The Human in Defense Systems

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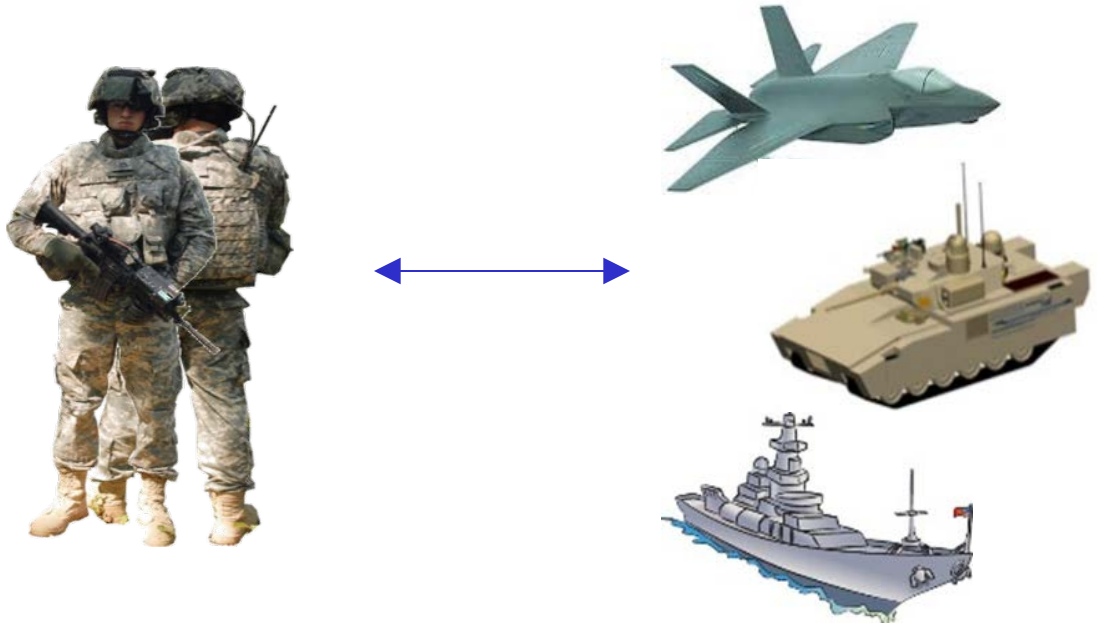
Outline

- Challenges and Opportunities
- Human-Centric Acquisition
- Connections Between the ASD(R&E) Communities of Interest
- Guiding Vision: Man-Machine Interfaces
- Developing a Systems Engineering “Language”

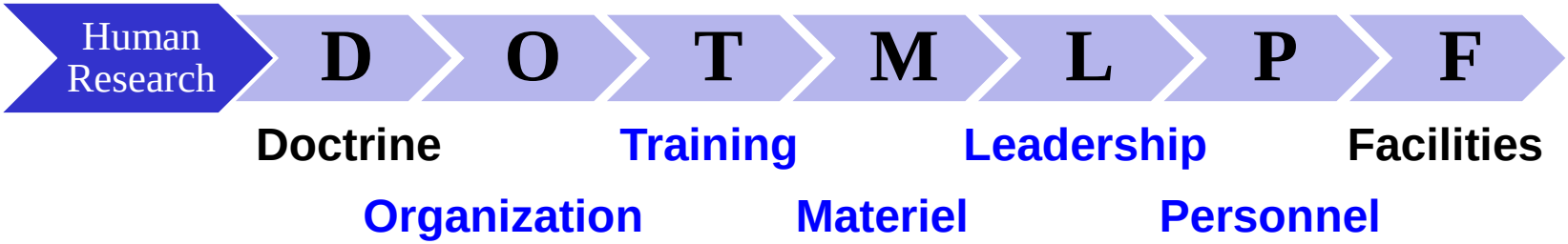


Challenges and Opportunities

Challenges and Opportunities

- **Challenges:**
  - **Reducing the cost of defense systems throughout their life cycle**
  - **Research in human systems does not always transition into Programs of Record (PoR)**

- **Opportunities:**
  - **Human systems research significantly impacts the DOTMLPF spectrum**



Challenges and Opportunities

- **The DoD and Industry are working together to:**
  - **Eliminate bad human-systems integration**
  - **Develop tactics, techniques, and procedures to optimize human performance**

Challenges and Opportunities

- **Request Industry to further participate by:**
  - **Mirroring the DoD placement of the human at the center of the Acquisition Process**
  - **Encouraging human systems researchers to think of the Programs of Record as their "customer"**

Human-Centric Acquisition

DoD S&T Focus Has Traditionally Been System Centered

Enablers/Commons

Space Programs (PNT, Comms, ISR)

Cyber

EW/ EMS

Space

C2

Undersea Offensive

Air Force

Navy

Army

Marine Corps

Focused on big acquisition systems

A car is not this….

…it is this!

Mostly materiel with human interface

Soldier system is not this…

… it is this!

Mostly human with materiel interface

Human-Centered Acquisition

Space Programs
(PNT, Comms, ISR)

Cyber

EW/ EMS

Space

C2

Undersea
Offensive

Air Force

Navy

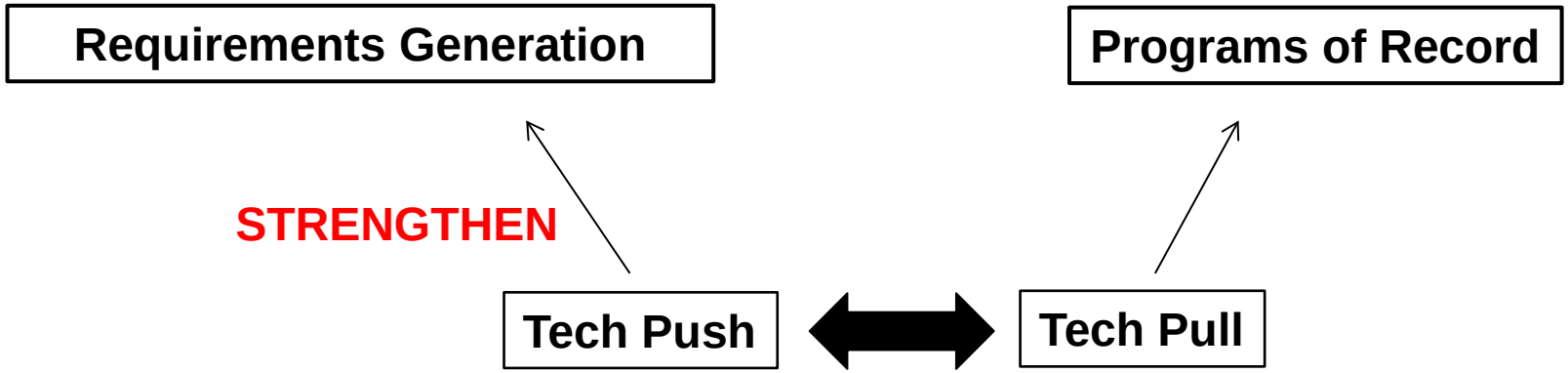
Army

Marine Corps

- The human is the starting point for system design
- Expands upon the capabilities of the Warfighter

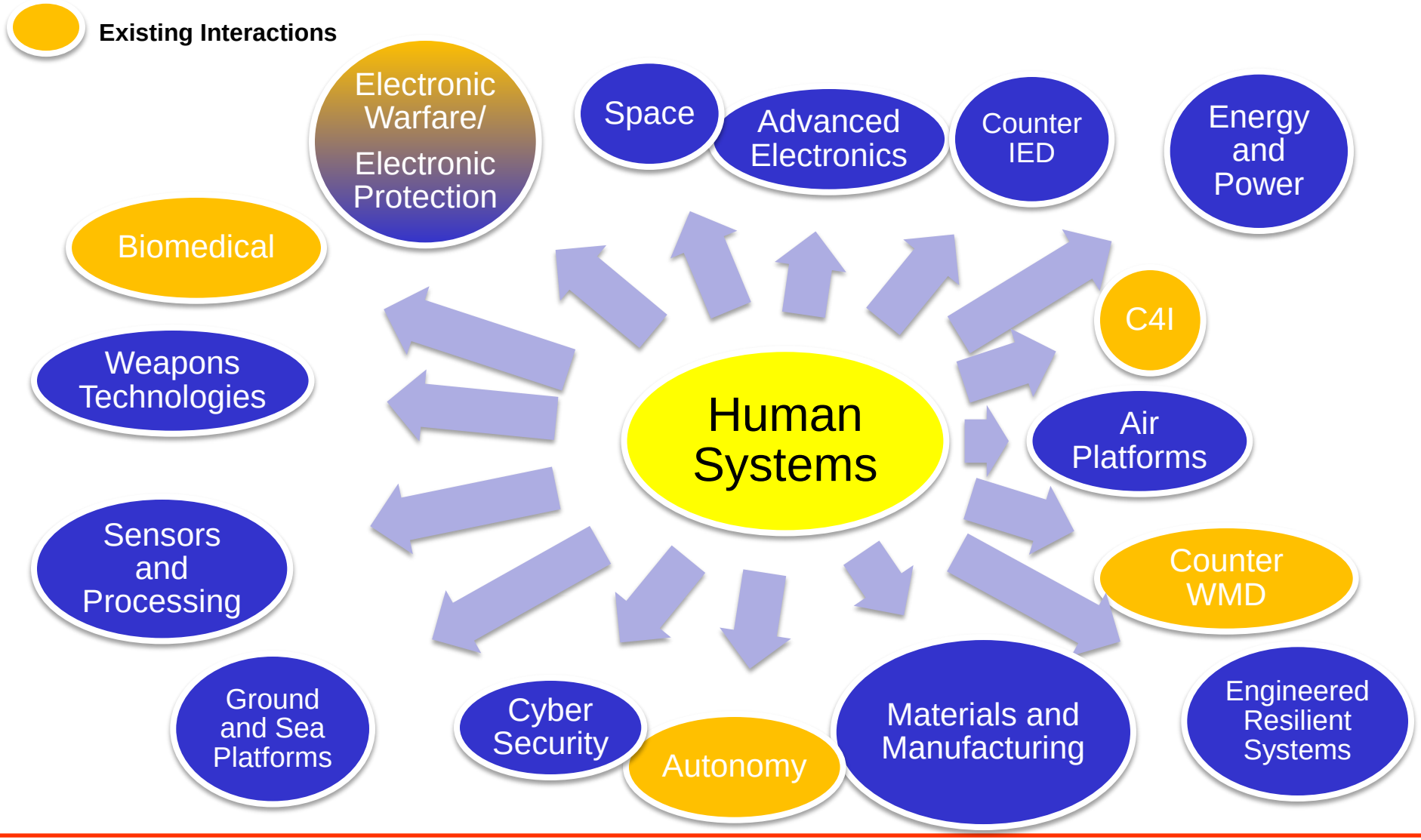
S&T Insertion into the Acquisition Process

Interactions with the Requirements writers within the Joint Staff and Components will bring human systems considerations into the planning cycle



Connections Between the ASD(R&E) Communities of Interest

Interactions with Human Systems CoI



Joint Human Systems IR&D Technical Interchange June 2013

Contact: Jaymie Durnan, Jaymie.a.durnan.ctr@mail.mil

Online Virtual Interchange

DefenseInnovationMarketplace.mil

HS COI Selection

Evaluation Criteria

- Link to technology gap
- Tech insertion opportunity
- Risk level
- Meets requirement?
- Innovation

Submissions Evaluated by CoI Subarea Leads, Service Reps and SMEs

Results

19 companies selected to brief 43 projects

CoI Selection — May 13

Tech Interchange — 24-28 Jun 13

Nov 12 — Mar 13 — May 13 — 24-28 Jun 13 — Dec 13

Joint Human Systems IR&D Technical Interchange June 2013

- All 19 companies provided follow-on opportunities
  - Meetings, site visits, data exchanges
  - Key organizations at OSD and Services are engaged
  - Working CRADAs, MOAs, and research proposals
- Industry feedback
  - "Marketplace very helpful to get the "Big Picture" of the Human Systems CoI"
  - "Tri-Service approach very effective and efficient"
  - "Senior level insight helped provide context to Fedbizopps data"
  - "Left the Technical Interchange knowing someone in DoD was interested in their projects"
- DoD Next Steps
  - Track actions and status outcomes of projects
  - Committed to using process

Changing the Emphasis of DoD Data Analytics

- **Interacting with data analytics researchers to focus part of their research on decision making**
- **DoD is hosting a Technical Interchange Workshop to better understand how decision scientists, computer scientists, and visual display experts need to interact to optimize decision support tools**
- **Systems Integration Laboratories (SILs) will be used to evaluate the effectiveness of data analytics toolsets in human decision-making scenarios**

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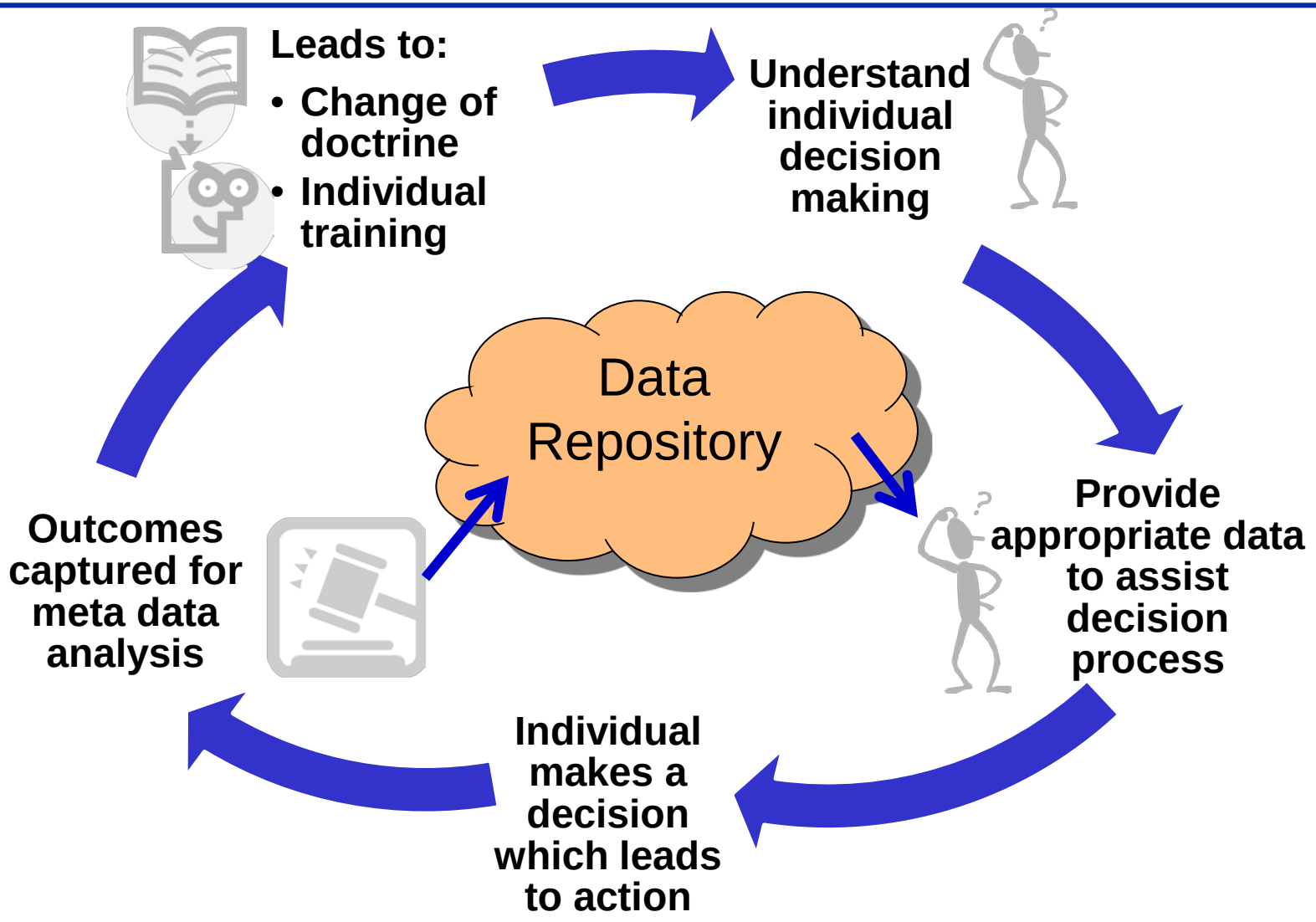
Vision for Decision Support



Guiding Vision: Man-Machine Interfaces

Guiding Vision: Natural Human-Technology Interactions

These soldiers will move through this building…without speaking a word

Need to replicate this for human–technology interactions

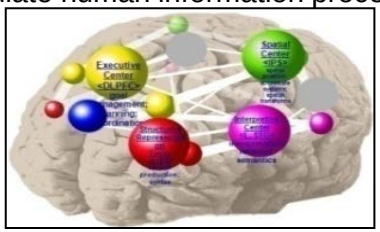
More interactive and faster responding "hybrid human-machine teams"

Converge Multiple Domains: Natural Human-Technology Interactions

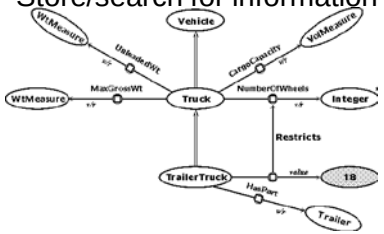
HUMAN

MACHINE

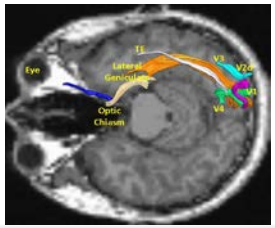
Computational Modeling
Simulate human information processing



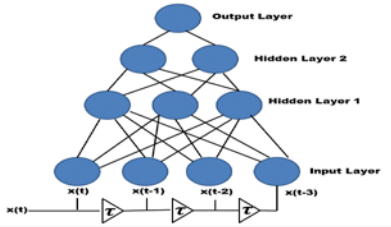
Knowledge Systems
Store/search for information



Neuroscience
Brain's operating principles

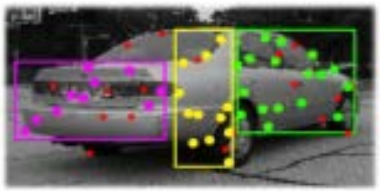


Context Inference
Reason about a situation



Evolutionary Biology / Social Psychology
Cognitive and Behavioral operating principles

Computer Vision
Lays groundwork for reasoning about a situation



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Developing a Systems Engineering "Language"

Army's Soldier System Engineering Architecture (SSEA)

Set-based design:

- **A design method that requires a shift in how one thinks about and manages design**
- **Allows more of the design effort to proceed concurrently and defers detailed specifications until tradeoffs are more fully understood**

Contact: Sue Butler, Natick Soldier RDEC, susan.j.butler8.civ@mail.mil

Applying MilStd.881 Construct

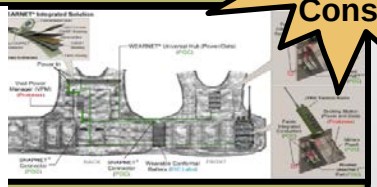
Platform	Systems Engineering Approach	
	Air	Ground
Chassis/ Frame		
	Rigid, Static (laws of physics based)	**Rigid, Static** (laws of physics based)

technical system

Subsystems
(few examples only)

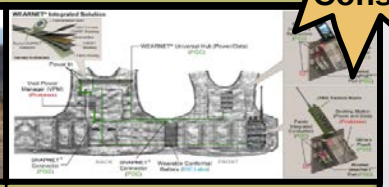
Electronics	Avionics	Vehicle Electronics
Propulsion	Engines, motors	Engines, motors
Optics	Cameras, lens, imaging, sights	Cameras, lens, imaging, sights
Controls	Computers, sensors, levers	Computers, sensors, levers
Fuel / Power	JP-8, batteries, etc	JP-8, batteries, etc
Communications & Networks	Comms devices, systems and network connectivity	Comms devices, systems and network connectivity
System Health	Diagnostics & Maintenance	Diagnostics & Maintenance

System Engineering the Army's "Soldier System"

Platform	Systems Engineering Approach: Soldier and Small Unit	As Compared to	Systems Engineering Approach: Air	Systems Engineering Approach: Ground
	Applying MilStd.881 Construct			
Chassis/ Frame	 **Rigid, Static** (laws of physics based very small platform)		 **Rigid, Static** (laws of physics based)	 **Rigid, Static** (laws of physics based)
			technical system	
Subsystems (few examples only)				
Electronics	Worn & borne electronics		Avionics	Vehicle Electronics
Propulsion	Engines, motors		Engines, motors	Engines, motors
Optics	Cameras, lens, imaging, sights		Cameras, lens, imaging, sights	Cameras, lens, imaging, sights
Controls	Computers, sensors, levers		Computers, sensors, levers	Computers, sensors, levers
Fuel / Power	Batteries, fuel cells, generators, etc		JP-8, batteries, etc	JP-8, batteries, etc
Communications & Networks	Comms devices, ad hoc mobile network		Comms devices, systems and network connectivity	Comms devices, systems and network connectivity
System Health	Diagnostics & Maintenance		Diagnostics & Maintenance	Diagnostics & Maintenance

Soldier and Small Unit Systems Illustration of the Challenge
(in comparison to other Weapons Platforms)

Applying MilStd.881 Construct

Platform	Systems Engineering Approach: Soldier and Small Unit		As Compared to	Systems Engineering Approach: Air	Systems Engineering Approach: Ground
Chassis/ Frame	  				
	Dynamic, Flexible, Variable (biological/physiological/ psychological / sociological based)	Rigid, Static (laws of physics based very small platform		Rigid, Static (laws of physics based)	Rigid, Static (laws of physics based)
	socio-technical system			technical system	
Subsystems (few examples only)					
Electronics	"Humionics" – brain, contextual processing	Worn & borne electronics		Avionics	Vehicle Electronics
Propulsion	Muscles & willpower	Engines, motors		Engines, motors	Engines, motors
Optics	Eyes & Vision	Cameras, lens, imaging, sights		Cameras, lens, imaging, sights	Cameras, lens, imaging, sights
Controls	Brain & cognitive processing Willpower	Computers, sensors, levers		Computers, sensors, levers	Computers, sensors, levers
Fuel / Power	Food & water Brain, muscle & willpower	Batteries, fuel cells, generators, etc		JP-8, batteries, etc	JP-8, batteries, etc
Communications & Networks	Verbal & non-verbal language, social networks, culture belongingness / unit cohesion	Comms devices, ad hoc mobile network		Comms devices, systems and network connectivity	Comms devices, systems and network connectivity
System Health	Diagnostics, prognostics, treatment, fitness & wellness	Diagnostics & Maintenance		Diagnostics & Maintenance	Diagnostics & Maintenance

Soldier/Small Unit: The Army's ONLY biologically-based weapons system platform

Summary

- **Human systems research provides opportunities to bend the cost curve of DoD acquisition**
- **DoD is emphasizing the connection between the human and the technology**
- **DoD is sponsoring several workshops to build upon the “Guiding Visions”**