Human Systems
Priority Steering Council

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Human Systems Priority Steering Council

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New NDIA Division
HUMAN SYSTEMS

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 (CoI)
• 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

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

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

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

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Major Focus of PSC
Human Systems Training for Readiness

**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
Training Technology End States

- 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

- Continuous, high fidelity mission training with LVC multinational partnering – when and where needed

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
Interfaces
Technology End States

Mission Complexity

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

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

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

- Natural language dialogue
- Influence operator state

- Social Cognitive Architectures for synthetic teammate development
- Hybrid force demonstration for multiple UxVs via natural man-machine interactions

Mission Effectiveness (re US capability)

Number of years away

1 3 5 7 10 10+ 
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 $\times$ 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