Human Systems COI

16th Annual S&ET Conference

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Goals for this Briefing

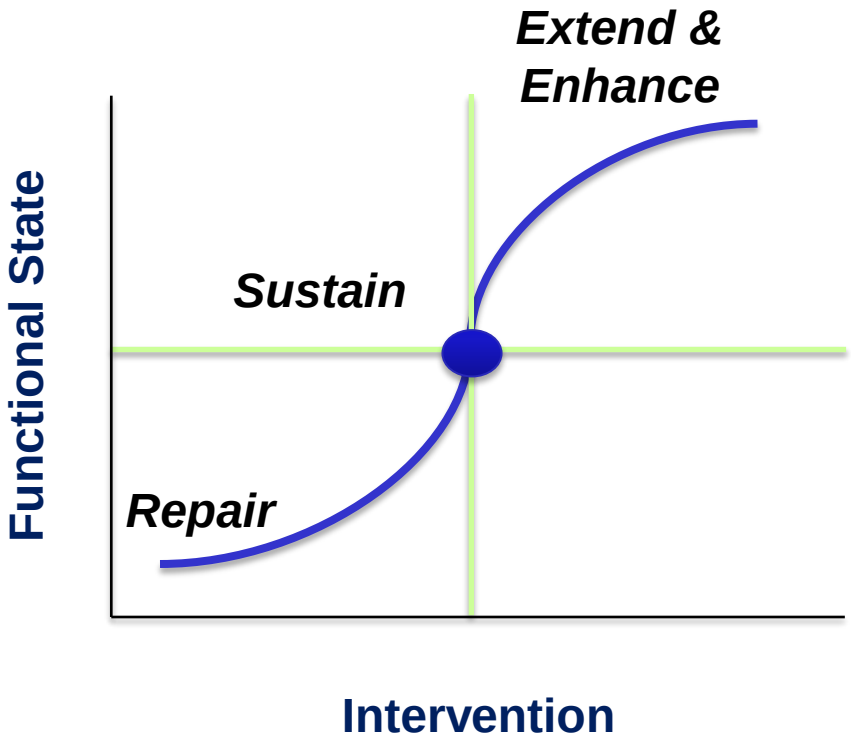
1. **Share our current Demand Signals**
   - These evolve and change over time
2. **Discuss our approaches to addressing these Demand Signals**
   - Always looking for new and better ways
3. **Motivate you to help identify proven or emerging approaches**
   - Looking for complementary S&T

Motivate Innovative, Complementary S&T – Better Buying Power Tenets

Content

- Portfolio Overview
- COI PB2015
- COI Structure & Organization
- Demand Signals by Service
- Sub Areas and Scope
- HS COI Sub Area: Personalized Assessment, Education, & Training
- Personnel & Training: Industry Analysis
- Overview of other Human Systems sub areas
- Success Stories: Meeting the Demand Signal
- Outreach & Engagement Opportunities
- Summary

Conceptualizing “Human Systems”



COI Taxonomy *(Sub Areas)*
Personalized Assessment, Education, & Training
Protection, Sustainment, & Warfighter Performance
Systems Interfaces & Cognitive Processing
Human Aspects of Operations in Military Environments

Vision & End States

Vision

Provide innovative human-centric science solutions to enhance the readiness and reduce the cost of our all Volunteer Force

End States

Readiness *Enhance mission capability by:*	Affordability *Reduce cost due to:*
• Out-thinking the adversary	• Injuries/death
• Designing human-factored interfaces	• Manpower needs per system
• Understanding PMESII* battle space	• Fog of war
• Optimizing body-worn equipment systems	• System burden on human performance

*Political, Military, Economic, Social, Information, Infrastructure

Human Systems Taxonomy

Personalized Assessment, Education, & Training

- Personnel Assessment Measures
- Leader Development Methods
- Training Methods & Technologies
- Joint Interoperable Training

Protection, Sustainment, & Warfighter Performance

- Understanding Critical Stressors
- Understanding Individual Differences
- Developing Operationally Relevant Metrics

Systems Interfaces & Cognitive Processes

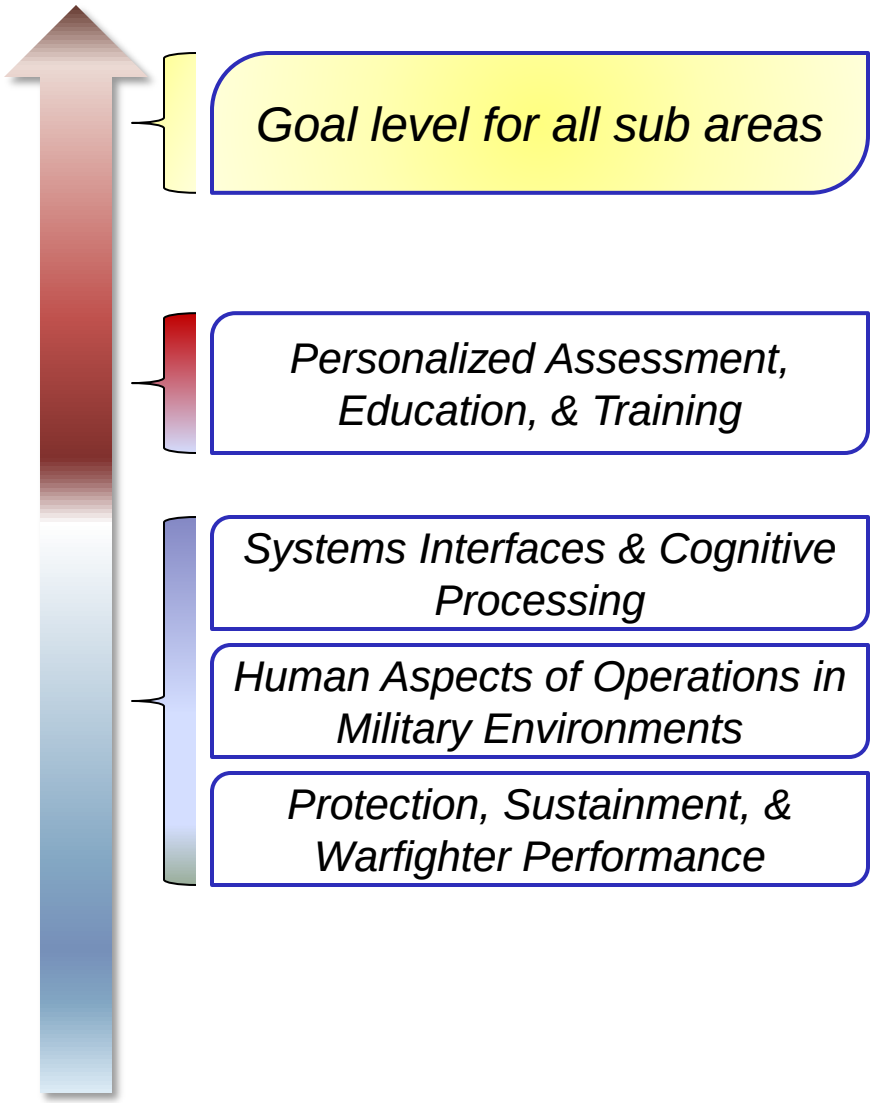
- Human-Machine Teaming
- Human Cognitive Process Modeling
- Intelligent, Adaptive Aiding

Human Aspects of Operations in Military Environments

- Cultural Situation Awareness
- Crisis Analytics for Military Operations
- Language & Sociocultural Training

HS COI Output

- ***Level 4: Delivering Joint S&T Roadmaps***
- ***Level 3: Building Joint S&T Roadmaps***
- ***Level 2: Active Coordination***
- ***Level 1: Information Sharing***



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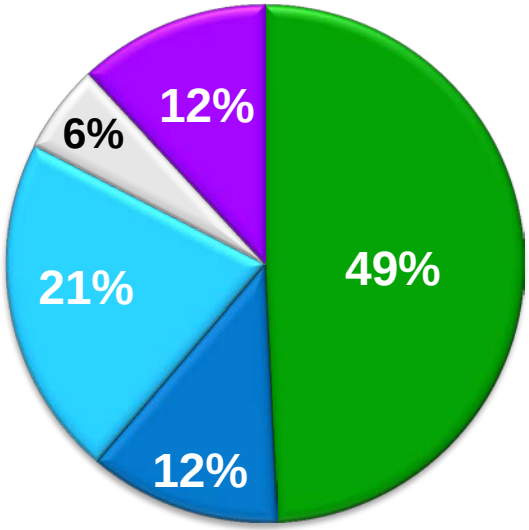
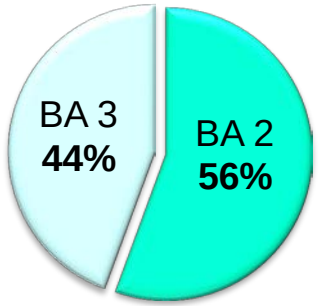
COI Investment Profile DoD PB15

Component Investment

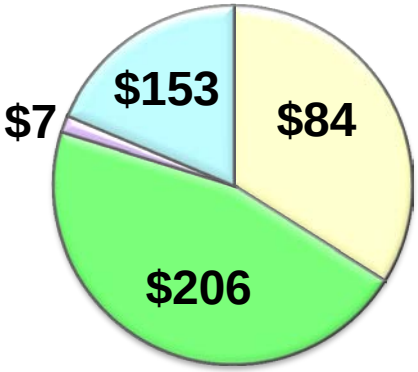
- Army
- Navy
- Air Force
- DARPA
- Other Components



Budget Activity



COI Sub Areas Total = $450M



- Personalized Assessment, Education, & Training
- Protection, Sustainment & Warfighter Performance
- Human Aspects of Operations in Military Environments
- System Interfaces & Cognitive Processing

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HS COI Leadership

- **Senior Steering Group**
  - OASD (R&E) Human Performance, Training, & BioSystems
  - Army Research Institute for the Behavioral & Social Sciences
  - Army Research Laboratory – Human Research & Engineering Directorate
  - Army Natick Soldier Research, Development, & Engineering Center
  - Office of Naval Research - Codes 30 and 34
  - Air Force Research Laboratory - Human Effectiveness Directorate
- **Senior Leader Group**
  - All of the above, and…
  - OASD(HA) / Defense Health Agency
  - Army Medical Research & Materiel Command
  - Navy Bureau of Medicine & Surgery
  - Air Force Research Laboratory - 711th Human Performance Wing
  - Services - Human Systems Integration Offices

Sub Area Leads

Personalized Assessment, Education, & Training

ONR	**Dr. Ray Perez**
ARI	Dr. Jen Tucker
ARL	Mr. Rodney Long
AFRL	Dr. Wink Bennett

Protection, Sustainment, & Warfighter Performance

ARL	**Dr. Mike LaFiandra**
NSRDEC	Dr. Tyler Brown
ONR	Dr. Peter Squire
AFRL	Ms. Stephanie Miller

System Interfaces & Cognitive Processes

AFRL	**Dr. Todd Nelson**
ARL	Dr. Susan Hill
USN	*in transition

Human Aspects of Operations in Military Environments

ARL	**Dr. Liz Bowman**
ONR	Dr. Rebecca Goolsby
AFRL	Dr. Geoffrey Barbier

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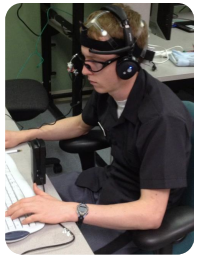
Army Demand Signals

Personnel and Training

- ❖ Personalized, integrated assessments to improve performance and reduce risk
- ❖ Personalized, integrated training to accelerate proficiency /increase affordability
- Assessment measures & models
- Intelligent tutoring, virtual humans
- Integrated training environments



Survivability

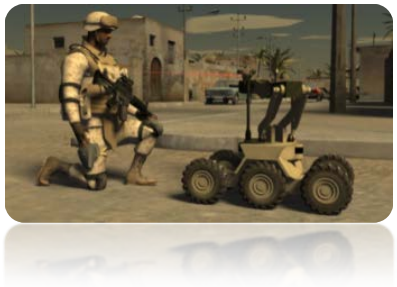
- ❖ Greater force protection to ensure survivability across all operations
- ❖ Enable operations in extreme environments
- Integrated Protective Head Borne System
- Visual Perception Impacts Eyewear
- Signature Management

Soldier System Integration

- ❖ Achieve operational maneuverability in all environments and at high operational tempo
- Augmentation
- Real–world Neuroimaging
- Socio-technical Systems

Situational Awareness

- ❖ Timely mission command & tactical intelligence human-agent teaming
- Hand Held ISR
- Augmented Reality
- Human-Robot Interaction



❖ ***Enduring Challenges***
• ***Major Investments***

Navy Demand Signals

Manpower, Personnel, Training, & Education

❖ Enhance warfighter performance

- Advanced personnel recruitment, selection, assignment, retention, & professional development
- Utilizing world-class innovative training technologies
- Engaging, scenario-based training & automated performance-based readiness assessment

Warfighter Health & Survivability

❖ Maintain health & injury recovery at point of injury

- Improve continuum of casualty care from injury, en route, & shipboard to treatment facilities
- Reduce noise-induced hearing loss
- Improve lightweight body armor & equipment
- Mitigate health and performance risks in undersea operations

Bio-Engineered Systems

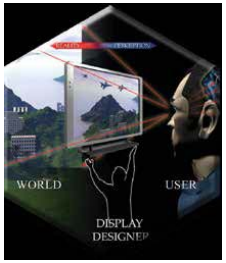
❖ Prepare warfighters to deploy anywhere/anytime

- Biologically inspired intelligent sensors & autonomous systems
- Computational cognitive models
- Neurocognitive processes to enhance combat system design & adaptive digital tutoring systems

Human Systems Design & Decision Support

❖ Design training & operational systems that enable effective human-machine interaction

- Incorporating human capacities into system performance
- Design & control of autonomous & robotic systems
- Effective, user-friendly decision support systems for kinetic & non-kinetic operations



❖ ***Navy Vision***

- ***Performance Objectives***

Air Force Demand Signals

Advanced Training Technologies

- ❖ Air Superiority
- ❖ Education & Training
- Complex evolving threats
- Training costly, static, and stove piped
- 4th & 5th generation mixed force

Battlefield Airmen / Pararescue Jumpers

- ❖ Special Operations
- ❖ Personnel Recovery
- Too heavy and excessive power use
- Information flow not integrated
- Non-intuitive data delivery

Aerospace Physiology & Toxicology

- ❖ Agile Combat Support
- New platforms-extreme environments
- Cognitive overload
- Toxicology Threats

Adaptive Automation

- ❖ Global Integrated ISR
- ❖ Command & Control
- Interaction with autonomous systems
- Multi- Remotely Piloted
- Aircraft operator SA
- Analyst data overload
- Airman-weapon system trust

- ❖ ***USAF Core Missions***
- ***Challenges***

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Sub Areas & Scope

Personalized Assessment, Education, & Training

- ***Objective:*** *Develop personalized, integrated measures and methods to enhance talent management, develop leaders, and accelerate the proficiency and readiness of the Force.*
- ***Technical challenges:*** *more precise assessments of potential and risk; complex learner & tutor models; authoring tools; interoperability standards; learning architectures.*

- **Operational Opportunities:** *Enhanced talent management and development throughout a career; personalized training to accelerate readiness at individual, team, unit, Service, Joint, and Coalition levels*

Protection, Sustainment, & Warfighter Performance

- **Objective:** *Develop equipment & procedures to support a more safe & agile force on the battlefield*
- **Technical Challenges:** *Performance data is difficult to collect in operational environments; relevant metrics have to be identified and defined*
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System Interfaces & Cognitive Processing

- **Objective:** *Develop natural & intuitive human-machine interaction to enable Warfighter to execute mission more effectively & efficiently*
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Human Aspects of Operations in Military Environ's

- **Objective:** *Ensure Warfighters have access to & understand how changes in political, military, economic, social, infrastructure, & information (PMESII) variables affect the operational environment*
- **Technical Challenges:** *Noisy data; complex & dynamic threat environs; interpretation/evaluation of behaviors in chaotic, culturally complex environs*

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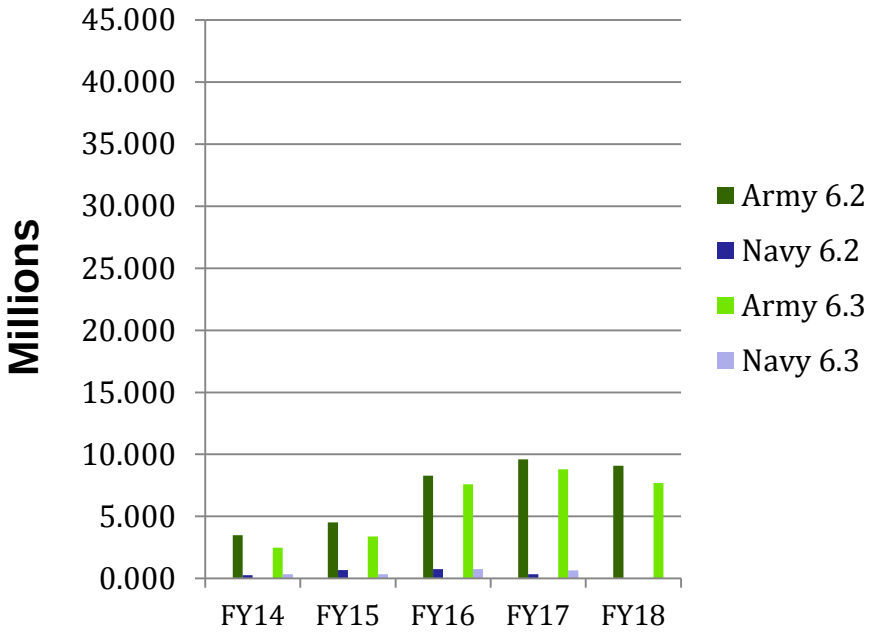
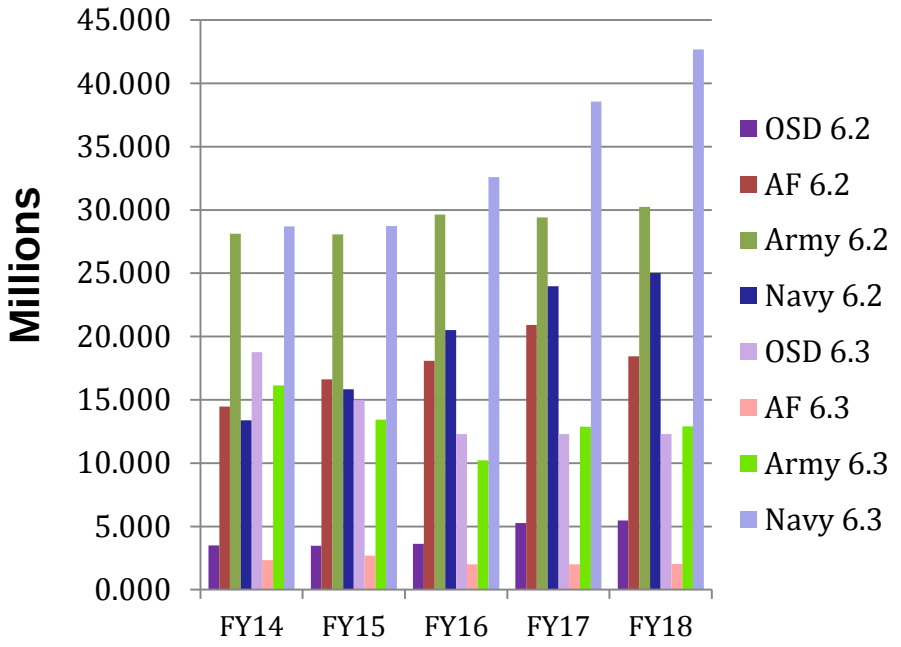
S&T Investment Across Services

Personnel Assessment



Education & Training

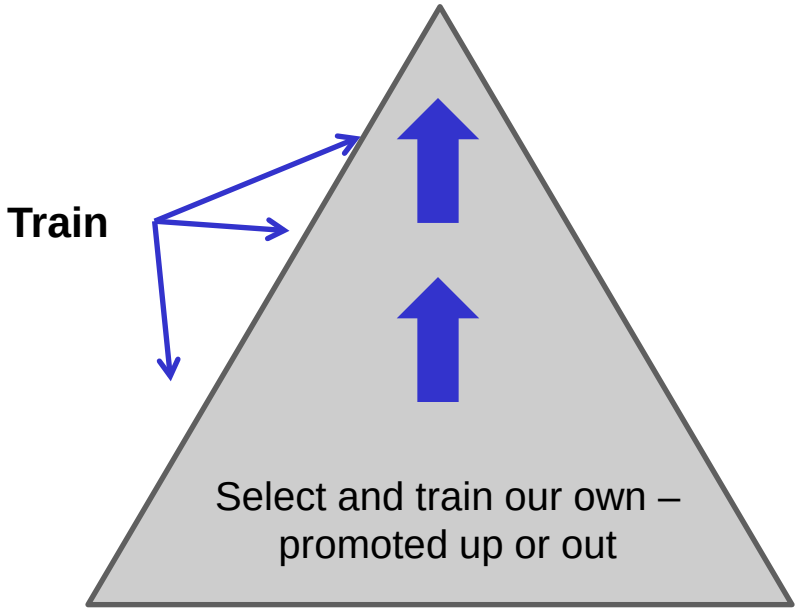


AREA	FY14	FY15	FY16	FY17	FY18
Personnel Assessment	6.6	8.9	17.4	19.4	16.8
Education & Training	125.4	123.8	128.9	145.3	149.1
Total	**132.0**	**132.7**	**146.3**	**164.7**	**165.9**

Critical for Success

Military

Training throughout a career



Select from a shrinking pool of candidates who meet entrance requirements

(Many with limited or no military experience)

Industry

Hiring expertise at all levels

Hire from a specific pool

(Often have significant expertise in desired areas)

Military Workforce Model is Unique

Changing Needs Enabled by S&T Advances

	WWII	Vietnam	OIF/OEF	FUTURE: Full spectrum of operations
Active Force Size:	***12M** (draft)*	***3M** (draft)*	***1.4M** (all volunteer)*	***1.2M** (all volunteer)*

Personnel Assessment

Past: Separate measures, same test for all, group probabilities of potential	**Near → Future**: Integrated measures & adaptive testing for more precise assessment of individual potential

(Physical + Cognitive + Non-cognitive) + Adaptive Testing → • ***Integrated*** • ***Personalized***

Education & Training

Past: Skills for specific tasks/missions, slow updates, same training for all	**Near → Future**: Competency-based for full spectrum, rapid updates, adaptive training accelerates learning

(Live + Virtual + Constructive) + Adaptive Training → • ***Integrated*** • ***Personalized***

S&T Portfolio

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Personnel Assessment
S&T to Deliver Capabilities

Operational Challenges

- ***Enlisted:*** *Shrinking pool of candidates who meet entrance requirements; Attrition decreases readiness and increases cost; Enhance performance*
- ***Officers:*** *Competition with industry for talent; Identify, develop, & retain highest potential*
- ***Personnel Management****: Changes in mission demands, force structure, & budget*
- ***Command climate****: Conduct issues degrade readiness, cohesion, effectiveness*

*Personalized, Integrated Personnel Assessment – **Goals***

- ***Enlisted****: Better assess individual potential and risk*
- ***Officers****: More accurately assess potential and risk*
- ***Personnel Management:*** *More comprehensive, flexible management tools*
- ***Command climate:*** *Effective assessment & methods to achieve desired outcomes*

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Personalized, Integrated Personnel Assessment – Goals

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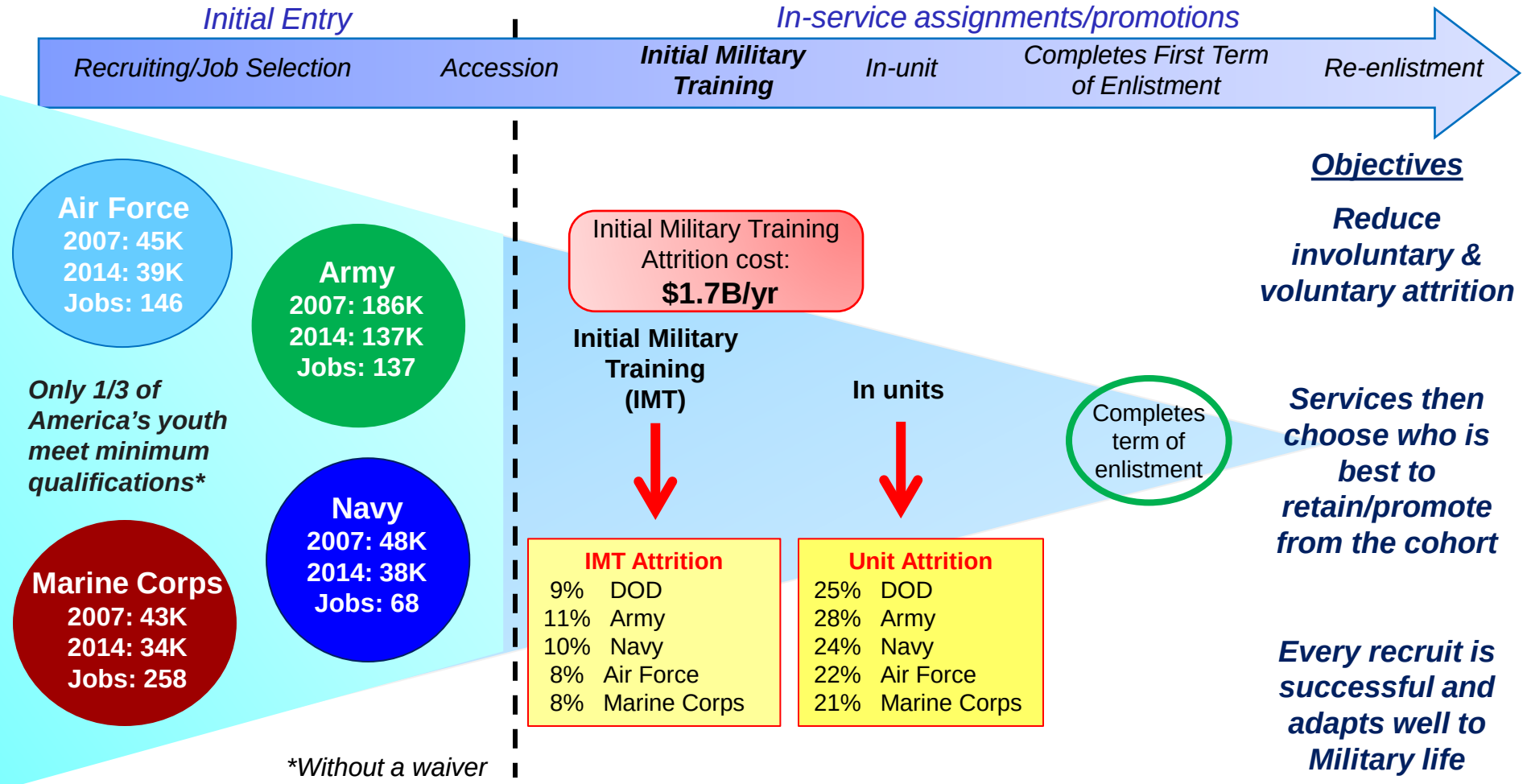
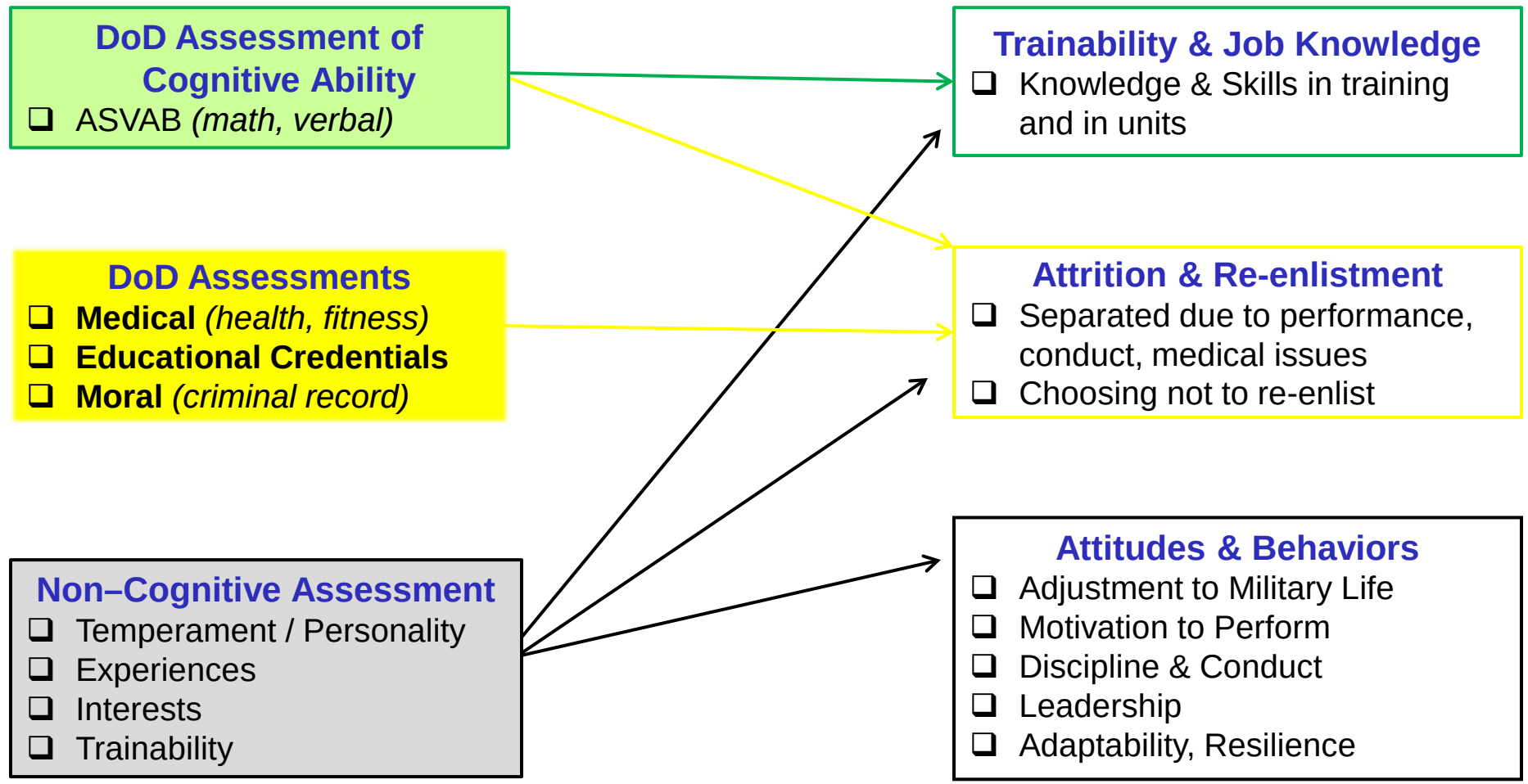
Selection & Assignment for Enlisted Service Members

Capability: Increase predictive capability of selection screens to reduce personnel lifecycle costs



Initial Entry Selection & Assignment for Enlisted Service Members



Success Story: Enlisted Personnel Selection

Tailored Adaptive Personality Assessment System

Challenge: *Better assess individual potential, risk, and fit for military career*

Developed: ***Tailored Adaptive Personality Assessment System (TAPAS)***

- *26 personality dimensions (including four that are military-specific)*
- *Applicant chooses from statement pairs generated on-the-fly based on responses*

Which of these statements is most like you?

- ❑ *I am not one to volunteer to be group leader, but would serve if asked.*
- ❑ *My life has had about an equal share of ups and downs.*

S&T Accomplishments

- *State of the art personality assessment*
- *Developed in partnership with industry*
- *Operational implementation by the Army (2009) and Air Force (2014)*

Pay–off

**First-year in Army for screened category*

Readiness:

- *Reduces attrition by 5%*
- *Reduces Initial Military Training re-starts by 3%*
- *Reduces conduct incidents*

Affordability: *(attrition cost – recruiting, training)*

- *Current implementation saves ~$30M/year*
- *Expanded use can save ~$50M/year*

Enlisted Personnel S&T Roadmap

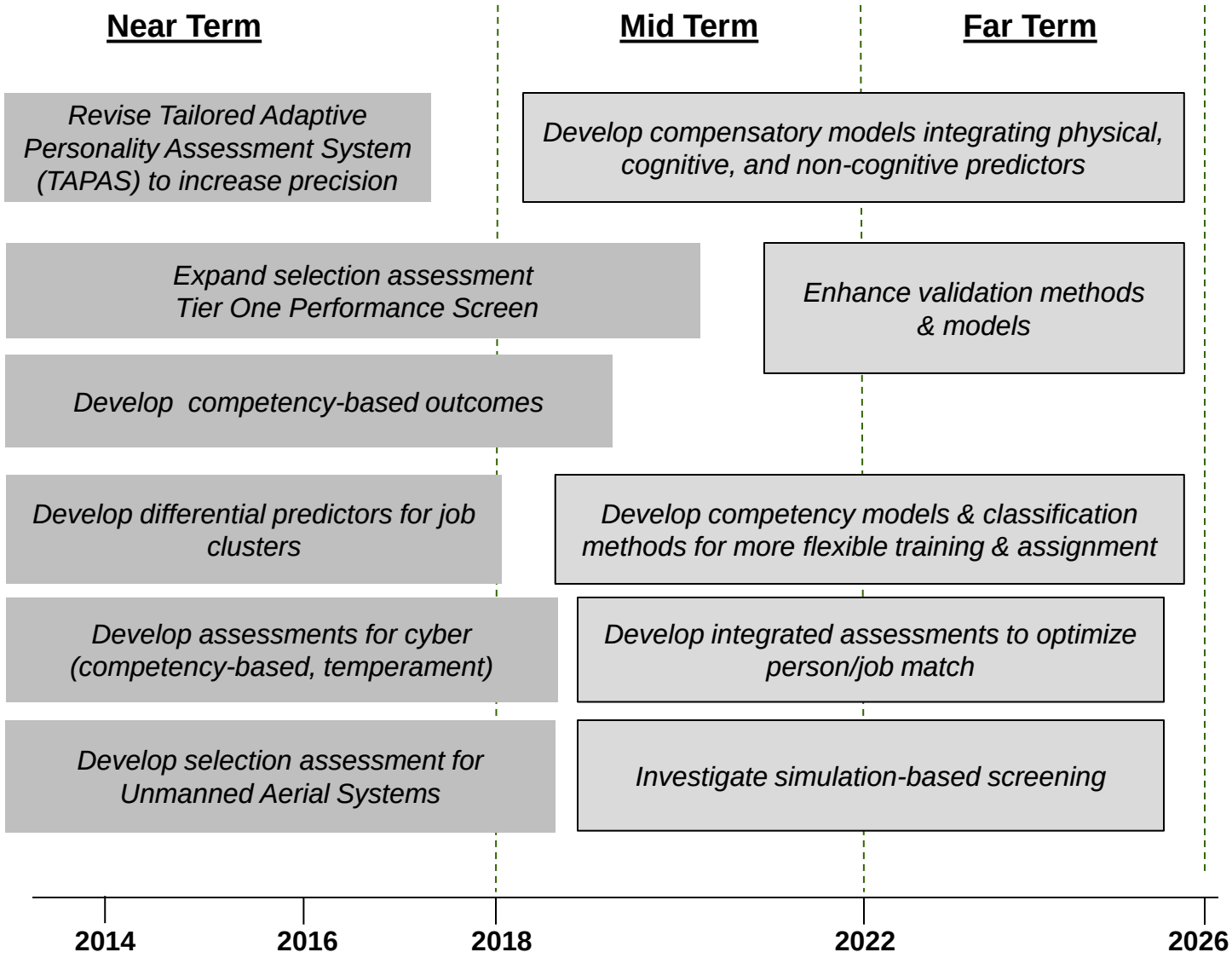
Capabilities/S&T Thrusts

Enhance Enlisted Selection
*(Person-**Service** match)*

- *Develop selection measures & instruments*
- *Validate non-cognitive screens*

Enhance Enlisted Assignment
*(Person-**Job** match)*

- *Develop measures & models for job clusters*
- *Develop measures & models for specific jobs*



In Progress/Proposed

Projected

Unique DoD Capabilites

S&T Workforce Competencies

- **Primarily Industrial/Organizational Psychologists**
- **Scientific Expertise**
  - Personnel assessment
  - Research techniques & analysis
- **Domain Expertise**
  - Military/Service personnel management
  - Facilitate transition from S&T (policy, program, implementation)

Facilities

- **Data is collected with military personnel in the field and via personnel databases**
- **Screens/tests are administered on operational systems and in facilities**

S&T Portfolio

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Personalized, Integrated Training
S&T to Deliver Capabilities

Operational Challenges *– Current training inadequate to address:*

- ***Complexity:*** *Evolving threats, wider range of missions, technology advances*
- ***Smaller force structure:*** *Skills/decisions at lower levels, fewer training personnel*
- ***Resource constraints:*** *Less live training, fewer units at deployment readiness*

Personalized, Integrated Training – ***Goals***

- *Integrated training environments for Service, Joint, & Coalition readiness*
- *Personalized training to accelerate proficiency*
- *Affordability via methods & tools for rapid updates*

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→ **Integrated Live-Virtual-Constructive**

Quick Tutorial

Live
Real personnel using ops systems

Virtual
Real personnel in simulated systems

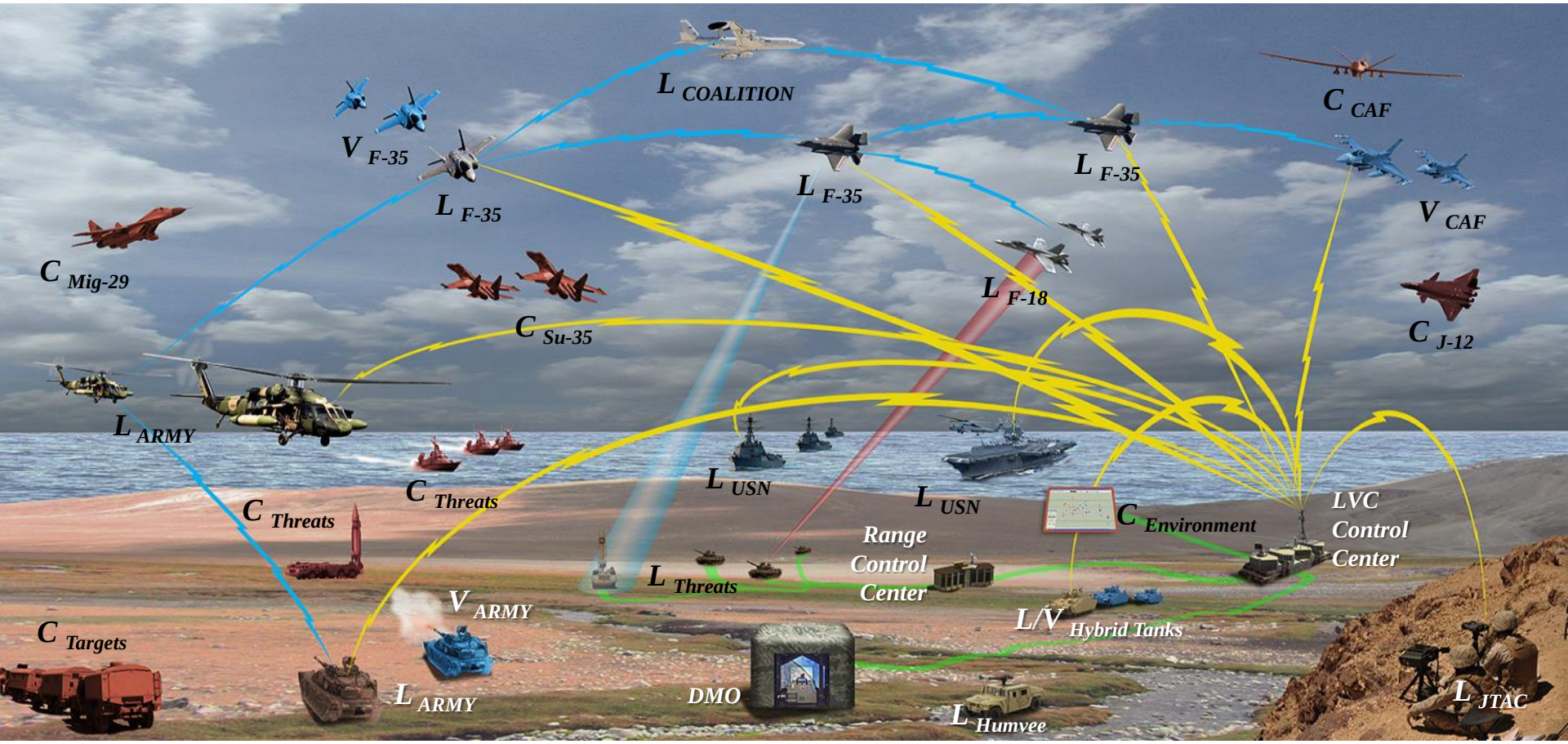
Constructive
Computer generated entities & models interacting with live & virtual systems

- ***Synchronize training***
  - Across LVC modes
  - Across branches, Services, & coalition
  - Securely & realistically
- ***Adapt training***
  - Full spectrum of operations
  - Varying skill levels
- ***Assess competency***
  - Collective (Service, Joint, Coalition)
  - Predict operational readiness
- ***Design, build, deliver, & manage training***

Personalized, integrated collective training
In real time & anytime

Operational Concept

Capability: *Integrated, persistent Live-Virtual-Constructive (LVC) training environments incorporating adaptive training methods to accelerate Service, Joint, & Coalition Readiness*



Affordable Mission Realism – Integrated Forces – Quantified Effectiveness

Integrated LVC Training: Roadmap

Capabilities & Major S&T Thrusts

Enable large-scale LVC Training

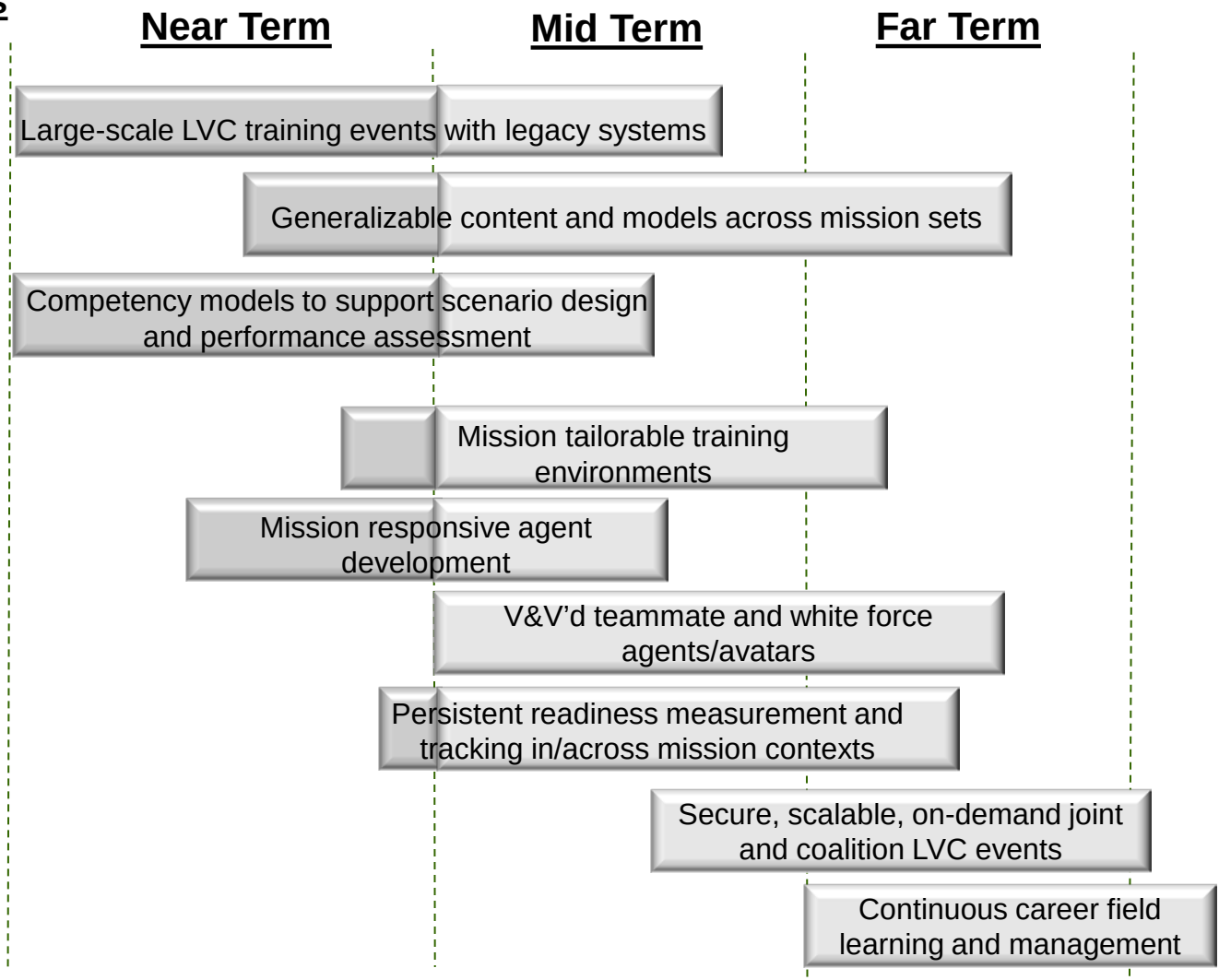
- Shareable content and models across domains
- Specifications for common markup for content/metrics
- Learning management systems for LVC ops
- Common metrics in coalition events

Joint Interoperable Training

- Integrated Gaming Family of Trainers
- Rapid Cognitive Agent/Models Development
- Realistic Synthetic Wingman Models
- Persistent Readiness Assessment and Tracking
- Automated Authoring Tools for LVC Scenario Generation

Globally Persistent Coalition Ops

- Global, Persistent, Joint/Coalition LVC training and assessment
- Integrated Secure Adaptive Environments



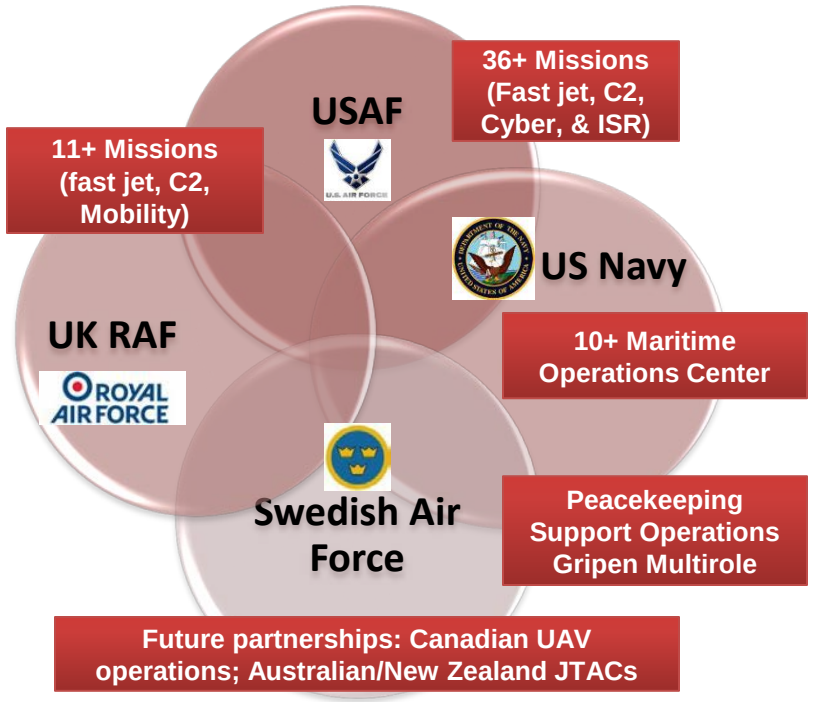
In Progress/Proposed

Projected

Joint & Coalition Training & Readiness Assessment

Challenge: *Need clear standards for Joint & Coalition training to:*

- ❑ *Characterize training & readiness needs & gaps*
- ❑ *Link learning objectives to effectiveness outcomes*
- ❑ *Diagnose performance*



S&T Accomplishments

- ❑ *Competency-based approach more effective than traditional task list approach*
- ❑ *Outcome measures more generalizable*
- ❑ *Demonstrated value of common language for objectives, metrics and gaps across Joint and Coalition partners*

Pay–off

Affordability

- *30% cost reduction for day-to-day training*
- *70% cost reduction for human white force*

Readiness

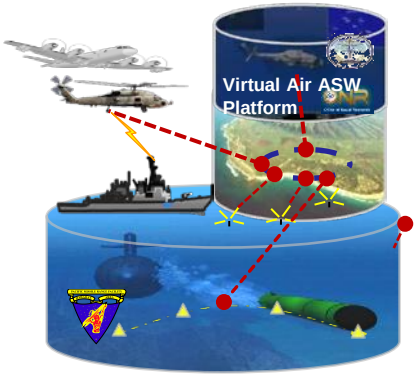
- *Competency-based training improves learning*
- *On-demand realistic training as opposed to 3-6 month prep for large events*

Unique DoD Capabilities

S&T Workforce Competencies

- *Software engineering, Modeling, Hardware design, Computer & Industrial Engineering*
- *Psychology, Instructional Systems Design, Neuroscience, Statistics*

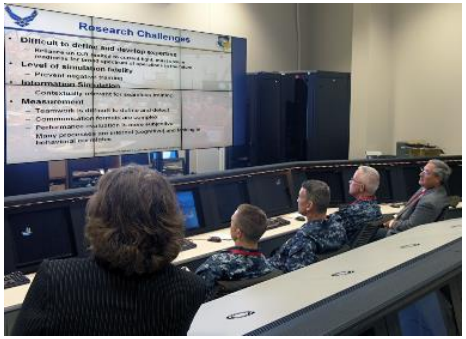
Army Simulation Training Technology Center: Immersive Simulations



LVC-Enabled Instrumented Underwater Range Tracking Acoustic Information

Networked Fleet Integrated Synthetic Training/Testing Facility

Close Air Support & Unmanned Systems



Air & Space Operations Center Team Training

Personalized, Integrated Training
S&T to Deliver Capabilities

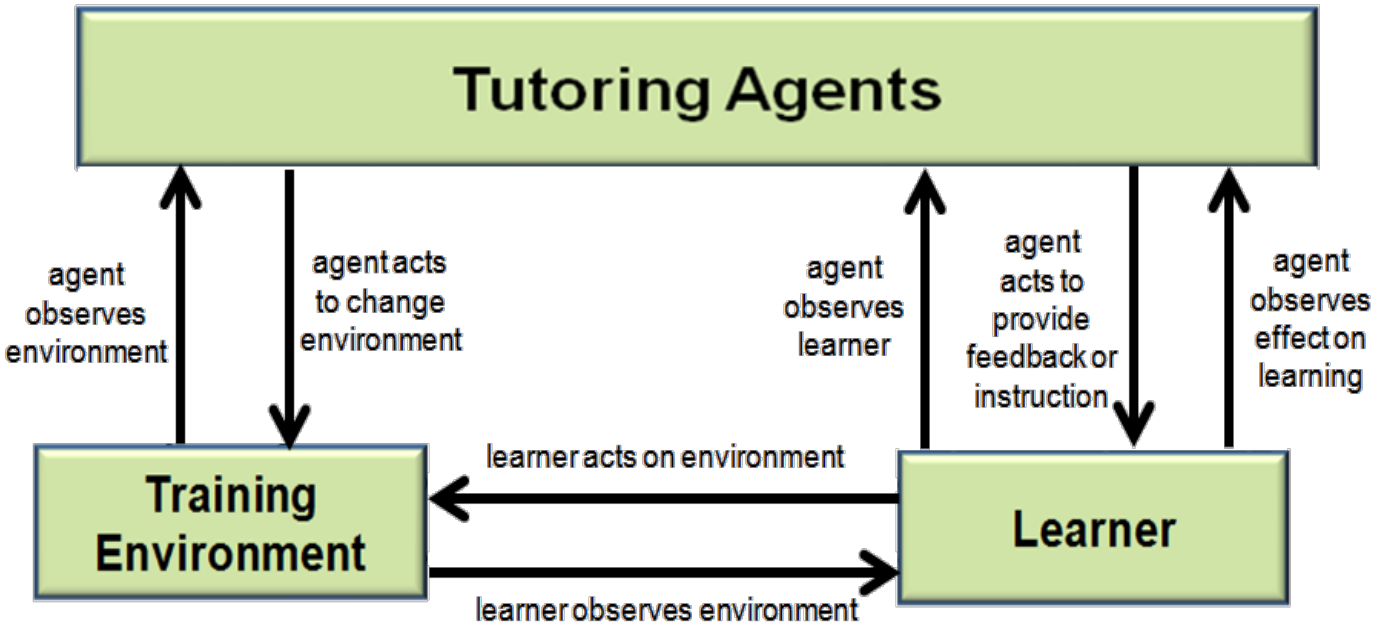
***Operational Challenges** – Current training inadequate to address:*

- ***Complexity:** Evolving threats, wider range of missions, technology advances*
- ***Smaller force structure:** Skills/decisions at lower levels, fewer training personnel*
- ***Resource constraints:** Less live training, fewer units at deployment readiness*

*Personalized, Integrated Training – **Goals***

- *Integrated training environments for Service, Joint, & Coalition readiness*
- ✓ ***Personalized training to accelerate proficiency*** → **Intelligent Tutoring Systems**
- *Affordability via methods & tools for rapid updates*

Quick Tutorial



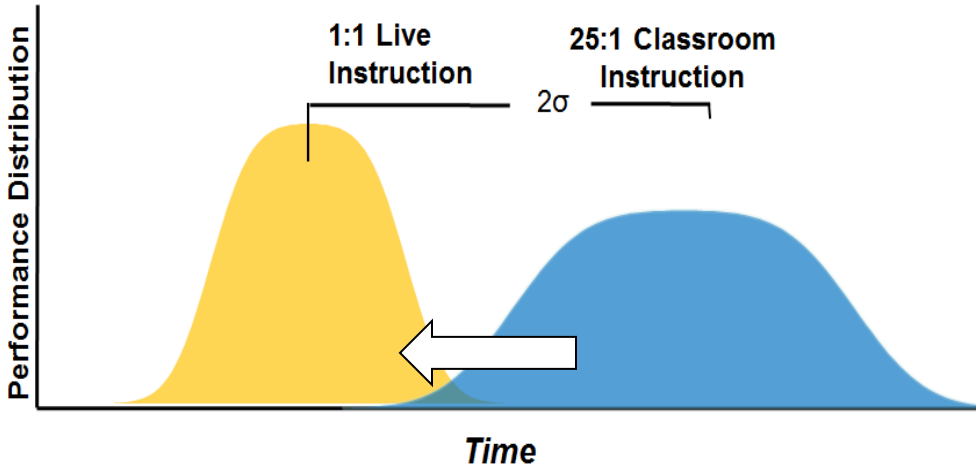
Self-development

Virtual Environments

Operational Environments

Operational Concept

***Capability**: Intelligent tutor that always remembers you and personalizes training for you anytime and anywhere – throughout your career*



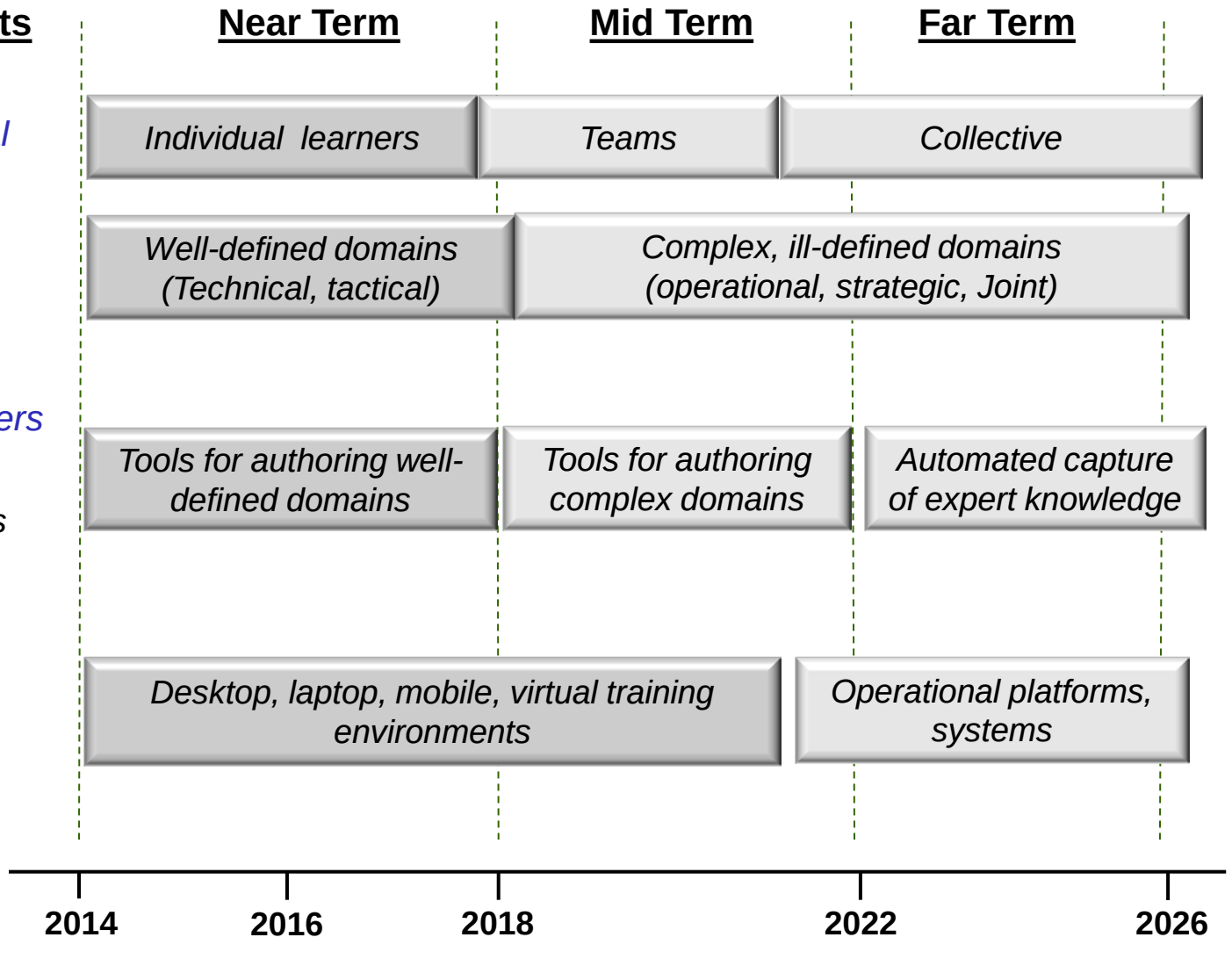
Individualized live tutoring has significant benefits
…but is not affordable

Tutors teach decision-making and problem solving.

Automating their expertise will make personalized training affordable.

Intelligent tutors as effective as the very best human tutors

Intelligent Tutoring Systems Roadmap



Success Story: ITS for Ship-Handling Skills

Conning Officers Virtual Environment – Intelligent Tutoring System (COVE-ITS)

Challenges:

- ❑ *Train advanced ship handling skills in less time and with fewer instructors*
- ❑ *Assess operational proficiency more objectively*

Reduced Human Error:

"As a result of mishaps at sea – ships and submarines – I have an $850 million, unforecasted maintenance bill."

ADM William E. Gortney, Commander
U.S. Fleet Forces Command (2013)

S&T Accomplishments

- ❑ *Developed ITS that simulates experienced instructors' techniques & facilitates interaction through a natural language interface*
- ❑ *Developed student performance measurement system that supports more objective evaluation of operational proficiency*

Pay–off

***Affordability**: Less time to train and fewer instructors needed ($5M to develop, $1M/year in training savings)*

***Readiness**: Training effectiveness study found that COVE-ITS students performed just as well as expert instructors*

Unique DoD Capabilities

S&T Workforce Competencies

- ***Psychology***
- ***Instructional design***
- ***Software engineering***
- ***Statistical modeling***
- ***Machine learning***

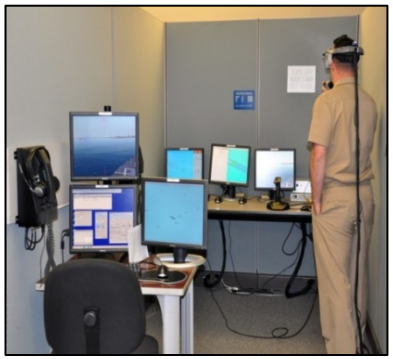
Laboratories/Facilities

- *Office of Naval Research*
- *ARL-HRED Simulation & Training Technology Center*

Field Research Examples

U.S. Military Academy

Fort Benning



Naval Surface Warfare Schoolhouse

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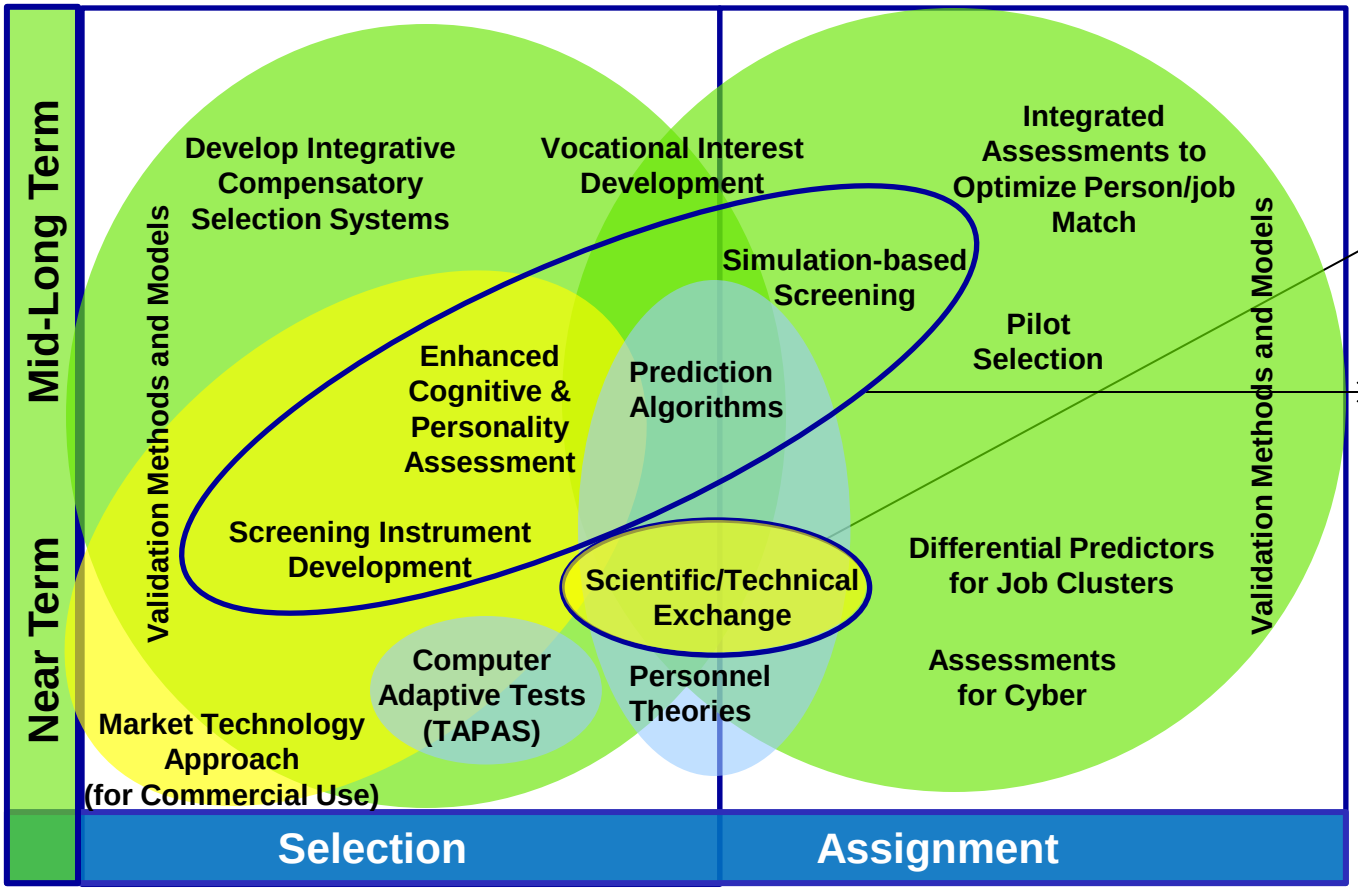
Assessment of Commercial–DoD Leverage Opportunities in HS – Personnel



Technology Leverage

Assessment Methods and Measures

Computer Technologies

Screening Instrumentation

Computer Technologies

Personal Assessment

Prediction Algorithm

Military/Service Personnel Management

DoD Focus

Commercial Focus

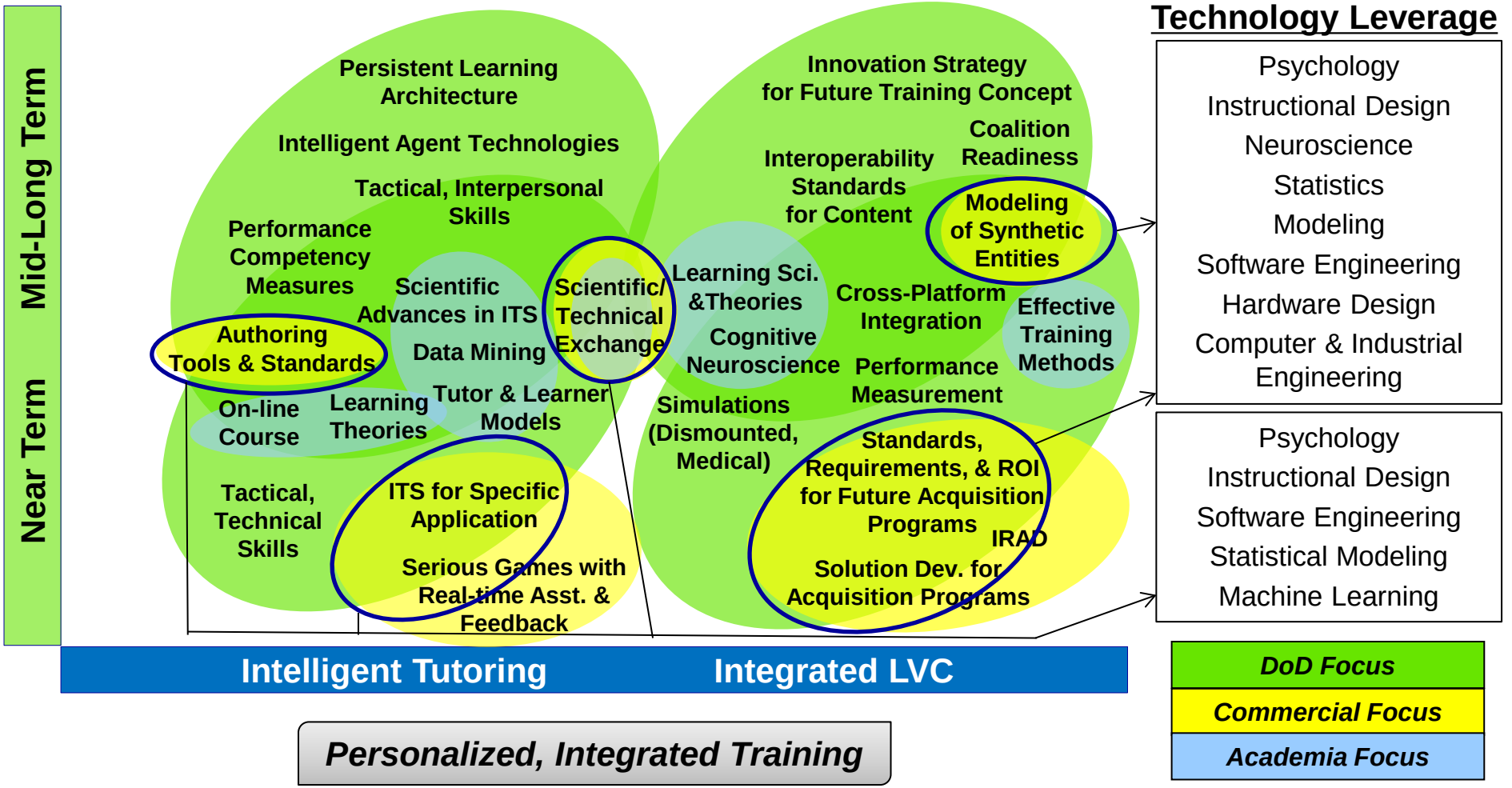
Academia Focus

Personnel Assessment

DoD looks for opportunities to leverage commercial technology where applicable.

Identifying commercial technology suitability to military use/environment is a challenge; it must be carefully evaluated to ensure requirements unique to DOD systems are met.

Assessment of Commercial–DoD Leverage Opportunities in HS – Training



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Sub Area

Systems Interfaces & Cognitive Processes

Objectives

- Allow Warfighters to focus on their primary mission, not on operating their tools
- Develop Human–Technology interactions with interfaces that:
  - Support bi-directional communication
  - Learn with experience
  - Do not require specialized operator selection and training

Program Overview

- ❑ **Human-Machine Teaming**
- ❑ **Intelligent, Adaptive Aiding**
- ❑ **Intuitive Interaction**

Key Technical Challenges

- Real-time physical & cognitive state assessment
- Determining when to adapt automation & interface modalities
- Natural language & gesture interfaces for human-machine interaction

Operational Opportunities

- Supervisory control interfaces & automation tools to permit a single warfighter to control multiple entities
- Interfaces with non-intrusive, mobile, wearable physiological monitoring technologies
- Novel 3-D visual symbologies for control in visually-degraded environments

Sub Area

Protection, Sustainment & Warfighter Performance

Objectives

- Understand the dimensions that affect human performance in the battle space
- Understand the trade-offs of new capabilities in operational environments
- Design for & exploit individual differences

Program Overview

- ❑ **Understanding Critical Stressors**
- ❑ **Developing Operationally Relevant Metrics**
- ❑ **Understanding Individual Differences**



Key Technical Challenges

- Define critical stressors that influence performance
- Understand ways of mitigating the effect of these stressors
- Develop measurements of performance that can be used in operational settings
- Define & validate operationally relevant test capabilities, metrics & measurement methods

Operational Opportunities

- Noninvasive persistent sensors & faster, lighter-weight computing for quantifying Warfighter performance in operational environments
- Enhance Warfighter performance through technologies such as those being developed in DARPA's Warrior Web, Air Force's BATMAN, & SOCOM's TALOS efforts

Sub Area

Human Aspects of Operations in Military Environments

Objectives

- Develop technologies to develop & display knowledge of combatant & non-combatant beliefs, attitudes, & norms that motivate threat behaviors in uncertain environments
- Develop capabilities to use that knowledge to construct optimal courses of action to achieve Commander's Intent & minimize unintended consequences
- Construct models to allow accurate forecasts of predicted events for proactive decision making

Program Overview

- ❑ **Human Activity ISR**
- ❑ **Crisis Analytics for Military Operations**
- ❑ **Language & Socio-Cultural Training**
- ❑ **Models for Socially-based Threat Prediction**

Key Technical Challenges

- Dynamic, unpredictable threat environments
- Emergent/variable sources of high volume, high velocity data of uncertain pedigree
- Complex interpretations of social-cultural data for sub-regions from semantic text
- Leader development to effectively negotiate an ever-changing environment of human complexity

Operational Opportunities

- Social data streams provide real-time situation awareness across the battlespace
- New analytics & algorithms are maturing to effectively exploit big, social data
- Basic research maturing to more effectively address social, cultural & language effectiveness & competency in operational environments
- Human ISR techniques maturing to provide enhanced situation awareness from many sensors

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Meeting the Demand Signal Success Stories

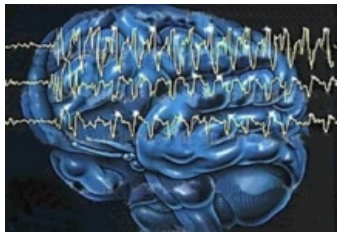
- **Translational Neuroscience for Enhanced Soldier-System Performance**
- **Body-Worn Equipment Systems**
- **F-22 On-Board Oxygen Generation System (OBOGS) Output Hypoxia**
- **Integrated Crisis Early Warning System (ICEWS)**

Example: Meeting the Demand Signal

Translational Neuroscience for Enhanced Soldier-System Performance

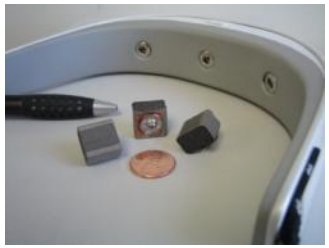
- **Objective**: Translate neuroscience-knowledge & tools from the laboratory into innovative, performance-enhancing Army technologies
- **Progress**: Successful demonstration & use of validation tools & technologies
  - Novel sensor designs & real-time analysis algorithms for improved interpretation of brain signals in operational settings
  - Innovative adaptive system designs
- **Payoff:** Real-time intuitive interactions that fundamentally change & enhance Soldier-system interactions & performance

Algorithms



Product: Robust Software

Neuroimaging Hardware



Product: Safe, Effective System Components

Interfaces

Product: Effective Comms Devices

Experimentation, Testing, & Validation

Product: EEG Phantom

Example: Meeting the Demand Signals

Body-Worn Equipment Systems

Objective: Optimize Form, Fit, & Function of body-worn equipment

- **Battlefield Air Target Man-Aided Knowledge (BATMAN)** FY02-FY16
  - 20+ Technologies Fielded (2012) including:
    - Human-Machine Interfaces, Displays, Tactical Headsets, Data / Power Cable Solutions
  - Improved intuitive equipment & human-machine interface technologies

- **Female Improved Outer Tactical Vest (FIOTV)**
  - Result: Improved functional fit, comfort, & mobility
  - Named one of Time Magazine's Best Inventions of 2012

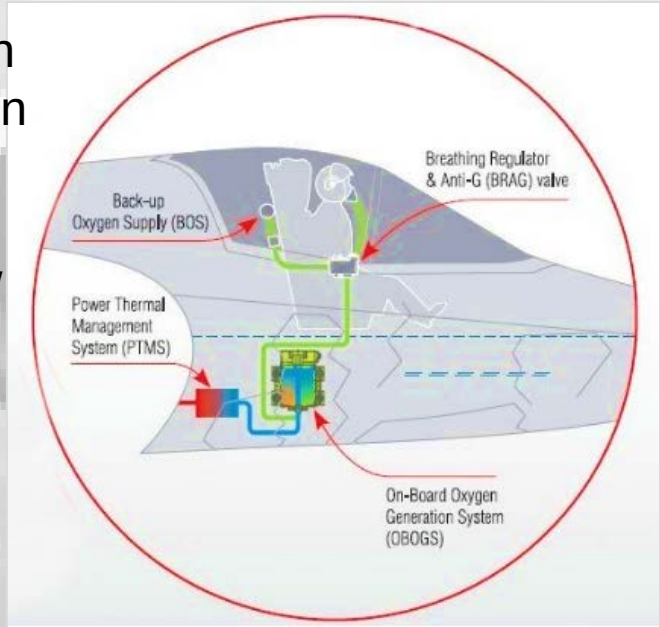
- **Marine Corps Load Effects Assessment Program (MCLEAP)**
  - Assess Warfighter agility under varying load conditions
    - Weight, Bulk, Stiffness
    - Develop Mobility metric for Requirements & Acquisition processes

F-22 On-Board Oxygen Generation System (OBOGS) Output Hypoxia

- **Project Description**
  - Quantified cognitive performance of pilots in F-22 and F-35 aircraft
  - Issues:
    - **Systems Integration**: Ability to measure oxygen levels required by pilot
    - **Cognitive Decision-making**: Requirement of the operator to recognize when they are in an impaired state

OBOGS System

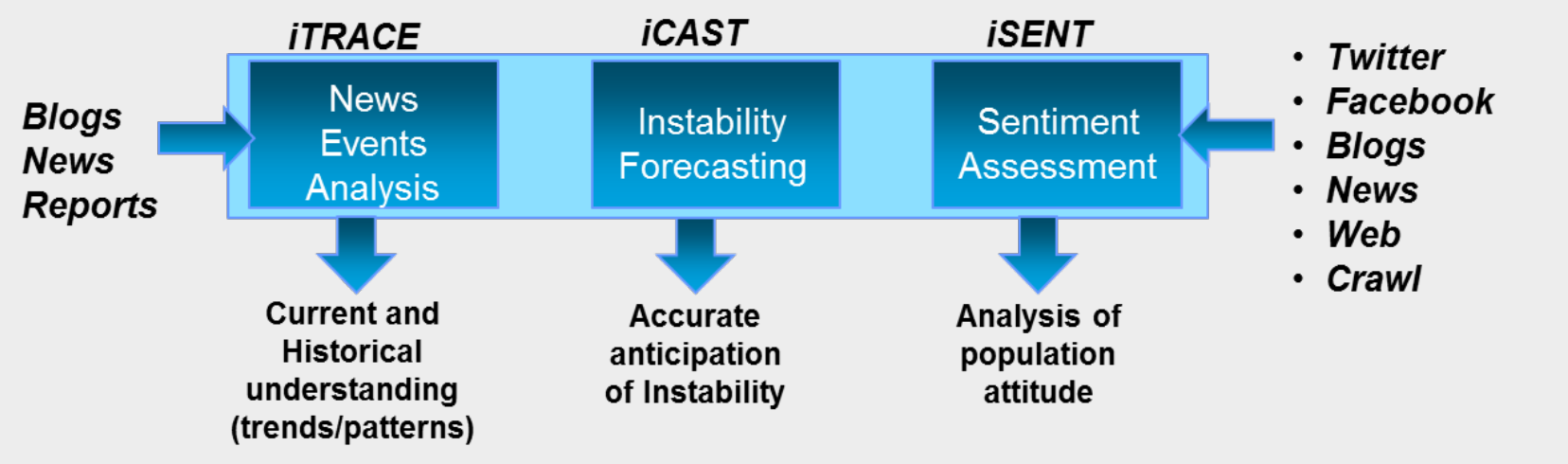
- **Accomplished**
  - Sensors on aircraft able to recognize if pilot is in an impaired state/hypoxic & supply appropriate oxygen output
    - Quantify impact of hypoxia on physical & cognitive performance on pilots actively engaged in physical / mental activities
    - Schedule breathing variable oxygen concentrations
  - Data is used to validate, modify, & re-design current/future OBOGS systems & Warning Band settings



- **Collaboration with ASBREM COI**

Integrated Crisis Early Warning System (ICEWS)

- **Objective: Create an analytic system that forecasts regional crises & instability to distribute manpower in effective, timely manner**
  - Near real-time data ingest & event coding for worldwide coverage
- **Funded through OSD Human Social Culture Behavior Modeling (HSCB) Program**
- **Successful transition to STRATCOM Integrated Strategic Planning & Analysis Network (ISPAN) Program of Record (FY15)**



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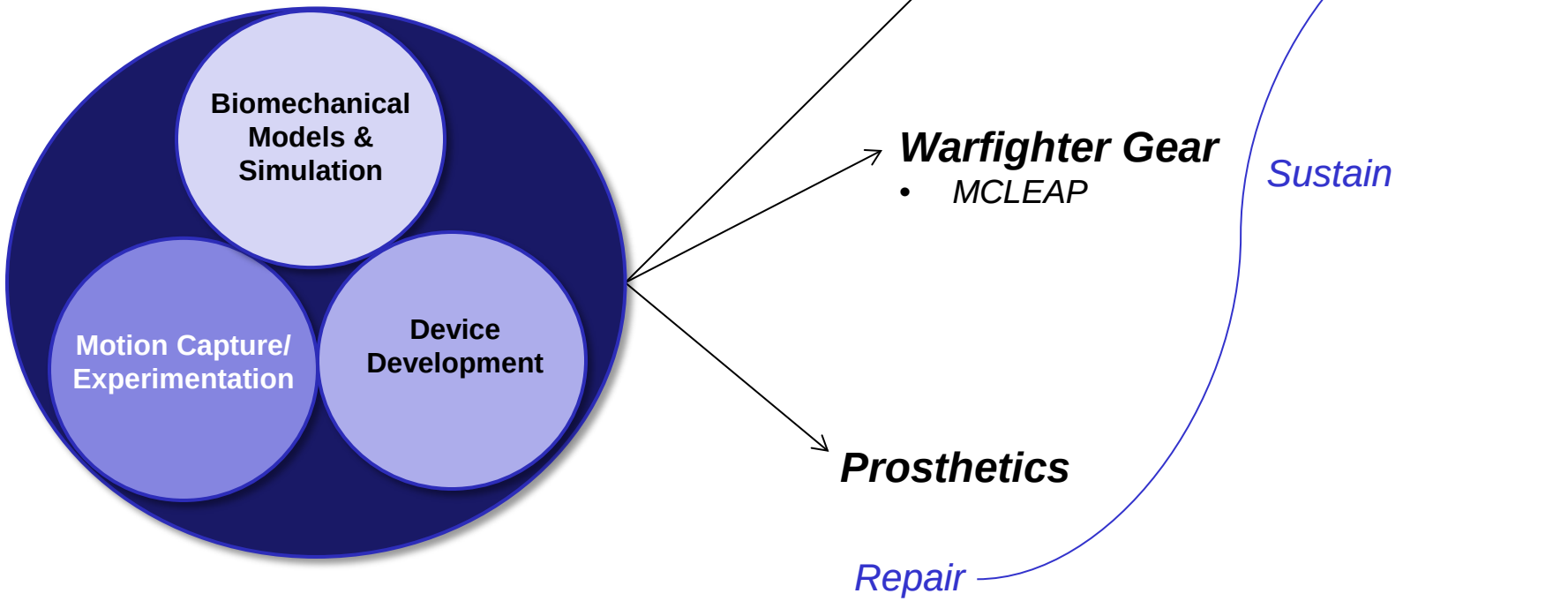
HS & Biomedical (ASBREM)

- **Biomechanical Modeling & Simulation (BMS)**
  - Improves affordability
  - Decreases time to prototype
  - Links technology design metrics to human performance



International S&T Collaboration

- **U.S.– India Cognitive Sciences/Autonomy & Directed Energy Workshops**
  - September 2014 in New Delhi, India
  - Led to the development of 11 potential collaborative projects

- **U.S.– Singapore Human Systems Workshop**
  - March 2014 in Singapore
  - Led to the development of 10 potential collaborative projects

- **TTCP HUM (Human Resources & Performance Group)**
- **NATO HFM (Human Factors & Medicine)**

Industry/Academia S&T Outreach & Collaboration

- **National Defense Industrial Association (NDIA) Human Systems Conference**
  - 6 – 8 Feb 2015
  - 2015 theme: **Human Systems – Maintaining Our Physical Edge, Enabling Our Cognitive Edge**

- **DoD Human Factors Engineering Technical Advisory Group (HFE TAG) Meeting 69**
  - 4 – 8 May 2015
  - 2015 theme: **The Relationship of Training Requirements & Technology to Mission-Level Capabilities**

- **Inter-service/Industry Training, Simulation, & Education Conference (I/ITSEC)**
  - 30 Nov – 4 Dec 2015
  - 2015 theme: **Forging the Future Through Innovation**

- **Joint Human Systems Independent Research & Development (IR&D) Technology Interchange Meeting with Industry**
  - 22 – 26 June 2015
  - Goals: Increase awareness, stimulate collaboration, and seek alignment between industry research & development projects and DoD high priority needs

Engagement: 2nd Joint Human Systems IR&D Technology Interchange

- **Summer 2015**
- **National Capital Region**
- **Marketplace will Feature Overview of Interchange and Department Needs**
- **Highlight Human Systems Key Focus Areas and Taxonomy**
- **Important Human Systems Strategic Information will be posted**
  - Roadmap
  - Presentations
  - Opportunities
- **Contacts**
  - Mr. Maris Vikmanis (maris.vikmanis@us.af.mil)
  - Mr. Giovanni “Gio” Pagan (giovanni.pagan@us.af.mil)

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Plenty of Opportunities for Government / Industry to Collaborate

- **Continuing to develop roadmaps for all Sub Areas**
  - Advance Personalized Assessment, Education, & Training to Level 4
  - Advance other Sub Areas to Level 3 (short-term) and Level 4 (long-term)
- **Developing programs and projects to address Demand Signals**
  - Share your approaches with us via coordinated events (NDIA HS Conference, IR&D Technology Interchange)
  - Directly interact with Sub Area Leads
- **Establishing Links with Other COIs**
  - Consider how your HS-focused efforts could be leveraged to support other COI needs
  - Consider how efforts you may have with other COIs could be leveraged to support HS

We must work together to sustain and enhance the readiness and capabilities of our Nation's Armed Forces