# Attachment 1 – Taxonomy Descriptions

This attachment lists the focus area descriptions. The descriptions are not intended to constrain industry solutions, but rather to highlight broad DoD research areas. The DoD will consider any submissions related to the focus areas below and is eager to explore creative solutions from industry.

## Human Systems

### System Interfaces & Cognitive Processes (SICP):

1. ***Distributed Teaming & Communication***: Methods and interfaces that emphasize the rapid formation, real-time assessment, and dynamically optimized performance of distributed heterogeneous teams of warfighters as well as human-machine teams in order to enable rapid, agile and robust mission operations. Areas include: Methods to enable the rapid formation of mission-effective heterogeneous teams; dynamic monitoring / assessment of team performance via optimal assemblage of novel and existing metrics; adaptive tactics for recovery from real or predicted team performance degradations; and novel distributed communication and collaboration tools, technologies and management methods that are responsive to variable network environments.

2. ***Joint All Domain Information Integration & Battle Management Enhancements***: This topic focuses specifically on warfighter-related challenges and solutions associated with envisioned joint all domain battle management activities. These challenges include, but are not limited to, how best to rapidly and continually integrate, visualize and assess cross-domain information (including cyber inputs) to support operationally relevant work activities such as battlespace situation awareness, decision-making, collaboration, work/task management, agile mission execution monitoring, and product development in a Joint All-Domain context. Research is needed to support robust and resilient Human-Machine Teaming leveraging complex automation such as AI and autonomy, and Human-Computer Interfaces to support rapid, effective and efficient tactical planning and mission execution activities in joint battle management operational contexts. This topic also includes novel, rapid transparency, prediction, and other collaborative methods to enable common ground and dynamic planning between distributed domain battle managers and other personnel across limited and/or denied comms environments.

### Protection, Sustainment, and Warfighter Performance (PSWP):

1. ***Sensor technology and the data collection/analysis infrastructure*** that is needed in order to collect real-time real-world performance data and make that data useful. Of particular interest are methods of leveraging widely commercially available wearables (i.e. fitness wearables or other wearable sensors), for the purpose of deriving performance or medically-relevant decision data, characterization, or diagnostics with direct applications to military performance.

2. ***Advanced algorithms*** that account for the influence of human variability on warfighter physical, cognitive, and/or behavioral performance. Such algorithms may utilize data from various sources, including operator traits, states, past performance and/or assessments, environmental data, medical data, physical assessments, etc. Of particular interest are algorithms that extend beyond traditional assessment criteria utilizing non-traditional metrics that predict operational performance differentiation between individuals in similar occupational roles.
3. ***Novel methods, interventions, or enhancement technologies*** (including material or non-material solutions) for the protection, performance, or sustainment of military operators in austere or environmentally extreme environments.
4. ***Understanding of how the gut responds to exposures*** (military stressors, nutrient intake), impacts of these responses on nutrition status and performance, and whether nutrition interventions could modulate this axis to optimize or significantly enhance warfighter performance.
5. Research solutions which ***combine multiple facets of the topic areas listed above***, or are applicable to wider military populations are of greater interest than solutions which only target one of these interest areas, or are applicable only to niche military populations

### Personalized Assessment, Education & Training (PAET):

1. ***Personnel Selection and Assignment*****:** Research and development in personnel assessment to produce integrated measures and adaptive testing for more precise assessment of individual potential, yielding improved personnel selection and assignment.
2. ***Instruction/Training Design, Assessment, and Readiness Monitoring*****:** Work in education and training to produce competency-based systems grounded in quantitative metrics to enable personalized, proficiency-based training that will accelerate acquisition and enhance operational performance
3. ***Advanced Learning Technologies*****:** Research to investigate best practices to leverage advanced learning technology to provide the most effective training in the most efficient manner

## Biomedical

### Biomedical CoI / Military Infectious Diseases (MID)

1. ***Far Forward Unknown Pathogen ID on Lab Analyzers***: The military lacks the ability to rapidly detect unknown infectious disease pathogens on any lab platform (FDA approved or not) in theater to mitigate infectious disease threats, which impacts forces readiness. A pathogen agnostic detection device is desired that can serve two purposes: (1) site surveillance to include site exploitation and environmental sampling to determine what pathogen(s) is present, and (2) clinical diagnostics following exposure to an unknown agent to help inform the correct treatment. The platform should

have the agility to be used far-forward as a CLIA-waived, low complexity clinical diagnostics platform.

2. ***Wearables as Infectious Disease Diagnostics***: The military lacks the ability to predict infection before it becomes syndromic either as a command/leadership tool or as a clinical diagnostic tool. Wearables are being considered for multiple different problem sets. Some (prediction of hydration status) are much more mature than others (prediction of infection). Wearable efforts in infection prediction have remained focused on physiologic measurements (heart rate variability, temperature, oxygenation, smooth muscle tetanus, etc) and machine learning algorithms from those measurements to inform prediction. Wearables must be measured by the same criteria and standards as all infectious disease diagnostics (sensitivity, specificity, positive predictive value, negative predictive value) in order to truly evaluate their effectiveness. However, no wearable to date has good enough diagnostic sensitivity or specificity using physiologic measurements alone. With current technology the ability to differentiate perturbations of physiological parameters due to infection versus other stressors/factors is unreliable. The desired endstate is a wearable solution that predicts infection in real time with acceptable sensitivity and specificity to ensure confidence in the results.
    - There is interest in determining how is the infrastructure of wearables and sensors are connected, and how/whether soldiers are expected to wear them. We would like to gain understanding where the connection goes, who it connects to, and where the information is sent.

3. ***Far Forward Prediction of Sepsis***: The military lacks the ability for the prediction of sepsis from combat wounds in a far forward setting. A capability that can predict sepsis before clinical symptomology will ensure that the most critical casualties receive appropriate medical care and that limited medical resources are triaged to the highest priority casualties. The platform should have the agility to be used far-forward as a CLIA-waived, low complexity clinical diagnostics platform. Capabilities that can demonstrate the appropriate sensitivity and specificity for the intended use at higher roles of care and are amenable to being easily adapted to far forward settings are acceptable.

## Biomedical CoI / Military Operational Medicine (MOM)

1. *Limb loss and Prosthetics:* The DoD cannot match industry investment in research for limb loss and prosthetic limb development. Operational medicine benefits from understanding industry advances in related technology and how it fits within military-specific MOM research priorities.

## Combined Human Systems – Biomedical Track

1. ***Closed loop Human Machine Teaming***: State of the art surrounding Sense-Assess-Augment as adaptive, applied solutions to operator performance decrements. Understand and design Human Machine Integration and demonstrate trusted integrated robotic systems.

Many mission areas such as Command & Control, Logistics, and Cyber apply, as well as the medical community. A medical example would be autonomous care for decision support systems in intelligent evacuation and prolonged care.

2. ***Advanced Warfighter-Machine Interfaces***: Interfaces and decision aids supporting human interaction with highly complex systems, including advanced automation and AI-enabled machines. Areas include identifying, characterizing and overcoming key challenges to warfighter interactions with complex, intelligent systems under uncertainty, such as situationally - adaptive interface concepts and usability methods, dynamic knowledge representation across sensory modalities, system observability and transparency, system direct-ability and adaptability, joint cognitive decision making, and maintaining appropriate trust across changing conditions.

   Many mission areas such as Command & Control, Logistics, and Cyber apply, as well as the medical community. A medical example would be developing Autonomous/Semi-Autonomous/Remotely Operated Medical, Data, and Virtual Health technologies that enhance capabilities from Point of injury through Casualty Evacuation.