5G ZONE
INDIANA

Response to the U.S. Department of Commerce

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Introduction

NINETWELVE INSTITUTE

NineTwelve Institute (NTI) teams industry, government and academia to meet critical technology needs. Its unique collaboration platform accelerates the design and implementation of emergent solutions by bringing together the key elements of innovation: collaboration, prototyping and experimentation.

By creating these cross-sector collaborative networks that design and deliver groundbreaking solutions, NTI focuses on emergent technologies such as 5G, advanced manufacturing, and trusted microelectronics.

INDIANA 5G ZONE

The Indiana 5G Zone (IN5GZ) is one of many NTI collaboratives, advancing the transformation of physical industries by powering smart cities, intelligent logistics and advanced manufacturing.

The Lab is a state-based public-private partnership (PPP), the first the U.S. to enable government, business, and academia to design and commercialize groundbreaking testbed offerings with immediate practical applications.

IN5GZ offers Quantum-safe Encryption as a Service (QEaas) to academic and commercial 5G networks across the country and allows potential targets in the public and private sectors to locate their data, keep their data safe, and control access remotely.

Leadership Team

SEAN HENDRIX – NINETWELVE CHIEF TECHNOLOGY OFFICER

NTIA 5G Challenge Program/Technical Lead

Mr. Hendrix is the NTI Chief Technology Officer and Managing Director of the Indiana 5G Zone. As a senior technology and management professional, he specializes in new product introduction. Mr. Hendrix has been highly successful in the start-up of new technical organizations with the purpose of engineering, developing, and launching new products for production. Mr. Hendrix has led a variety of teams and organizations spanning Systems Engineering, CV2X Networks/Protocols, Embedded Hardware Development, and Program Management. He was also the Executive Director of Engineering for A123 Systems and held leadership roles with Toyota, Delphi and Cummins.

DAVE HARDEN – CEO & FOUNDER, THE OUTPOST

Dave Harden is CEO and Founder of The Outpost, a dual-use ecosystem platform, funding and techniques that accelerate technology commercialization between government and industry and academia. Mr. Harden is an experienced President and COO with a demonstrated history of working in For Profit/Non-Profit/Government Innovation. He is highly skilled in entrepreneurship, strategic planning, strategy, team building, and management. As the Chief Operating Officer & Architect of AFWERX, he led one of the most influential and impactful government innovation programs in U.S. Department of Defense history, with unique contracting vehicles, challenge programs, online teaming and pitch platforms, and impactful outreach campaigns.

DR. LEN PICK – NINETWELVE CHIEF STRATEGY OFFICER

Dr. Pick is the NTI Chief Strategy Officer, leading the organization across 5G, Hypersonics, Innovation Services, Emerging Manufacturing, and other technology priorities. He was Director of the National Security and Defense Program Office for the Purdue Research Foundation in the National Capital Region, supporting the Department of Defense, Intelligence community, and Interagency work. He served as Senior Research Fellow at the National Defense University, Center for Technology and National Security Policy, and founded and served as Associate Director for the Mississippi State University Center for Cyber Innovation and the Center for Battlefield Innovation. He is a retired, service disabled, combat veteran who served as a U.S. Navy Special Operations Officer and senior DoD government civilian.

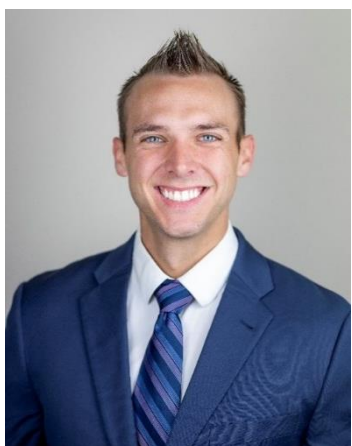## RUSTY YOUNGBLOOD – COO AND PARTNER, THE OUTPOST

Mr. Youngblood is the COO and Partner of The Outpost. He came out of 20 years of active-duty service as an Air Force Special Operator. His last 12 years have been spent as a Special Operator inside Joint Special Operations Command. Mr. Youngblood is a combat veteran with over 11 combat deployments including multiple rotations to Iraq, Afghanistan and Africa. He spent time as a small team tactical leader and a senior strategic leader. Mr. Youngblood also spent 3 years running the futures innovation team where he was personally responsible for 3 new multimillion-dollar R&D projects, as well as the management and execution of a $350M a year budget.

KASIA CHABERSKI – NINETWELVE VICE PRESIDENT, COMMUNICATIONS AND PROGRAM DEVELOPMENT

NTIA 5G Challenge Proposal Lead

Ms. Chaberski, Vice President of Communications and Program Development for NTI is a mission-driven professional focusing on development, management, and expansion of all NTI initiatives to help advance strategic technologies through vetted national and international consortia, testbeds, demo labs and innovation centers. Ms. Chaberski specializes in marketing, brand development, communications, translation, and business development, across multiple industries including microelectronics, 5G, unconventional energy, hypersonics, space, sensors, and cybersecurity.

MICHAEL BILYEU – NINETWELVE ASSOCIATE DIRECTOR

NTIA 5G Challenge Assistant Technical Lead

Mr. Bilyeu holds a Bachelor's Degree and Master's Degree in Aeronautical and Astronautical Engineering from Purdue University, where he specialized in propulsion and aerodynamics, minoring in Nuclear Engineering. At NTI, he assists member companies in the Indiana 5G Zone and other NTI innovation facilities in emergent technologies, with an emphasis on 5G and its applications for smart cities, integrated systems, cybersecurity, and transportation. He also provides practical hands-on mentoring and support services to Indiana 5G Zone members in related workforce development programs located at the lab. Prior to NTI, Mr. Bilyeu was a successful entrepreneur with expertise in tactical business strategies and sales.

BERNICE GLENN – NINETWELVE PACIFIC 5G ZONE LEAD

Ms. Glenn is NTI Vice President of Strategic Program Development, and supports the Pacific 5G Zone. She is responsible for the development of a Hawaii-based 5G lab accelerator virtually connected to the Indiana 5G Zone, with outreach to innovators, small businesses, academia, industry and government. She specializes in strategic teaming, private partnerships, US-Partner Nation technology collaboration, vetting of companies, and user-driven innovation programs. She has developed partnerships for Other Transaction Authorities, led regional economic development agencies, and managed dual-use technology accelerators. Ms. Glenn led US-Korea programs for disaster resiliency and humanitarian assistance and was designated an international telecommunications researcher by the Republic of Korea.

Challenge Structure & Goals

1.1 HOW COULD A CHALLENGE BE STRUCTRED SUCH THAT IT WOULD TAKE ADVANTAGE OF DOD'S ROLE AS AN EARLY U.S. GOVERNMENT ADOPTER OF 5G TECHNOLOGY TO MATURE THE OPEN 5G STACK ECOSYSTEM FASTER, ENCOURAGE MORE PARTICIPATION IN OPEN 5G STACK DEVELOPMENT INCLUDING ENCOURAGING NEW PARTICIPANTS, AND IDENTIFY ANY ROADBLOACKS TO BROADER PARTICIPATION?

A Challenge can be structured thematically on both DoD and Commercial use cases across strategic national security priorities and technology gaps. These could include advanced manufacturing; synthesis of sensor-sourced data for intelligence, surveillance and reconnaissance; as well as commercial applications such as the construction of complex infrastructure, consumer product applications, and other practical 5G uses. The Challenge would be a basic innovation model of end-to-end testing, bringing applications into a 5G demo lab, and testing the applications in a full environment with state-of-the-art equipment, 5G-application talent and managers, and an accelerator including troubleshooting by experts. This type of Challenge will encourage new participants and will help to identify roadblocks to broader participation by mapping and capturing issues faced by Challenge participants. This will encourage users regardless of their state of 5G integration to participate, as the Challenge includes support to bring the applications into a 5G environment.

A Challenge could also be structured to team industry, government and academia to meet critical technology needs with a collaboration platform that accelerates the design and implementation of emergent solutions by bringing together the key elements of innovation: collaboration, prototyping and experimentation.

1.2 HOW COULD A CHALLENGE BE STRUCTRED TO FOCUS ON THE GREATEST IMPEDIMENTS TO THE MATURATION OF END-TO-END OPEN STACK DEVELOPMENT?

The Challenge would take a broad approach initially in terms of technology concepts and approaches, acting as a wide topic funnel, drawing the participation of a large group of companies and facilitated to maximize solutions presented, but highly segmented into broad categories or disciplines – such as edge computing, IoT, cloud, full-stack applications etc. Using a traditional process initially, the Challenge would include a phase of reviewing these inputs and going through a transparent assessment that results in a down-select phase, where applications are tested within a practical exercise with user groups, culminating in a prototyping exercise or process.

Possible Challenge themes might include increasing technology outcomes around key 5G technical/implementation areas like frequency, deployment & coverage, cost, device/peripheral support, security/privacy, to include, but not limited to: standards, open architecture, virtualization, zero trust, network slicing, end-to-end encryption, deep network insights/real-time visualization, tech talent/workforce development, secure radio access. 5G Use Cases Challenges may include: C5ISR, Wifi, Smart Logistics, Advanced Manufacturing, Smart Bases/Cities, & AR/VR.

Three approaches could include or be combined as a selection/small demo funnel:

- o Prize/Contract (SBIR, OT, PIA, etc.) award pitch (leveraging streamlined Virtual Pitch Platform) around critical topic/theme areas;
- o Having downselected companies in the same discipline (e.g. Edge companies) compete in a standard sandbox environment (e.g. "Three companies, battle in the edge"); or

- o Creating multidisciplinary 5G stack teams and facilitating those teams to integrate to create end-to-end solutions. Essentially lightweight systems integration with a demo to merge multiple technologies to match a needed DoD capability/gap.

1.3 WHAT SHOULD BE THE GOALS OF A CHALLENGE FOCUSING ON MATURATION OF THE OPEN 5G STACK ECOSYSTEM? HOW COULD SUCH A CHALLENGE BE STRUCTURED TO ALLOW FOR THE GREATEST LEVELS OF INNOVATION? WHAT METRICS SHOULD BE USED IN THE ASSESSMENT OF PROPOSALS TO ENSURE THE BEST PROPOSALS ARE SELECTED?

Challenges focusing on critical topics/theme areas (Option 1 above) incentivizes groups to highlight how their technologies and teams will be best able to meet the narrowly-defined 5G needs.

Challenges focusing on single disciplines (Option 2 above) could feature best-in-breed by single areas, with a culminating exercise and challenge that integrates the finalists into a single team addressing a practical problem set and market.

Challenges focusing across disciplines (Option 3) would incentivize integration across levels of implementation and disciplines, strengthening the open 5G stack ecosystem by focusing on end-to-end solution teams.

The Challenges would stimulate the greatest levels of innovation by featuring and recognizing practical exercises. In our experience as a 5G lab, practical applications are critical to generating greater levels of innovation.

Metrics would be based on each team's solution in terms of their technical feasibility and commercial case feasibility. The impact of the solutions would be quantified by the technical and commercial value they create.

1.4 HOW WILL THE OPEN 5G STACK MARKET BENEFIT FROM SUCH A CHALLENGE? HOW COULD A CHALLENGE BE STRUCTURED TO PROVIDE DUAL BENEFIT TO BOTH THE GOVERNMENT AND THE OPEN 5G STACK MARKET?

Traditionally, government has been challenged in attracting the best talent and technology for rapid adoption into DOD/government problem sets. Creating multiple themed Challenges with an array of tangible outcomes (real money, real contracts) avoids "innovation theatre" and allows the government to fully access dual-use/benefit.

This proven and innovative approach to the Challenge scenarios would prioritize innovative base applications, for example in a Smart Base/Cities traffic demo, the use of video cameras would provide dual benefit to the Government and to the open 5G stack market.

The Challenge would feature solution themes across applications. The basic approaches of the Challenge are the same across the themes; we would work with National Telecommunications & Information Administration (NTIA) along with the Department of Commerce to define, market and execute specific challenges/themes.

Incentives & Scope

2.1 WHAT ARE THE INCENTIVES IN OPEN 5G STACK ECOSYSTEM DEVELOPMENT THAT WOULD MAXIMIZE COOPERATION AND COLLABORATION, PROMOTE INTEROPERABILITY AMONGST VARIED OPEN 5G STACK COMPONENTS DEVELOED BY DIFFERENT PARTICIPANTS, AND MATURE DESIRED FEATURED SETS FASTER WITH GREATER STABILITY?

At the heart of the Challenges is the value-added teaming process and arrangement, facilitated to maximize shared value and to strengthen cooperation and collaboration. Team members with inter-related or complimentary stack components will be prioritized according to new solutions their team can generate.

In addition, incentives will be provided specifically for nontraditionals (small, adjacent market or startup companies) with a financial prize, contracting opportunity, or beta partners for purchase orders provided to downselected nontraditionals and remote or in-person access to a 5G lab. The prize/contract/order will be provided to support the practical exercise portion of the lab phase.

There should be a variety of prizes offered:
1) Comprising a meaningful amount that will stimulate collaboration e.g. between $200,000 and $500,000;
2) A variety of categories of prize winnings geared towards different sectors. One example of this would be a Grand Prize of $500,000 with Sub-prizes by separate categories such as an industry category judged by a mixed government-industry-academic panel, an academic category at a relatively lower dollar amount with industry or industry-government as the judges with the part of the desired outcome focused on workforce development as recognized component of the stack ecosystem, and;
3) Prizes and incentives to stimulate follow-on innovation and collaboration across the 5G ecosystem, making it a sustainable challenge, with recognition events and assessments of projects based on featured themes that continue post-Challenge.

2.2 COULD A CHALLENGE BE DESIGNED THAT ADDRESSES THE ISSUES RAISED IN PREVIOUS QUESTIONS AND ALSO INCLUDES TEST AND EVALUATION OF THE SECURITY OF THE COMPONENTS?

Yes, it is critical that we add security evaluation and mentorship as one of the criteria and feasibility checklist. At the end of the challenge, we would provide a security bonus (e.g. $250,000) for the finalist companies/teams: we would offer the top two a specific Functional Challenge that would be evaluated via a penetration test, and provide within the Practical Challenge a $100,000 add on prize for a Security Round. This gives more opportunities for teams who are focused on security via test and evaluation, and thematically emphasizes the importance of security.

Another approach would be a "Hidden challenge" that is not emphasized specifically in the Challenge descriptions but is part of the requirement and rewarded via a bonus round.

2.3 COULD A CHALLENGE BE DESIGNED THAT WOULD REQUIRE PARTICIPANTS TO LEVERAGE SOFTWARE BILL OF MATERIALS DESIGN PRINCIPLES IN THE DEVELOPMENT OF COMPONENTS FOR AN OPEN 5G STACK?

Yes, and there are two ways to approach this that are very effective and efficient: (1) a Software Bill of Materials approach with pre-vetted software elements (e.g. elements that another software company has vetted). The teams are offered a variety of software elements from which to choose; or (2) We hold a competition to be on the Software Bill of Materials, drawing a significant number of companies whom we evaluate for the best IoT functions, machine learning, etc. The finalists across all the elements then would be designated by the Challenge organizers as the Challenge's Software Bill of Materials.

Requiring participants to leverage SBOM design principles in a significant way would require post-Challenge demand signals and grant or contract opportunities. For example, to engage innovators at a meaningful innovative level of SBOM and security, this event would need to be THE 5G challenge of the year, with a pipeline or review by the innovation ecosystem that leads teams to rapid contracting opportunities such as the National Spectrum Consortium OTs, AFWERX Programs, NavalX Challenges, and follow-on SBIR topics, CSOs, and other OTs supported by innovation maker spaces and government.

2.4 MANY OPEN 5G STACK ORGANIZATIONS HAVE DEVELOPED PARTIAL IMPLEMENTATIONS FOR DIFFERENT ASPECTS OF AN OPEN 5G STACK. WHAT PORTIONS OF THE OPEN 5G STACK HAS YOUR ORGANIZATION SUCCESSFULLY DEVELOPED WITH WORKING CODE? WHAT PORTIONS OF THE OPEN 5G STACK DOES YOUR ORGANIZATION BELIEVE CAN BE DEVELOPED QUICKLY (6 MONTHS OR LESS)? WHAT DEVELOPMENT SUPPORT WOULD BEST ENABLE TEST AND EVALUATION OF THE DIFFERENT ELEMENTS OF AN OPEN 5G STACK?

> We have full end-to-end solutions, and we can orient around partial functions of the stack and put them together with others. That is the benefit of having the reference environment. We don't require participants to be full-stack companies (this allows us to expand the scope, the participant base, collaboration possibilities, and teaming opportunities).

2.5 WHAT 5G ENABLING FEATURES SHOULD BE HIGHLIGHTED IN THE CHALLENGE, SUCH AS SOFTWARE DEFINED NETWORKING, NETWORK SLICING, NETWORK FUNCTION VIRTUALIZATION, RADIO ACCESS NETWORK INTELLIGENT CONTROLLER, RADIO ACCESS NETWORK VIRTUALIZATION?

> We will require the radio access network to be a black box component; those components are managed services by AT&T.

Timeframe & Infrastructure

3.1 WHAT SOFTWARE AND HARDWARE INFRASTRUCTURE WILL BE NEEDED TO SUCCESSFULLY EXECUTE THIS CHALLENGE?

For Software, the challenge can use a Virtual Pitch Platform, a cloud-based web application. For Hardware, members could use smartphones or computers to access the challenge application.

This approach offers the Department of Commerce and the National Telecommunications and Information Administration the ability to:

Pitch to multiple levels internally:
- Individuals
- 5G Teams
- Government Program Managers
- Industry

Rapidly receive pitching external companies:
- Provide access/and streamlined pitch approaches to speed front edge SBIR technologies, by providing access to smaller more agile companies, thus truly bridging the gap between small business and government.

Provide curated content:
- Offer an area where companies and their technologies are broken down and categorized, for easy access to Government stakeholders regardless of rank or position.

The platform is focused on 'Getting Guaranteed Feedback + Open The Door For More':

Teams receive actionable insights to fast track their ideas:
- o What they liked about your pitch.
- o What issues they see.
- o What next steps they recommend.

Teams can make their ask for what they need:
- o Project Funding: Pitch to leadership and program offices to get funding.
- o Channel Support: Speak to those who control NTIA and Department of Commerce budgets to get stuff done.
- o Introductions: Get introductions and referrals to further your ideas.
- o Advice: Get insights from the best for implementing your ideas or technology.
- o Mentorship: Grow from the support of experienced leaders.

3.2 WHAT IS A REASONABLE TIMEFRAME TO STRUCTURE SUCH A CHALLENGE? SHOULD THERE BE DIFFERENT PHASES FOR SUCH A CHALLENGE? IF SO, WHAT ARE APPROPRIATE TIMELINES FOR EACH SUGGESTED PHASE?

Depending on the program activities, the timeline could range from 6-24 months.

For a DoD 5G challenge to be successful, we would team with NTIA and the Department of Commerce to:

- Design the Challenge with end user input, helping sponsors to frame the goals, ensuring practical use-cases are addressed. During this phase, we would test the parameters of the challenge with prospective participants to identify issues based on their 5G domain-specific knowledge.

- Develop and execute an outreach plan to identify and recruit targeted participants. As part of recruitment, we would vet participants to ensure that they meet security and technical requirements of the challenge.

- Execute the Challenge, coordinating logistics including implementing the pitch platform, providing regional test sites that are practical demo labs, and recruiting experts to serve as advisors to participants and to act as judges.

- Support Challenge winners by providing them with technical lessons learned, research support, and mentoring winners in agile processes to launch their 5G applications.

Contact Information

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