Human Systems Priority Steering Council

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Office of Naval Research

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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

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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

Human Systems Priority Steering Council
FY13-17 Priority S&T

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Major Focus of PSC
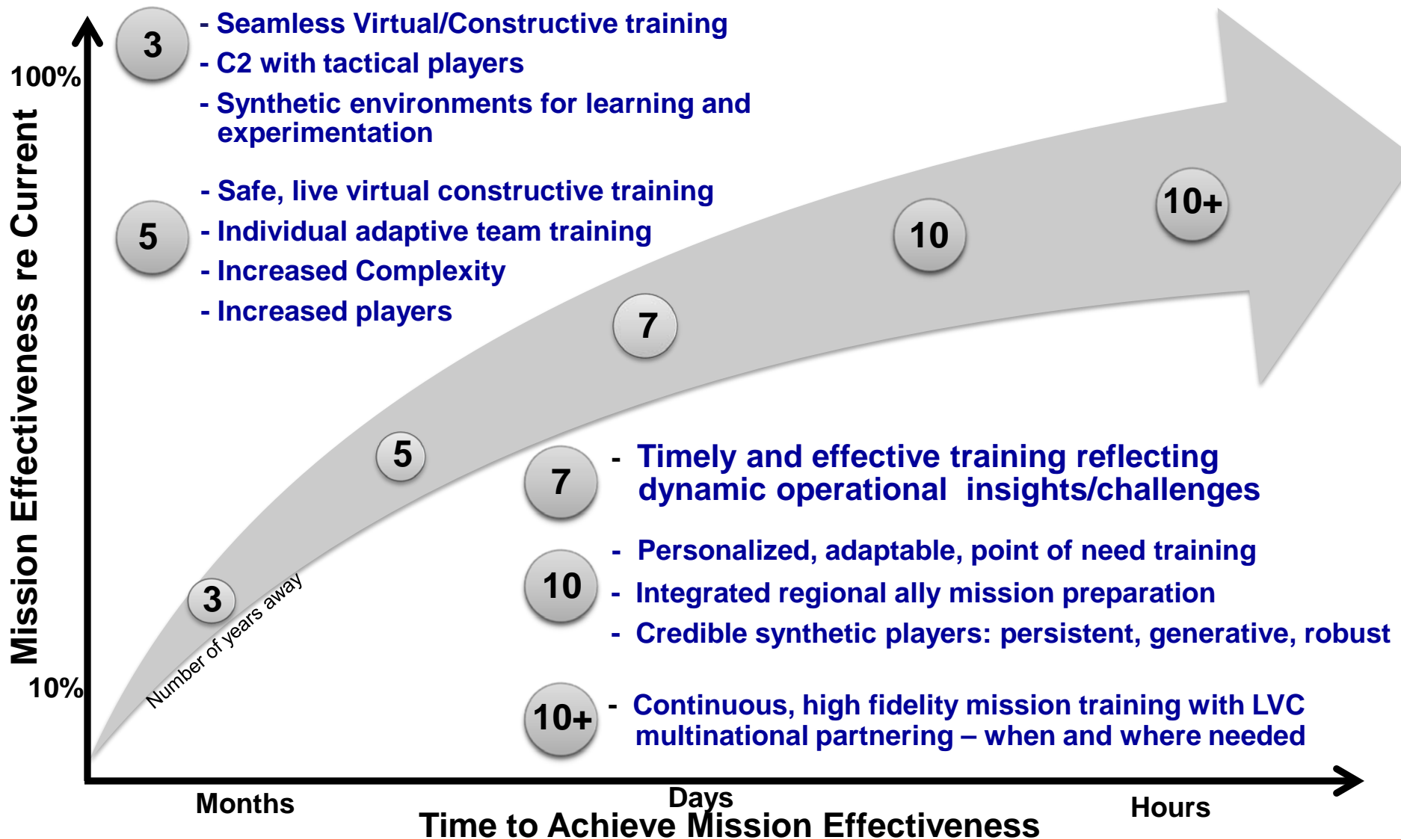
Human Systems Training for Readiness

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

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Training Technology End States

3
- Seamless Virtual/Constructive training
- C2 with tactical players
- Synthetic environments for learning and experimentation

5
- Safe, live virtual constructive training
- Individual adaptive team training
- Increased Complexity
- Increased players

7 - Timely and effective training reflecting dynamic operational insights/challenges

10 - Personalized, adaptable, point of need training
- Integrated regional ally mission preparation
- Credible synthetic players: persistent, generative, robust

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

Number of years away

3 **5** **7** **10** **10+**

Mission Effectiveness re Current

100%

10%

Months   Days   Hours

Time to Achieve Mission Effectiveness

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

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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.

Human Systems Interface for Effectiveness

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

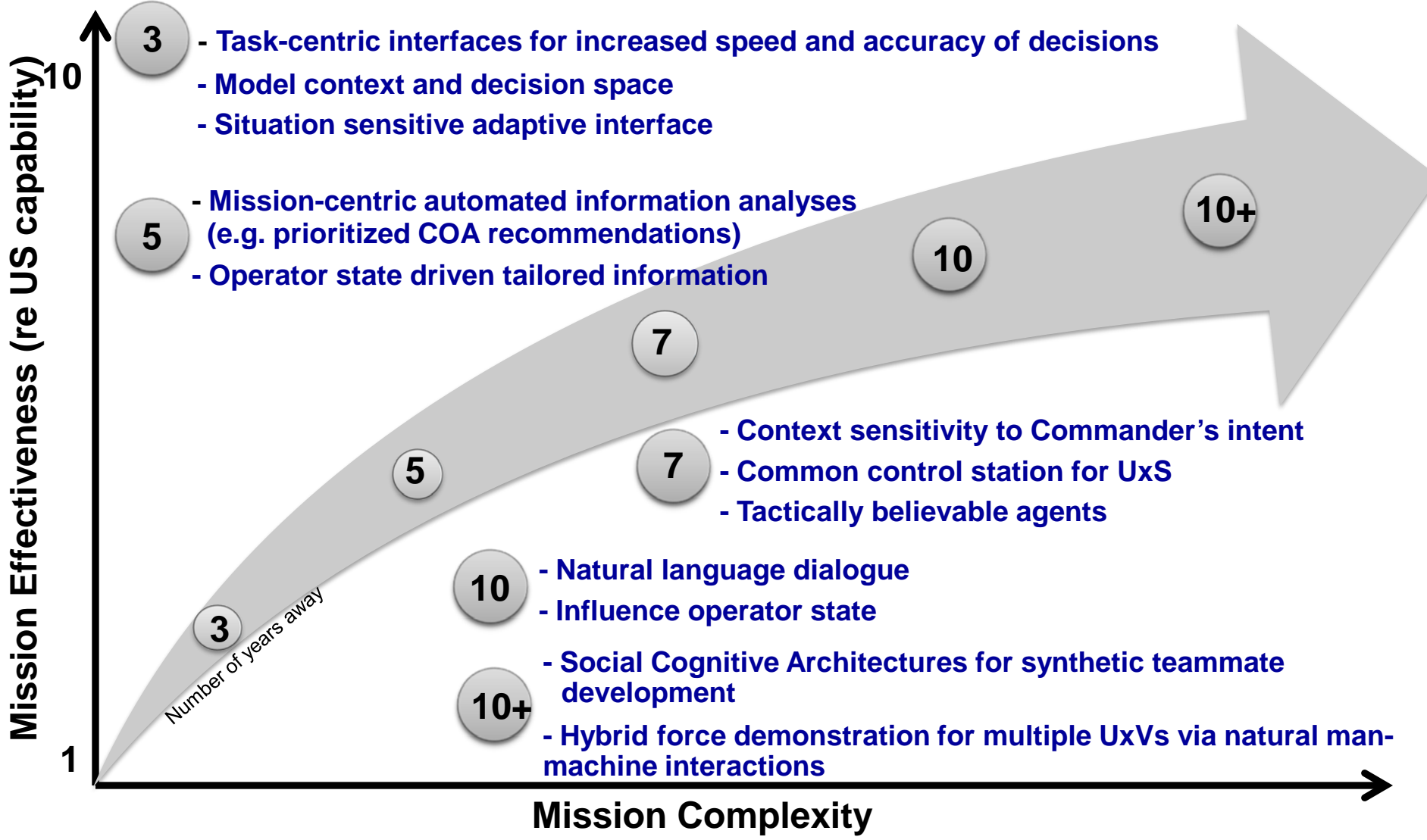- Data quantity will continue to increase nonlinearly

Virtual lab

Actual lab

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Interfaces Technology End States

Mission Effectiveness (re US capability)

3 - 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

Number of years away

Mission Complexity

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

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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 ($2\tau \rightarrow \frac{1}{2}T$)

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

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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