FCMR-RTJ
SUBJECT: xTech Brain Operant Learning Technology (xTechBOLT) Prize Competition

Summary

The US Army Medical Research and Development Command (USAMRDC) is announcing the xTech Brain Operant Learning Technology – *xTechBOLT* – prize competition. The prize competition is designed to incentivize industry to develop and demonstrate the use of one or more tool(s) (e.g., QEEG, fMRI, MEG, BIOMRK, NIRS, PET, MEA, SPECT, or other) to locate, track, and trace four types of learning traits, including explicit and implicit knowledge, from exposure to storage, and use those neural pathways to capture emotions and empathy and research a proof of concept mechanism (software or hardware, or both) that could be developed to promote optimal retention and access to memories.

The goals for this competition are to understand the effects of emotion and empathy on learning and memory and the functional roles played by various brain regions and their mutual interactions in relation to emotional and empathetic processing and effect on both implicit and explicit learning. Understanding these effects will help build the United States Military of the future, by revolutionizing how we teach and train Warfighters, how we build better medical providers, and how we utilize novel brain operant learning technologies.

The Army (and more broadly the U.S. Department of Defense) seek “path finding” teams and technologies through this competition. Therefore, xTechBOLT is not interested in low-risk, repackaged approaches of tried and true techniques. We aim to find early-stage innovations with the potential to dramatically improve military training outcomes with novel hardware- and/or software-based technologies.

The Army recognizes that it must enhance engagements with innovative problem solvers, by: (1) understanding the spectrum of technologies under development commercially that may benefit the Army; (2) integrating small business innovators into the Army’s Science and Technology (S&T) ecosystem; and (3) providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the Army.

The xTechBOLT competition will provide increasing non-dilutive prizes to select applicants to proceed in the competition. All applications will be reviewed by Army subject matter experts and up to 10 applicants with the highest ranking concept white papers will receive a prize of $10,000 each and advance to give a pitch on their proposed concept to a live Army judging panel. The live judging panel will select five (5) applicants to receive additional awards of $25,000 each and be invited to present a proof-of-concept of their technology solutions at the 2021 Interservice/Industry Training,

Simulation and Education Conference (I/ITSEC) in Orlando, Florida. Out of those five (5) finalists, a grand prize winner will be selected and awarded an additional $500,000 prize. The remaining finalists will receive prizes as follows: Second place - $125,000.00, Third place – $75,000.00, Fourth place - $50,000.00, Fifth place - $25,000.00. Details on the prize structure are listed below in this announcement.

Background

Learning and memory maintain a very interdependent relationship. Learning secures information and skills while memory relates to how the information is stored, recalled and put into practice.

Learning is divided into explicit knowledge (traditional source content, courses, articles, and lectures) and implicit knowledge (skills, ideas, experiences). Each day our 100 Billion neuron brain is inundated with over 34 gigabytes of information - 105,000 words (23 words per second during awake hours). Each parcel of information is stored in a 2.5 Petabyte memory bank with room to spare. Different regions of the brain are utilized to store declarative and procedural memories. Using effective connectivity analysis, two different brain networks have been identified that drive learning styles. While both processes involve activation in a set of cortical and subcortical structures, explicit learners engage a network that uses the insula as a key mediator whereas implicit learners evoke a direct frontal-striatal network.

Emotion and empathy have substantial influence on the cognitive processes in humans, including perception, attention, learning, memory, reasoning, and problem solving. Emotion also facilitates encoding and helps retrieval of information efficiently. However, emotion may enhance or impair learning and long-term memory (LTM) retention. Neuroimaging indicates that the amygdala and prefrontal cortex cooperate with the medial temporal lobe in an integrated manner that affords memory consolidation, encoding, and formation; and finally requires the hippocampus for successful learning and LTM retention.

An essential central psychological skill is empathy; the ability to understand and to share the mental states of others. Both cognitive empathy (mentally representing other's thoughts, feelings, and intentions), and affective empathy (aligning one's own emotions and behaviors with another person's emotional state) affect learning and memory. Neuroimaging suggests that affective empathy is generally supported by activation of

the inferior frontal gyrus (IFG), anterior insula, anterior cingulate cortex, and supplementary motor area (SMA), while cognitive empathy is supported by the activation of the IFG, anterior insula, and the anterior midcingulate cortex (aMCC).

Although efforts are intended to be applied across the joint force, this effort aligns with the Army Soldier Lethality (Medical Readiness) priority. Once procedural and declarative memory efficiencies are identified and understood, military scientists can then design technologies to produce optimal learning, enhancing human ability and skills, to produce a lethal effective military capable of handling any, and all, adversaries.

Prize Competition Objectives

a. xTechBOLT is seeking applicants to use one or more tool(s) (e.g., QEEG, fMRI, MEG, BIOMRK, NIRS, PET, MEA, SPECT, or other) to:

- Locate, track, and trace four types of learning traits including explicit and implicit knowledge from exposure to storage, and use those neural pathways to capture emotions and empathy from exposure to storage;
- Research a proof of concept technology which may include software or hardware, or both that could be developed to promote optimal retention and access to memories.

b. Applicant technologies must be independently verified as either: mature Basic Research, at a Technology Readiness Level (TRL) of 2, and ready to move into Applied Research; or can be verified at a TRL for 3 or 4,

c. Applicant technologies must have an executable strategy to mature to a TRL of 6 and

d. Applicant technologies must have a transition strategy, for movement to a Program Management Office (PMO).

Applicant Eligibility

Each eligible entity:

- Shall be incorporated in, and maintain, a primary place of business in the U.S.;
- May not be a Federal entity or employ a Federal employee acting within the scope of their employment.
- Sole proprietors may participate in xTechBOLT if the individual is a citizen or national of the U.S. or a lawful permanent resident of the U.S. and the business is registered in the U.S.

- Foreign companies may participate in xTechBOLT by establishing a U.S. domestic business relationship (e.g., wholly owned U.S. subsidiary) or partner with an U.S. based company.

Competition Overview

Each applicant must participate in each phase of the competition to be eligible for the final prize. Final demonstrations will take place at the 2021 Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) in Orlando, Florida.

Proposed Schedule (Subject to Adjustments):

Date	Activity
Release – 16 October 2020	**Concept White Paper submission period**
9 November 2020	**Semifinals Technology Pitch invitations sent**
30 November 2020 – 2 December 2020	**Semifinals Technology Pitch Days at I/ITSEC 2020, Orlando, FL**
2 December 2020	**Finalists Announced**
30 November 2021 -2 December 2021	**Finals Judging at I/ITSEC 2021, Orlando, FL**
2 December 2021	**Winner Announced**

- **Date of Release through 16 Oct**: Phase 1 deadline for submission of Concept White Papers to the xTechBOLT competition. Submissions received after the deadline will not be reviewed.

- **9 Nov 2020**: Panel selects up to 10 Concept White Paper winners. Winners will be invited to Phase 2, Technology Pitch, at I/ITSEC in Orlando, Florida starting on 30 November 2020.

- **30 NOV 2020**: Phase 2 Semifinal - Technology Pitches: Up to 10 applicants conduct technical presentations to the xTechBOLT Panel at I/ITSEC in Orlando, Florida. The panel will select up to five (5) finalists. These finalists will be invited to Phase 3 to submit a proof of concept presentation.

- **30 Nov 2021** – Phase 3 Final - Presentation: Proof of Concept Presentation with the Joint Health Subject Matter Experts and Leadership at I/ITSEC in Orlando, Florida.

Prizes & Incentives: Prizes will be offered under Title 10, US Code (USC) Section 2374a (Prizes for Advanced Technology Achievements). The total prize pool is $1 M. See table below for Prizes per stage.

Phase	**Number of Winners**	**Prize**
Concept White Paper Submissions	Up to 10	$10,000 each
Semifinals Technology Pitches	Up to 5	$25,000 each
Final Proof of Concept Presentation	Up to 5	1st Place – $500,000 2nd Place - $125,000 3rd Prize - $75,000 4th Place – $50,000 5th Place - $25,000
	Total	**$1,000,000.00**

The efforts described in this Notice are being pursued under the authorities of 10 US Code (USC) 2374a (Prizes for Advanced Technology Achievements). While the authority of this program is Title 10, US Code (USC) Section 2374a, a concept white paper submitted to the xTechBOLT program may generate interest by another Army organization for a funding opportunity outside of this program (e.g., submission of a proposal under a Broad Agency Announcement). The interested Army organization may contact the applicant to provide additional information.

xTechBOLT Application Process:

The xTechBOLT program is voluntary and open to all entities that meet the eligibility requirements. **There may be only one submission per eligible entity.** The registration information and upload submission must be received by 11:59 PM PST on 15 September 2020. Submissions received after the deadline will not be considered.

Visit the contest page for registration details:
https://www.xtechsearch.army.mil/

All xTechSearch submissions are treated as privileged information and contents are disclosed to Government employees or designated support contractors only for the purpose of evaluation and program support.

a. Concept White Paper Submission

i. All eligible entities shall submit a concept white paper and accompanying video up to 3 minutes in length outlining their use of one or more tool(s) (e.g., QEEG, fMRI, MEG, BIOMRK, NIRS, PET, MEA, and/or SPECT) to locate, track, and trace four types of learning traits including explicit and implicit knowledge from exposure to storage, and those neural pathways capturing emotions and empathy. Applicants must indicate imperative brain areas and identify critical inflection points along neural pathways that are required for efficiency, informing future potential intervention targets. Applicants shall develop a proof of concept mechanism (software or hardware, or both) that could be developed to promote optimal retention and access to memories. The White Paper must clearly communicate understanding of the topic, tools, and technologies related to the neurobiology of operant learning, considering and applying emotion and empathy factors, and describe fully a proposal to deliver a technical solution based on emerging science, novel discovery and modern detection methodologies. The proof of concept (POC) should be able to reproducibly reveal, predict, and replicate motor and cognitive skills' pathways and movement sets, and significantly advance our understanding of the neurobiology of learning, memory, emotion, and empathetic brain-behavior, and possible brain-machine interconnectivity. Additionally, the POC should align and support the future capability to advance targeted stimulation of the brain's connective networks, influence synaptic gates to enhance training effectiveness and skill permanence, and entertain the ability to insert novel "unexperiences."

ii. Please adhere to the following requirements:

- All concept white papers must be submitted using the template found on the registration page, *"xTechBOLT_WhitePaper_Template.doc"*. **Any white papers submitted in a format other than that provided by the template will not be reviewed.**
- Provide an optional **Vimeo URL** on the contest registration page to a video supporting your application. Production value does not matter at all, and the can be used to briefly explain the concept, introduce your team, or to otherwise demonstrate the technology concept proposed. **MAXIMUM of 3-minutes for the video's length.**
- Please list your company name, and proposal title EXACTLY how you would like them to appear on any contest marketing materials,

recommend clear and concise proposal titles to give readers and potential stakeholders understanding of how your technology would benefit the Army.

iii. Each concept white paper will be reviewed by an xTechBOLT Panel including Warfighter, acquisition, and research and development subject matter experts. Up to 10 applicants with the highest ranking concept white papers will receive a prize of $10,000 and advance to Phase 2: Technology Pitches.

iv. The concept White Papers will be evaluated using the detailed evaluation criteria found on the contest submission page.

b. Semifinals: Technology Pitches

i. Selected applicants will conduct an in-person live public presentation at the I/ITSEC Conference in Orlando, Florida. Applicants will present their technology concept and team ability to the Army xTechBOLT Panel. The technology pitch shall outline their technology (with a justification for the tool choice (e.g. QEEG, fMRI, MEG, BIOMRK, NIRS, PET, MEA, SPECT, or other) used in identifying operant brain pathways and identify the software or hardware, or both that will advance the human learning process, applicability (the potential impact on Revolutionizing the Military Health System (MHS) and Army Medicine), and presentation quality (the ability to communicate the concept so as to be understood by a diverse audience). Each applicant will have 15 minutes to pitch, followed by 10 minutes for questions and answers with the xTechBOLT Panel. Up to 5 applicants will receive a prize of $25,000.00 and a written invitation to Phase 3, the xTechBOLT Semifinals.

ii. Detailed instructions and evaluation criteria will be provided to applicants selected to conduct the in-person presentations at I/ITSEC.

iii. Up to 5 finalists will be invited to make a live Proof-of-Concept Demonstration at the I/ITSEC Conference in Orlando, Florida.

c. Finale – Proof of Concept Demonstration

i. Up to 5 finalists will be invited to conduct an in-person Proof-of-Concept Demonstration to a panel of Army subject matter experts and the public at the I/ITSEC Conference in Orlando, Florida.

ii. Detailed instructions and evaluation criteria will be provided to finalists. A single grand-prize winner will be selected by the xTechBOLT Panel and awarded a prize of $500,000. The remaining finalists will be ranked and placed in order of merit and awarded prizes as follows: Second place - $125,000.00, Third place – $75,000.00, Fourth place - $50,000.00, Fifth place - $25,000.00.

Intellectual Property
The Army is a strong proponent of deliberate intellectual property (IP) rights and management by the private sector and the Department of Defense. For the xTechBOLT program:

a. The Federal Government may not gain an interest in IP developed by an applicant without the written consent of said applicant;
b. Nothing in this xTechBOLT prize competition shall diminish the Government's rights in patents, technical data, technical information, computer software, computer databases, and computer software documentation that the Government had prior to this xTechBOLT prize competition, or is entitled to, under any other Government Agreement or contract, or is otherwise entitled to under law; and
c. The Federal Government may negotiate a license for the use of IP developed by a registered applicant in the prize competition.

Visit Contest Page now:
https://www.xtechsearch.army.mil/

Point of Contact
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