SOC26BZ01-DV002: IRONWALKER

PROJECTED CMMC LEVEL REQUIREMENT:
Level 1

TECHNOLOGY AREAS:
None

MODERNIZATION PRIORITIES:
Advanced Computing and Software | Advanced Materials | Human-Machine Interfaces | Integrated Network Systems-of-Systems | Trusted AI and Autonomy

KEYWORDS:
Artificial Intelligence; Augmented Reality; Additive Manufacturing; Subtractive Machining; Advanced Manufacturing; Human-Machine Teaming; Operator Training; Expeditionary Manufacturing; Deployable Manufacturing; Digital Work Instructions; CNC Machining; 3D Printing; Autonomous Manufacturing; Field Repair; Point-of-Need Production

ADDITIONAL INFORMATION
N/A

OBJECTIVE:
The objective of this topic is to conduct applied research to an innovative capability for a deployable, and user-friendly manufacturing system that integrates Artificial Intelligence (AI) and Augmented Reality (AR) to enhance advanced additive and subtractive machining capabilities. This system will provide each operator with AI-driven advanced manufacturing expertise and AR-based work instructions to train, certify, and guide them in operating complex machinery for the production of air, ground, and maritime components.

ITAR:
The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

DESCRIPTION:
This effort will explore, design, and evaluate an innovative manufacturing capability that combines Artificial Intelligence (AI) and Augmented Reality (AR) to enhance advanced additive and subtractive machining operations. As a part of this feasibility study, the proposers shall address all viable overall system design options with respective specifications that enable rapid deployment, ease of use, and minimal training burden while maintaining the precision and repeatability required for air, ground, and maritime component production.
The research will focus on integrating AI-driven advanced manufacturing expertise with AR-based work instructions to guide operators through the full lifecycle of production—from setup and calibration to machining, quality assurance, and certification. The system shall leverage modular, transportable platforms suitable for forward-deployed or austere environments, with consideration for integration into both manned and autonomous (e.g., bipedal robotic) operations in future phases.
Proposers shall detail specification for key system attributes, including but not limited to:

- AI Capability: Real-time adaptive guidance, error detection, and optimization based on operator input and environmental factors.

- AR Work Instructions: Interactive overlays for step-by-step tasks, safety checks, and certification pathways.
- Machining Integration: Compatibility with advanced additive and subtractive manufacturing processes using multiple metal and composite materials.
- Deployment and Sustainment: Footprint, power requirements, portability, and environmental resilience.
- Cybersecurity and Data Management: Secure handling of operational data, digital twin integration, and compliance with DoD cybersecurity requirements.

PHASE I:

As a requirement of this Direct to Phase II (DPII) proposers must include a feasibility study that assess what is in the art of the possible that satisfies the requirements specified in the above paragraphs entitled “Objective” and “Description.”

The objective is to document the results of a thorough feasibility study (“Technology Readiness Level 3”) to investigate what is in the art of the possible within the given trade space that will satisfy a needed technology. The feasibility study should investigate all options that meet or exceed the minimum performance parameters specified in this write-up. It should also address the risks and potential payoffs of the innovative technology options that are investigated and recommend the option that best achieves the objective of this technology pursuit.

PHASE II:

Develop, integrate, and demonstrate a fully functional IRONWALKER prototype system. based on the optimal solution identified in the completed Phase I feasibility study. This effort will focus on merging mature additive and subtractive machining systems, commercial off-the-shelf (COTS) augmented reality platforms, and advanced AI-driven manufacturing guidance engines into a cohesive, operator-centric solution.

PHASE III DUAL USE APPLICATIONS:

This system could be used in a broad range of military applications where rapid, deployable, and precise manufacturing capabilities are needed to sustain operations in contested, remote, or resource-limited environments. In the commercial sector, IRONWALKER’s portable, AI/AR-guided manufacturing capability could support industries such as aerospace, maritime shipping, oil and gas, construction, heavy equipment repair, and disaster recovery operations. Its ability to integrate with both human operators and future autonomous robotic platforms allows for flexible deployment in locations where skilled machinists are unavailable or where traditional manufacturing facilities are inaccessible.

REFERENCES:

1. Department of Defense Additive Manufacturing Strategy, Office of the Under Secretary of Defense for Research and Engineering, January 2021, https://www.cto.mil/wp-content/uploads/2021/01/dod-additive-manufacturing-strategy.pdf
2. National Institute of Standards and Technology (NIST) – Additive Manufacturing Standards Roadmap, Version 3.0, July 2023, https://www.nist.gov/additive-manufacturing
3. Massachusetts Institute of Technology Lincoln Laboratory – Human-Machine Teaming for Manufacturing and Maintenance, Technical Report, September 2022, https://www.ll.mit.edu/sites/default/files/page/doc/2023-06/MITLL_2022_Annual_Report.pdf
4. Defense Innovation Board – AI Principles: Recommendations on the Ethical Use of Artificial Intelligence by the Department of Defense, October 2019, https://insidecybersecurity.com/sites/insidecybersecurity.com/files/documents/2019/oct/cs2019_0292.pdf

TECHNICAL POINT OF CONTACT (TPOC):

None