Ground Vehicle Systems Center

Close-out Report

Agreement Number: 19-15

Collaborator Name: To the Stars Academy of Arts and Science, Inc. (TTSA, now TTS)

Date Closed: 10 October 2024

Agreement Title: Novel & Emerging Technology Exploitation (NETE)

Government Principal Investigator/POC: Ben Soave, Joseph Cannon

Project Synopsis:

To The Stars Academy of Arts and Science (now The The Stars (TTS)) is a company with materiel and technology innovations and artifacts that TTS believes can provide capability advancements for Army ground vehicles. These technology innovations have been acquired, designed or produced by the Collaborator, leveraging advancements in metamaterials and quantum physics to push performance gains. The Collaborator provided an artifact/technology to US Army DEVCOM Ground Vehicle Systems Center - Ground Vehicle Survivability and Protection (GVSP), who use Government laboratories and resources to characterize the technology and find applications for ground vehicles.

Research Plan:

This research effort was conducted in 2 phases:

Phase 1: Material and Structural Characterization

This activity was conducted at US Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC) and characterized the material and structural properties of TTS provided Magnesium-Zinc-Bismuth Artifact (A1). Findings were published in the DEVCOM GVSC Materials Characterization Laboratory Test Report "*Analysis of Metallic Specimen of Unknown Origin*" (CUI) and the DEVCOM GVSC findings presentation *"Novel & Emerging Technology Exploitation CRADA: Artifact 1 Finding Report"* (CUI). Phase 1 analysis utilized microscopy and spectroscopy techniques to evaluate the artifact.

Phase 2: Morphology and Micro-structure Characterization

This activity was conducted by the All-Domain Anomaly Resolution Office (AARO) in partnership and with Oak Ridge National Laboratory (ORNL). AARO and ORNL evaluated Artifact 1's structure, chemical composition, and isotope ratios via multiple methods, including microscopy, spectroscopy, and spectrometry. ORNL and AARO reports and findings can be found at the following link: https://www.aaro.mil/UAP-Records/ .

TRL Beginning: N/A

TRL End: N/A

Government Goals: Characterize and exploit emerging and novel material artifacts and technologies for ground vehicle applications.

Collaborator Goals: Utilize government analysis and findings to adapt TTS technologies for military ground vehicle applications.

Research Results:

The primary functional claim of TTS for A1 was that its micro-structure resembled and possessed the constituent materials to serve as an electro-magnetic (EM) energy wave guide as describe by Podolskiy et al.[1] Macro- and micro-material characterization was performed by GVSC, AARO, and ORNL (USG) between 2019 and 2024.

The USG found that the physical and elemental properties of the A1 are incompatible in its current state to serve as an EM wave guide. While the samples possessed the constituent materials suitable for an EM waveguide, the present physical structure and elemental properties are incompatible to function as an EM waveguide. Considering all available evidence, the USG assessed that this specimen is likely a test object, a manufacturing product or byproduct, or a material component of aerospace performance studies to evaluate the properties of Mg alloys.

Benefits Gained:

Numerous benefits were achieved through this collaborative research effort. Those benefits include:

- Private and Government entities working together to advance knowledge and understanding of contemporary scientific questions of national security interest.
- Expanded networks and relationships between disparate USG agencies and private industry toward common national security interests.
- Advancement of public knowledge and scientific processes regarding the characterization and analysis of novel materials and technology.

PI Interpretation:

1. **Was the research worth the effort?**

This research was worth the effort as it advanced the knowledge and science regarding novel materials of national security interest. The research developed relationships between disparate government agencies, major defense industry partners, and technology entrepreneurs that will have utility when future similar research questions arise. The research informed the legislative branch and the public regarding contemporary national security questions, building trust and transparency.

2. **Did you or the collaborator test and evaluate developing technology with intellectual property rights assigned?**

The A1 sample was the intellectual property of TTS. A1 was determined to have no military or ground vehicle application as presented. No joint intellectual property was developed under the CRADA.

3. **Did the research yield expected results?**

The research did not yield a useable EM waveguide design that was anticipated upon entrance of the collaboration.

4. **Did the research solve a problem or identify new ones?**

The research answered critical national security questions at the forefront of the USG defense and intelligence community.

5. **Did the research/collaboration refine or improve processes?**

The research developed heuristics and anomalous material characterization processes as the first physical artifact that the AARO characterized and resolved as part of their legislative mandate from Congress.

6. **Did the research/collaboration yield new inventions or other intellectual property?**

No new intellectual property was developed under this CRADA

7. **Would you recommend collaborative efforts with this collaborator in the future?**

TTS has been an excellent partner and accommodating to GVSC and the DOD interest in the collaboration of their technology artifacts under the NETE CRADA. Since the CRADAs establishment, the DOD has formally established the AARO as the primary proponent for novel/anomalous material characterization. AARO and TTS have mutual interests, aims and ends and could benefit from future collaboration in this scientific space.

8. **Why or why not did the technology advance or not advance?**

The technology artifact presented by TTS was not in pristine condition given its chain of custody and reported history. The technology artifact's physical/structural state and elemental

properties are incompatible to function as an EM waveguide as originally described by TTS and concluded by AARO.

References:

[1] (U) Journal article, Journal of Modern Optics; Podolskiy, V. A., Alekseev, L. V., & Narimanov, E. E.; 03 MAY 2005; Strong Anisotropic Media: the THz Perspective of Left-handed Materials; Vol. 52(16), pp 2343–2349