with both mission objectives and communication demands simultaneously.

BioComm to be embedded with ADaM (Anomaly Detection and Monitoring) capability which enables human supervisors or operators to exploit, benefit from, and interact with BioComm systems with high confidence by alerting the operators of multiple, heterogeneous ACSs on anomalous system behaviors without requiring a deep understanding of the underlying systems.

- Digital Hormone Model augmented with Criticality-Sensitive Control
- Surprise-Based Learning capable of learning the expected or normal behavior of a wide range of autonomous systems, detect any behavioral anomalies or deviations from the norm, identify potential causes, and recommend feasible changes to a human supervisor.

Estimated TRL at beginning and end of contract: ( Begin: 3 End: 5 )




## Technical Objectives and Work Plan

Technical Objective: Develop and demonstrate the feasibility of BioComm for autonomous, self-configurable, self-adapting communication systems (ACS) based on the proven technologies of digital hormone and criticality-sensitive control.

Work Plan:

Task 1 (4 weeks) -- Develop system architecture for BioComm-ADaM that combines Digital Hormone Model (DHM), Criticality-Sensitive Control (CSC), Surprise-Based Learning (SBL), and cognitive radio communication configuration autonomy (CCA)
Task 2 (8 weeks) -- Define baseline specification of BioComm with communication configuration autonomy
Task 3 (8 weeks) -- Define baseline specification of SBL-based ADaM
Task 4 (12 weeks) -- Evaluate and demonstrate the architecture integrated and prototyped with the components via system-level simulation using CORE (versatile network emulator)
Task 5 (8 weeks) -- Develop and demonstrate preliminary GUI for the BioComm-ADaM system.
Task 6 -- Program management, meetings, travel, and Phase II planning.

## NASA Applications

-- Application 1: End-to-end delay may be significantly reduced by enabling ACS assets to automatically adjust their positions until they can communicate again instead of waiting for the next rendezvous time.
-- Application 2: A group of ACSs are flying in a large formation as a distributed "antenna" or "telescope" to the correct location without losing the radio communication while still maintaining the formation shape.

## Non-NASA Applications

- Commercial drones market with low-cost COTS SDR products for multi-drone applications such as disaster emergency response

## Firm Contacts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