

NSIN and xTech Present: Good Vibrations Challenge

I. Event Overview and Purpose

The Department of Defense (DoD) National Security Innovation Network (NSIN) and the U.S. Army's xTech Program, in partnership with the Combat Capabilities Development Command Army Research Laboratory (DEVCOM ARL) Autonomous Sensing and Integration Branch, are launching the **Good Vibrations** Challenge to implement innovative solutions for extracting unique features from ground vehicle signatures collected using acoustic and seismic sensors and to develop classification algorithms to enable robust discrimination between the different classes of vehicles. This competition is targeted at students who are currently attending an institution of higher education ([IHE](#)), pursuing a degree within the United States.

Submissions will be evaluated by a team of subject matter experts (SMEs). After an initial evaluation, up to 15 applicants will be selected as semi-finalists to participate in the Solution Development Round that begins in January 2024, and receive a \$1,000 prize award. Up to 10 applicants will be selected as finalists to attend an in-person pitch event in the Washington DC Capital Region during July 2024. The top three finalists having algorithms with the highest scored performance accuracy will be respectively awarded \$35,000, \$25,000, and \$15,000 in prize money.

II. Benefits of Participating

- \$90,000 in awards available to the selected semi-finalists and finalists.
- Potential for follow-on efforts with DEVCOM ARL.
- Exposure to leaders across multiple branches of the U.S. Department of Defense (DoD) responsible for the development and deployment of unmanned ground sensor technologies.
- Opportunities to learn from and collaborate with other academic leaders and partners in this space.

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III. Eligibility Requirements

- Students at an accredited institution of higher education
- US citizenship required
- 18 years or older
- Applicants may submit as individuals or as teams
- Ability to demonstrate the solution's capabilities by July 2024

IV. Why

The US Army is seeking novel, robust techniques to discriminate threat vehicles using inexpensive terrestrial ground sensors to gain surveillance and reconnaissance of the battlefield. With advancements in signal processing and autonomy, Army modernization efforts need to advance the terrestrial sensing layer to serve as a complementary, persistent observation channel to the aerial and space layers. This challenge focuses on developing the core capabilities of acoustic and seismic sensing for target discrimination techniques.

V. Proposed Timeline

The proposed schedule is outlined below and subject to change without notice.

Table 1. Proposed Timeline for Good Vibrations Challenge

Date	Activity
Week of October 2, 2023	Solicitation Release – challenge.gov, NSIN website, xTech website
October 26, 2023	“Ask Me Anything” Session
November 29, 2023	Solicitation Phase Closes & Down-selection begins
January 17, 2024	Down-selection ends, Semi-Finalists (up to 15) Announced & Solution Development Round begins
April 17, 2024	Solution Development Round submission Closes & Down-Select begins
June 12, 2024	Finalists announced (up to 10 participants) & Pitch Round begins
Week of July 15, 2024	Pitch Event (Up to top 10 performers) in the Washington, DC metro area.
Week of July 22, 2024	Winners (3) Announced

VI. Prizes and Incentives

Prizes will be offered under 10 U.S.C. §4025 (Prize competitions). The total prize pool is \$90,000.

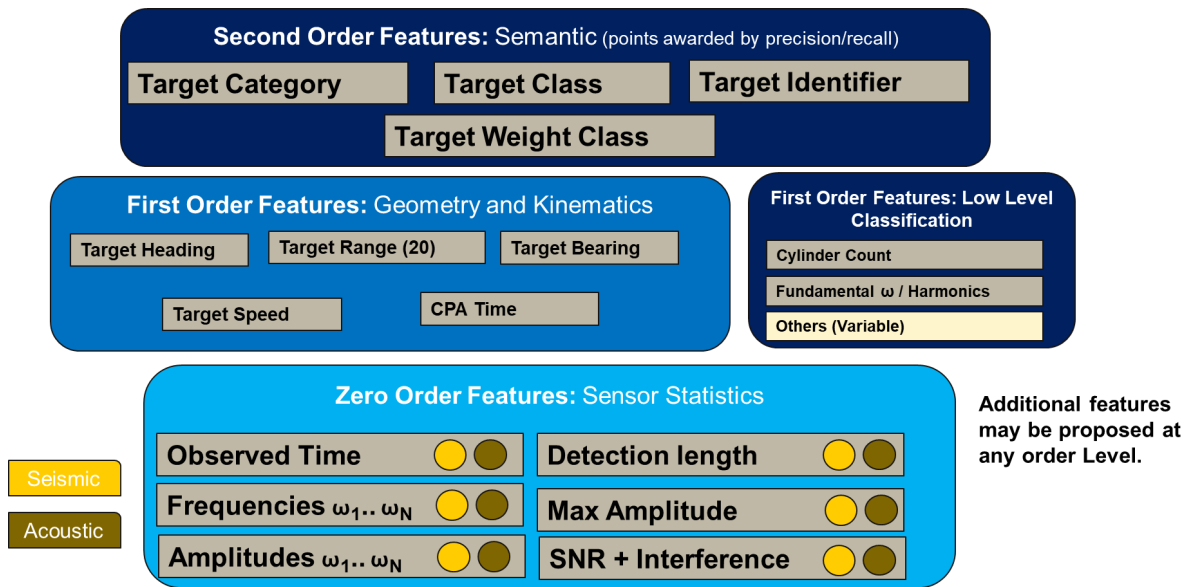
Phase	Winners	Prize
Solicitation	Up to 15	\$1,000 each
Pitch	Up to 3	1 st place: \$35,000 2 nd place: \$25,000 3 rd place: \$15,000
	Total	\$90,000

VII. Problem Statement

“Develop core (acoustic and seismic) multi-modal sensing algorithms and sensor fusion that reveal common and unique attributes for target classification of ground vehicles.”

The Good Vibrations challenge is seeking novel techniques to extract acoustic and seismic features that are unique to various categories and classes of ground vehicles using real-time, power-efficient algorithms. The goal is to extract features technically relevant to target classification (Figure 1). Data signatures from resource-constrained acoustic and seismic sensing modalities will be provided as Government Furnished Information (GFI) to the semi-finalist applicants to extract target features and determine target geometry, kinematics, and category / class. A scoring mechanism will be used to assess the viability and performance of the proposed and delivered algorithms based on criteria defined herein.

Figure 1. Taxonomy of Features for Good Vibrations Challenge



The objective is delivery of signal processing software that will process the target signature data and produce target-relevant measurements and derived data that could be leveraged by DEVCOM ARL to discriminate the nature of the detected activity.

VIII. Competition Structure (Detailed information on criteria and technical parameters can be found [here](#))

Concept White Paper Round

- (1) **White Paper:** Applicants will submit a concept white paper (not to exceed seven pages) outlining their understanding of the problem, solution and approach, potential impact, and technology

and concept viability. White papers will be evaluated on the following criteria and sub-dimensions:

- Introduction
- Problem, Proposed Solution
 - Problem Understanding
 - Solution Description
 - Innovative Approach
- Investigator's Disposition
 - Relevance of Skills and Background
 - Passion/Motivation
 - Availability
- Potential Impact
 - Zero Order Features
 - First Order Features
 - Second Order Features
 - Thresholds and Accuracy
- Technology and Concept Viability
 - Scientific Feasibility
 - Low-Power and Constrained Compute
 - Previous Source Code Example
- Presentation Quality
 - Quality of Prose
 - Data Quality & Attribution
 - Visual Aids

In addition to the above listed judging criteria, the White Paper must address:

- Proposed Programming language(s)
- Proposed Development environment
- Specific target features applicants are proposing to extract from the acoustic and seismic data signatures (provided as GFI with this solicitation).

(2) **Example Software:** Applicants will also submit a prior signal processing software example that demonstrates the applicant's ability to provide solutions. The example software will be evaluated by signal processing SMEs.

Solution Development Round – Semi-Finalists (More detailed information on criteria and parameters can be found [here](#))

Applicants selected as semi-finalists to proceed to the Solution Development Round will be allotted a period of 3 months for the development of software algorithm solutions, which will be evaluated on the following criteria and sub-dimensions:

- Solution Summary

- o Introduction
- o Design Description
- o Innovative Approach
- System, Architecture, and Hardware
 - o System Architecture
 - o Material List
 - o Low-Power and Constrained Compute
 - o Platform Cost
 - o Components Availability
- Performance
 - o Zero Order Features
 - o First Order Features
 - o Second Order Features
- Code Submitted
 - o Source Code Provided
 - o Readme
 - o In-Line Code Documentation
- Quality of Deliverables
 - o Quality of Prose
 - o Data Quality & Attribution
 - o Visual Aids

a. Solution Development Round Deliverables:

- o Includes software, precise and replicable description of the build environment, and any dependencies that are not Free and Open-Source Software (FOSS).
- o Documentation for the algorithm, API, and executables.
- o Description of developmental hardware environment with emphasis on compliance to the requirement of being a “low-power, computationally constrained, platform”.

Pitch Round for Finalists

The Pitch Round begins when the Solution Development Round closes. Applicants selected as finalists in this round will deliver a presentation and pitch their solutions in an in-person event in the greater Washington, D.C. area in July 2024. The pitch will include 10 minutes for a public presentation and 5 minutes for questions and answers from the judging panel. Presentation topics will include a description of their actual implementation to include signal processing methods, software architecture, consistency with their proposed solution from white paper round, and overall results. The deliverable for the Pitch Round is a presentation viewgraph formatted as follows:

- o Sized 16:9 (1920x1080 pixels)
- o Horizontal presentation

- o PDF file

The Pitch Round will be evaluated in five key areas:

- Overall technical approach
- Proposed algorithm description(s)
- Proposed Programming language(s)
- Proposed Development environment
- Specific target features applicants are proposing to extract from the acoustic and seismic data (provided as GFI with this solicitation).

Additional details will be provided to Finalists in preparation of the pitch event.

IX. Intellectual Property

Students retain ownership of existing Intellectual Property (IP) submitted under this Challenge and agree that their submissions are their original work. Students are presumed to have sufficient rights to submit the submission. For any submission made to the Challenge, you grant NSIN and DEVCOM ARL a limited license to use this IP for testing and evaluation for efforts specifically related to the Challenge. NSIN and DEVCOM ARL will negotiate with individual competitors in the event additional usage, integration, or development is contemplated.

X. Follow-On Activities

This NSIN Challenge public announcement is an open call to students seeking innovative, commercial technologies proposed to create new DoD solutions or potential new capabilities fulfilling requirements, closing capability gaps, or providing potential technological advancements, technologies fueled by commercial or strategic investment, but also concept demonstrations, pilots, and agile development activities improving commercial technologies, existing Government-owned capabilities, or concepts for broad Defense application(s). As such, the Government reserves the right to award a contract or an Other Transaction to eligible entities for any purpose, to include a prototype or research, under this public announcement. The Federal Government is not responsible for any monies expended by the applicant before award and is under no obligation to pursue such Other Transactions.

This Open Call Announcement is considered to have potential for further efforts that may be accomplished via FAR-based contracting instruments, Other Transaction Authority (OTA) for Prototype Projects 10 USC 4022 and Research 10 USC 4021, Prizes for advanced technology achievements 10 USC 4025 or Cooperative Research and Development Agreements. If a prototype OTA is awarded and considered successfully completed, follow-on software development may be pursued in accordance with 10 USC 4022(f). The public open call announcement made at NSIN Presents: Good Vibrations Challenge is considered to satisfy the reasonable effort to obtain competition in accordance with 10 USC 4025(b), 10 USC 4021 and 10 USC 4022. Any FAR-based actions will follow announcement procedures per FAR 5.201(b) accordingly actions will follow announcement procedures per FAR 5.201(b) accordingly.

About [DEVCOM Army Research Laboratory](#)

The U.S. Army Combat Capabilities Development Command (DEVCOM) Army Research Laboratory is the Army's research laboratory strategically placed under the Army Futures Command. DEVCOM ARL is the Army's sole foundational research laboratory focused on cutting-edge scientific discovery, technological innovation, and transition of knowledge products that offer incredible potential to improve the Army's chances of surviving and winning any future conflicts. DEVCOM ARL executes intramural and extramural research organized by 11 competencies that provide the Army with foundational expertise and specialized capabilities grounded in scientific excellence and driven by unique Army challenges. Our disruptive scientific research coupled with collaborations and prioritized funding to the worldwide scientific community, both academic and commercial, create and exploit scientific knowledge in the competencies that are leveraged to develop new opportunities, build programs, align people and funding, and advise on future operational concepts.

About [National Security Innovation Network \(NSIN\)](#)

NSIN, the National Security Innovation Network, is an unrivaled problem-solving network in the U.S. Department of Defense that adapts to the emerging needs of those who serve in the defense of our national security. We are dedicated to the work of bringing together defense, academic and entrepreneurial innovators to solve national security problems in new ways.

About [xTech](#)

The xTech Program hosts Army prize competitions, connecting businesses with Army and DoD experts to build solutions for current problems. Through these competitions, the xTech Program, led by the Assistant Secretary of the Army for Acquisition, Logistics, and Technology, allows businesses to compete for cash prizes and potential follow-on contracts to accelerate and transition their transformative technology solutions into the Army.