Human Systems Priority Steering Council

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Mission

To promote the exchange of technical information and discussions between government, industry, and academia, and the expansion of research and development in areas related to the human as a system whose performance must be integrated into any system of systems

Objectives

• Advocate human-centered research and the integration of cognitive and biological technologies
• Promote discussions to make the “human factor” a top priority in Research, Development, Test and Evaluation (RDT&E)
• Conduct studies and prepare reports in response to requests from the DoD HS Community of Interest (Col)
• Advocate, lead, and influence increased discussion and research on the elements of human-system integration (HSI) domains

Chair: Dr. Greg Zacharias, Charles River Assoc
# Human Systems Overall Scope

## System Interfaces
- Strategic Decisionmaking
- Tactical Decision Support
- Autonomous vehicle control
- Cyber Operations & Trust
- Adaptive Planning

## Personnel & Training
- Adaptive, tailored instruction
- Live, Virtual, Constructive simulation
- Realistic immersive training
- Train Partner State Forces

## Social & Cultural Understanding
- Information sharing w/ partners
- Cultural situation awareness
- Cultural & language expertise
- Social Network Analysis
- Cultural impact of actions

## Protection & Sustainment
- Extreme environment protection
- Physical Performance Enhancement
- Autonomous augmentation
- Physical Aiding
- Extended Combat Rations
System Interfaces

Strategic Decisionmaking
Tactical Decision Support
Autonomous vehicle control
Cyber Operations & Trust
Adaptive Planning

Personnel & Training

Adaptive, tailored instruction
Live, Virtual, Constructive simulation
Realistic immersive training
Train Partner State Forces

Major Focus of PSC
Problem: Complex Evolving Threats Outpace Readiness Training

• Warriors train for tomorrow’s fight using yesterday’s technology, methods, and strategies
• Current training scenarios not matched to evolving mission complexity and dynamics
• Warfighters are trained to doctrine -- fight strategically and dynamically to meet new threats
• Training is costly
  – Live systems deplete inventory, consume fuel, require maintenance & wear out
  – Ranges & role players are expensive – lack responsiveness to changing scenarios
  – Training ranges not designed for flexible training and throughput is inadequate
- Seamless Virtual/Constructive training
- C2 with tactical players
- Synthetic environments for learning and experimentation
- Safe, live virtual constructive training
- Individual adaptive team training
- Increased Complexity
- Increased players

- Timely and effective training reflecting dynamic operational insights/challenges
- Personalized, adaptable, point of need training
- Integrated regional ally mission preparation
- Credible synthetic players: persistent, generative, robust
- Continuous, high fidelity mission training with LVC multinational partnering – when and where needed

Mission Effectiveness re Current

Number of years away

Time to Achieve Mission Effectiveness

Distribution Statement A: Approved for public release; distribution is unlimited.
Human Systems Training Technical Challenges

Challenge 1: First Principles for Training Design
- Synthetic environments for experimentation and learning
- Techniques to automatically capture operationally relevant measures of performance
- Validated tools to optimize training outcomes across individuals and teams

Challenge 2: Realistic, Adaptive and Interactive Scenario Based Training
- Persistent integration of real world events and content into scenarios and syllabi
- Demonstrated and validated for the full range of warfighter capabilities reflecting recent lessons learned
- Training that adapts to individual needs of warfighters in near real-time
- Trading realism for flexibility

Challenge 3: Persistent, Affordable, Integrated Training
- Mission-focused training simulations that support individual and collective training
- Seamless, secure integration of training systems across services and coalition partners
Human Systems
Training - Measures of Success

Challenge 1: First Principles for Training Design
- Calibrating training to mission effectiveness
- Automated feedback for unit performance mission training scenarios

Challenge 2: Realistic, Adaptive and Interactive Scenario Based Training
- Automatic players in training scenarios indistinguishable from live players (‘Turing Test’)
- Improved performance resulting from training that automatically adapts in near real time
- 25% reduction in time and cost to develop training scenarios

Challenge 3: Persistent, Affordable, Integrated Training
- Capability to author once and deliver training to any internet-capable device
- Affordable, turnkey capability to link simulations across services for joint training exercises.
Problem: Current system operation is rigidly data-centric vice flexibly information-centric

- Modern technologies exacerbate critical manning and talent pool deficiencies by ignoring role of Mission, Task & Context – Moving & presenting data vice information
- Current adaptive planning tools do not allow rapid “course of action” analysis and generation
- Information displays typically non-interactive, adapting little to changing needs
- Data quantity will continue to increase nonlinearly
Mission Complexity

Mission Effectiveness (re US capability)

1 - Task-centric interfaces for increased speed and accuracy of decisions
   - Model context and decision space
   - Situation sensitive adaptive interface

5 - Mission-centric automated information analyses (e.g. prioritized COA recommendations)
   - Operator state driven tailored information

7 - Context sensitivity to Commander’s intent
   - Common control station for UxS
   - Tactically believable agents

10 - Natural language dialogue
    - Influence operator state

10+ - Social Cognitive Architectures for synthetic teammate development
     - Hybrid force demonstration for multiple UxVs via natural man-machine interactions
Human Systems Interface Challenges

Challenge 1: Human-Machine Teaming
- Robots that can participate in realistic dialogue with the operator
- Domain-agnostic performance metrics for human-machine interactions

Challenge 2: Intelligent, Adaptive Aiding
- Adaptive determination of relevant data for human-machine interaction
- Platform-independent frameworks to capture cognitive concepts of rich user models: beliefs, desires, intentions, obligations, and goals

Challenge 3: Intuitive Interaction
- High fidelity operator state modeling with information from rich user models
- Coordinated command and control of hybrid forces
Human Systems Interface - Measures of Success

Challenge 1: Human-Machine Teaming
- Number of agents controlled by single operator (x \rightarrow 10x)
- Percent of warfighters serviced
- Percent of operator requests anticipated to criterion (0\% \rightarrow 90\%)
- Latency for machine-generated alternative courses of action (2T \rightarrow \frac{1}{2}T)

Challenge 2: Intelligent, Adaptive Aiding
- Speed and accuracy of decisions x scope (search time = 0)
- Transaction efficiency = ratio of relevant/irrelevant data
- Increased situation salience

Challenge 3: Intuitive Interaction
- Accuracy of operator state assessment for information optimization
- Effectiveness of natural dialogue (transaction efficiency)
- Ease of interaction, time to achieve full competency
Human Systems
Broad Agency Announcements

USAF

- **BAA 09-05-RH - Science and Technology For Warfighter Training and Aiding**
  - POC: Dr. Winston Bennett
- **BAA 09-04-RH - Warfighter Interface Technologies Advanced Research Programs (WITARP)**
  - POC: Mr. Randy Yates
- **BAA 09-02-RH - Advances in Bioscience for Airmen Performance**
  - POC: Mr. Mark Fagan
- **BAA 09-03-RH - Research & Analytical Support for the 711th HPW Human Effectiveness Directorate**
  - POC: Ms. Linda Lange
- **BAA-AFOSR-2011-01 Research Interests of the Air Force Office of Scientific Research**
  - POC: Dr. Hugh DeLong

Navy

- **ONR BAA 11-031 - Office of Naval Research (ONR)**
  - POC: Dr. William Krebs
- **ONR BAA 12-001 - Office of Naval Research (ONR) Long Range BAA**
  - POC: Dr. William Krebs
Human Systems
Broad Agency Announcements

Army

• 11 - 13 Natick BAA  Broad Agency Announcement (BAA) For Basic and Applied Research
  – POC: Multiple
• W5J9CQ-11-R-0017 U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences
  – POC: Jim Belanich
• W5J9CQ-12-R-0002 - United States Army Research Institute for the Behavioral & Social Sciences
  – POC: Dr. Jay Goodwin
• W911NF-07-R-0003-04 - Army Research Office – Broad Agency Announcement for Basic and Applied Scientific Research
  – POC: Dr. Robert Ulman
• W91CRB-08-R-0073 - Research, Development and Engineering Command – Simulation and Training Technology Center
  – POC: Dr. Frank Tucker
• W911NF-07-R-0001-05 – Army Research Laboratory and the Army Research Office Broad Agency Announcement for Basic and Applied Research
  – POC: Dr. Tomasz Letowski
Summary

• Evolving threats outpace contemporary readiness training
• Interfaces are not operator/information-centric
• Training Goals
  – Synthetic environments for mission training
  – Continuous, real-time training with LVC multinational partnering
  – Seamless, secure integration of training systems across services
• Interface Goals
  – Frameworks that capture the intentions & obligations of the operator
  – Integrated data based on operators’ modeling of natural language & gestures
  – Human-machine teaming based on immediate feedback and accurate predictions of operators’ mental states via interactions