1. **Research Title:** Human-Robot Collaboration for Manufacturing through Natural Interactions

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

   Related Degree in Engineering, Robotics, Industrial Systems, Manufacturing, Computer Science, Machine Learning, Artificial Intelligence (MS or PhD level)

4. **Objectives:**
   Develop strategies for improving interactions between human operators and robotic hardware in manufacturing and maintenance contexts, through modalities such as natural language, gestures, and other modalities that require minimal to no operator training.

5. **Description:**
   Despite advances in robotic hardware, especially collaborative systems that allow humans and robots to operate in the same space, programming these systems is often a manual process, tailored to a specific set of motions. Real-time, natural interactions with these systems by non-experts would expand the application space. However, many challenges have complicated efforts to ease programming and expand autonomy, including difficulties associated with planning, generalizing beyond past experience or training, and spatial reasoning. This topic call seeks to address one or more of such challenges, in a manner that targets aerospace manufacturing and maintenance environments. In particular, approaches should target high accuracy, reliability, and safety, even if it requires sacrifices in generality or flexibility. Advanced machine learning and artificial intelligence approaches are welcomed–including large language models (LLMs)–but should be properly situated within a broader control architecture to maximize accuracy and reliability. Approaches may also incorporate spatial data, such as motion capture, which can be leveraged at AFRL facilities in tandem with collaborative arms and mobile hardware. The techniques developed in this research can be demonstrated using representative tasks that assess underlying ability to plan, adapt, and execute accurately.

6. **Research Classification/Restrictions:**
   Unclassified and Unrestricted. Eligible for Public Release. Open to U.S. Citizen Students Only.

7. **Eligible Research Institutions:**
   All DAGSI institutions

8. **PA Approval #:**
   AFRL-2024-4437