2019

Introducing Our 2019 Seed Projects

Monterey, California; Naval Postgraduate School

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Twelve student and faculty research projects at the Naval Postgraduate School (NPS) are receiving seed funding to continue developing their ideas. The Seed Program exists to provide initial capital for research that improves national security and war-fighting capabilities through a competitive, venture capital funding model:

- Phase One: Open call for research proposals
- Phase Two: Selected projects receive $10,000 each to develop a detailed plan
- Phase Three: Selected projects receive additional funding to complete research

Here are the twelve projects selected for 2019 seed funding:

- **Cybersecurity Exercises for All: Content Development and Usability Improvements for Labtainers:** Labtainers is an environment for creating and deploying Linux-based cyber exercises, useful for student education and professional development. Labtainers offers realistic, complex exercises with multiple networked computers. Labtainers exercises have been incorporated into courses at NPS, the University of Chicago, the University of Florida, and CSU-Long Beach, among others, and have potential to be effective training aids for other Department of the Navy organizations. This project will expand the library of Labtainers exercises and develop new labs to support cybersecurity education. It will also enhance the Labtainers lab authoring tools by creating an integrated development environment. Lead researcher: Chad Bollman, assistant professor at NPS
- **The NPS Data Center for the Global Temperature-Salinity Profile Program (GTSPP):** This project will establish the NPS Data Center for the Global Temperature-Salinity Profile Program (GTSPP), which aids the scientific community and Naval Undersea Warfare Center. Managing the GTSPP provides NPS a rare opportunity to reach large-scale, real-time data on ocean temperature and salinity. This project will implement a data flow monitoring system to improve the collection and timeliness of data and increase quality control. These improvements will enhance the U.S. Navy's sea power capability. Lead researcher: Peter Chu, distinguished professor at NPS and chair of the Oceanography Department
- **The Strategic Value of the Defense Industrial Base:** Trends, Challenges and Opportunities: The decline in the defense industrial base over the last decade, whether it is perceived or real, has contributed to the strategic atrophy outlined in the 2018 U.S. National Defense Strategy. The defense industrial base is important for the security of our country and our ability to avoid, or fight and win, future conflicts. This project will seek to provide an understanding of the defense industrial base as a strategic asset, and gain an understanding of the industry trends and potential gaps, and identify ways to fill the gaps. Lead researcher: Geraldo Ferrer, associate dean for research at NPS and chair of Naval Supply Chain Management

- **World Peace and/or a Piece of the World: Media's Supporting Role in China's Foreign Affairs Aspirations:** With a $50 billion Asian Infrastructure Investment Bank and a $40 billion Belt and Road Initiative to facilitate easier trading with Asia, Africa and Europe, China is aiming to reshape international world power with impressive financial backing. This research aims to shed light on how Chinese media reports on these initiatives by analyzing trends in the daily English language news headlines by China's official state news service, Xinhua News Agency. It will draw conclusions on the intent behind these omissions, and other positive and negative sentiments present in Chinese media. Lead researcher: Elizabeth Gooch, assistant professor at NPS
- **Additive Manufacturing of Metal Foams Using Activated Precursors:** Additive manufacturing (AM) of metal structures provides unique opportunities for design and performance of fabricated parts that are otherwise inaccessible. Specifically, metal foams have potential use in ultralight buoyant parts, catalysts and fuel cells that are of interest to the U.S. Navy. This research will investigate a potentially scalable AM approach that brings together the unique expertise of researchers at NPS. The research is expected to yield a novel alternative scalable fabrication method that can generate large metal parts with unique properties, as well as successful proposals, publications and patents. Lead researcher Emre Gunduz, associate professor at NPS
- **Portable Dynamic Transmission Electron Microscopy Using Pyroelectrics:** A transmission electron microscope (TEM) is a powerful characterization tool that can reveal atomic scale details in materials. TEMs are used throughout the U.S. Navy and other laboratories to give detailed information on phase composition and crystal structure. This project includes the design and building of custom pyroelectric crystals, and is expected to yield designs and working prototypes for a pyroelectric dynamic TEM, as well as successful proposals, publications and patents. This research team also expects to initiate collaborations with other national laboratories and institutions such as Lawrence Livermore National Laboratory and Los Alamos National Laboratory. Lead researcher Emre Gunduz, associate professor at NPS
- **The NPS Cabled Acoustic Observatory:** The U.S. Navy needs to maintain its competitive edge in its ability to observe, characterize, and predict the nature of the ocean environment and its impact on naval sensor systems. An acoustic observatory at NPS will provide unique data sets for research relevant to Navy needs in the undersea environment. Underwater acoustics is still the principle mean for "seeing" through the ocean and conducting the U.S. Navy undersea warfare mission. And Monterey Bay and adjacent waters off the Central Coast of California offer a unique natural marine setting that is ideal for a cabled acoustic laboratory. The NPS Cabled Acoustic Observatory will provide a continuous data stream of high-bandwidth information that could be the basis for research in numerous areas. With this facility readily accessible, NPS can conduct multifaceted experimentation supporting both classroom and research activities. Lead researcher John Joseph, research associate at NPS
- **DTN-IP Fusion Communication Architecture for Survivable Tactical Mesh Networks:** Over the last decade, the U.S. Army and Marine Corps have expressed the need for high-capacity networked communications and warned of future mission requirements to connect manned and unmanned units. Simultaneously, there is an ongoing (and admirable) effort to migrate all networking needs to "commercial off-the-shelf" (COTS) equipment. However, there is a

tension between these two goals, due to the fact that the commercial market does not incentivize the development of infrastructure-less, autonomic wireless devices. This research team seeks to further develop their architectural solution to relieve this tension between military operational requirements and COTS device limitations: the DTN-IP Fusion Framework. DTN, or Disruption-Tolerant Networking is a hop-by-hop communications paradigm (in contract to traditional IP's end-to-end paradigm) and is designed to handle precisely the communication challenges encountered in adversarial tactical environments. Lead researcher Justin Rohrer, assistant professor at NPS

- **Naval Postgraduate School Emerging Technology Center:** This research will establish the Naval Postgraduate School Emerging Technology Center (ETC) to serve as NPS's conduit for engaging external stakeholders from government, academia, national labs, and Silicon Valley. The ETC will facilitate these relationships to allow NPS faculty and students to provide research and capabilities to external stakeholders. The research will focus primarily on Silicon Valley technology, in order for the private sector to receive feedback on how to better enhance their products for government and military operational purposes. The ETC will directly expand NPS's collaborative work with industry and other government organizations. Lead researcher Allison Scarborough, faculty associate of research at NPS
- **Neutralizing China's Power in Africa:** Economic Strategies for the U.S.: Africa is home to large supplies of natural resources, a growing population and significant growth potential. If the U.S cannot address China's dominant presence on this continent, it will be a missed opportunity for U.S. investors. China's big investments tend to take the form of loans for large infrastructure projects. For example, the government of Sierra Leone just cancelled a 300+ billion loan from China to construct a new airport. This research will provide insight as to how and why African governments respond to Chinese investments, which can help the U.S. identify opportunities to invest and strengthen ties with African partners. It will also examine whether and how U.S. trade and investment can strengthen U.S. partnerships with African countries and mitigate the expansion of Chinese power in Africa. Lead researcher Rachel Sigman, associate professor at NPS
- **Porting the CyberCIEGE Video Game for Broader Use:** CyberCIEGE is an educational video game and a popular and proven learning tool for enhancing computer network security education and training. Developed and maintained by NPS, the game has an established user base within the U.S. Government as well as in universities, community colleges and high schools. However, CyberCIEGE currently requires a Windows platform. This research project will port it to a ubiquitous gaming platform, such as Unity, to further broaden its potential audience. This process would also make CyberCIEGE available on mobile devices, such as tablets, and eventually as a web service accessed via a browser. Lead researcher Mike Thompson, research associate at NPS
- **Adapting Commercial Technologies to Modernize Tactical Communications:** Tactical networks are composed of heterogeneous links (i.e., Bluetooth, WiFi, cellular, etc.) that support mobile ad hoc communications. In the last few years, there has been an active push within the Department of Defense to use Software Defined Networks (SDN) for deployment of tactical mobile ad hoc networks. A SDN enables a node to decouple network control and data forwarding operations, which allows for better network management and network security. Modernizing the network infrastructure of the Navy and Marine Corps by utilizing

commercial technologies and standards will enhance the mission effectiveness of these systems in terms of data communications and cybersecurity. The cyber threats against military network infrastructure requires new solutions to safeguard tactical communications. SDNs enhance network security via centralized control of network behavior. This project aims to take the first steps towards addressing, in a systematic fashion, the use of SDNs to ensure reliable, secure routing of relevant information in tactical networks. Lead researcher Preetha Thulasiraman, associate professor at NPS

The Seed Program is continuing to fuel more innovative research each year, and there are more projects seeking full funding. To learn more, visit npsfoundation.org/defense-innovation-fund.

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