

S&T Stakeholders Conference- EAST

June 2-5, 2008

Human Factors Division:
Personal Identification Systems and
Human Systems Research & Engineering

Thomas Coty, Personal Identification Systems Director
Janae Lockett-Reynolds, HSR&E Program Manager
Ji Sun Lee, Technology Acceptance and Integration Program Manager

Science and Technology Directorate
Human Factors Division



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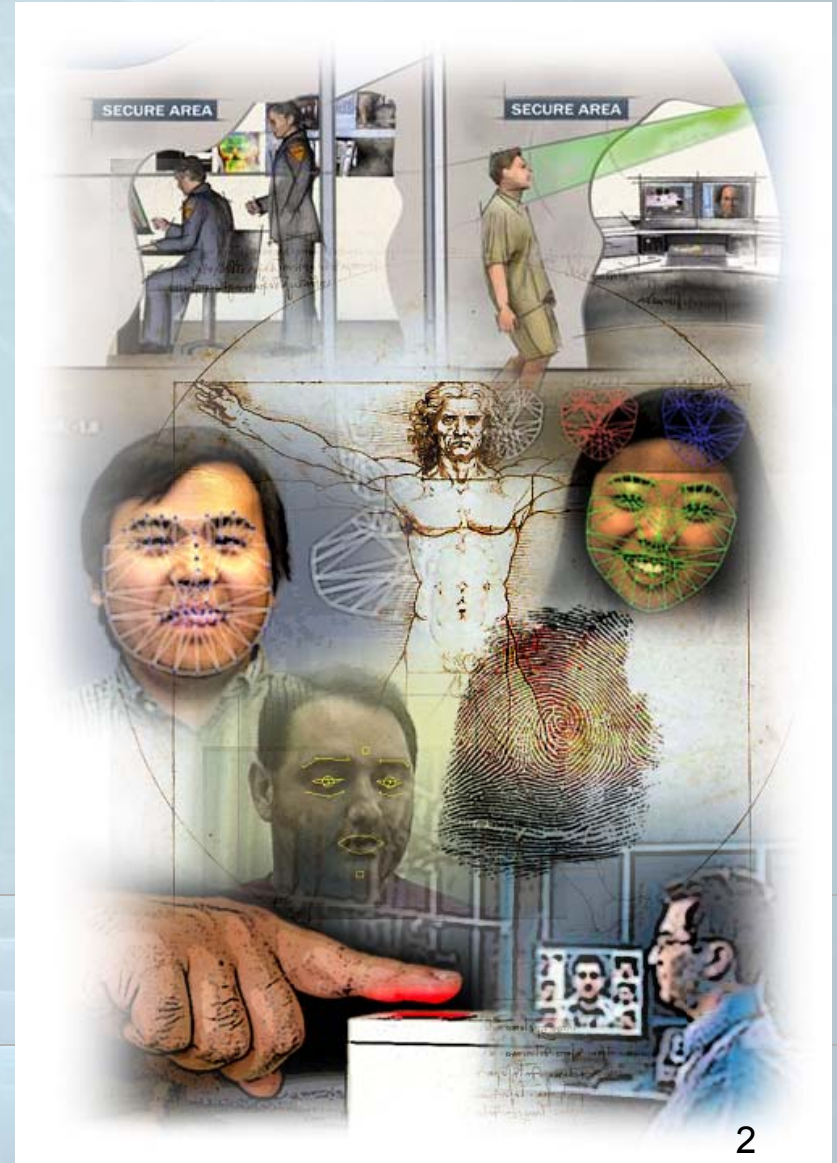
Vision:

Human Factors is committed to ensuring the security of our Nation by integrating the human dimension in developing capabilities to support the analytical, operational and policy needs of Homeland Security.

Mission:

To apply the social, behavioral and physical sciences to improve identification, analysis, and understanding of the threats posed by individuals, groups, and radical movements; to support community preparedness, response, and recovery to catastrophic events; and to advance national security by integrating the human element into homeland security science & technology.

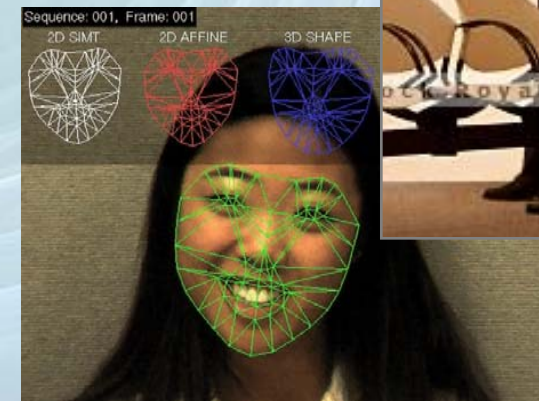
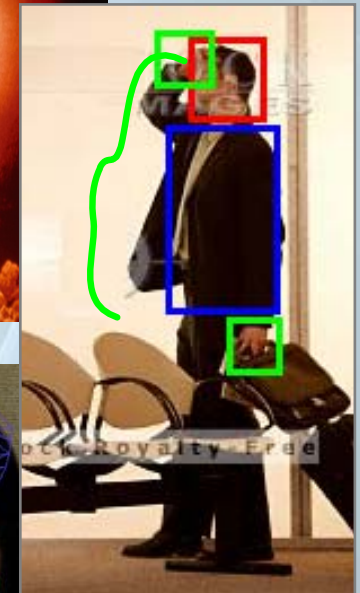
Customers: TSA, US-VISIT, USCIS, ICE, SCO, USSS, FEMA, OI&A, USCG, State & Local, S&T Divisions



HFD Thrust Areas

The DHS S&T Human Factors Division is comprised of three primary thrust areas, with programs under each:

- Social-Behavioral Threat Analysis
 - Precursors, Signatures, and Deterrence of Radicalization
 - Suspicious Behavior Detection
 - Community Preparedness, Response, and Recovery
- Personal Identification Systems
 - Biometrics
 - Credentialing
- Human-Systems Research & Engineering
 - Technology Acceptance and Integration
 - Human-Systems Optimization



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Human Factors Division Goals

1. Enhance the analytical capability of the Department to understand terrorist motivation, intent, and behavior.
2. Improve screening by providing a science-based capability to identify *unknown* threats indicated by deceptive and suspicious behavior.
3. Improve screening by providing a science-based capability to identify *known* threats through accurate, timely, and easy-to-use biometric identification and credentialing validation tools.
4. Enhance safety, effectiveness, and usability of technology by systemically incorporating user and public input.
5. Enhance preparedness and mitigate impacts of catastrophic events by delivering capabilities that incorporate social, psychological and economic aspects of community resilience.

Know our enemies, understand ourselves; put the human in the equation.



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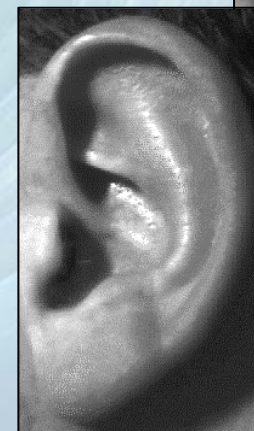
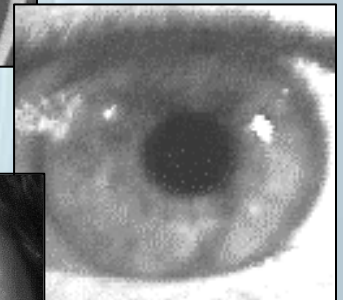
What are Biometrics?

A Characteristic:

A measurable biological (anatomical and physiological) and behavioral characteristic that can be used for automated recognition.

A Process:

Automated methods of recognizing an individual based on measurable biological (anatomical and physiological) and behavioral characteristics.



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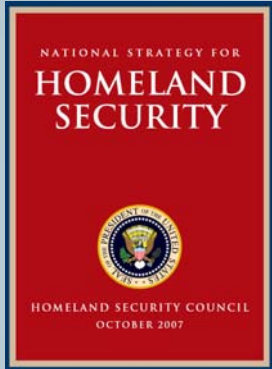
Why is DHS doing Biometrics S&T?

- Biometrics is an enabling technology that may significantly improve future DHS screening capabilities.
- DHS operational components have identified biometrics as a high priority capability gap.
- Screening operations within the DHS mission space pose major challenges to widespread deployment of biometrics.
 - Scale and diversity of screening sites
 - Need to accommodate existing DHS screening practices
 - Minimal impact on screener workload
 - Minimal impact on wait time and throughput of screened individuals
 - Harsh lighting and environmental factors
 - Real-time access to match results across the DHS enterprise
 - Interoperability with mission partners



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Biometric Priorities at DHS S&T

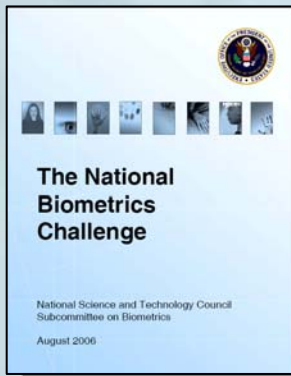
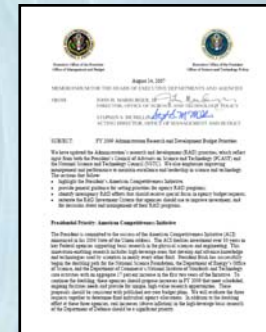


“In the face of resourceful terrorists, however, we must continue to expand the US-VISIT program’s biometric enrollment from two fingerprints to ten fingerprints, as well as leverage science and technology to enable more advanced multi-modal biometric recognition capabilities in the future that use fingerprint, face, or iris data.”

- National Strategy for Homeland Security, Homeland Security Council, October 2007

“...agencies are to place emphasis on the priorities outlined in The National Biometrics Challenge and the resulting agenda developed by the NSTC Subcommittee on Biometrics and Identity Management.”

- OMB and OSTP FY2009 R&D Budget Priorities (www.ostp.gov)



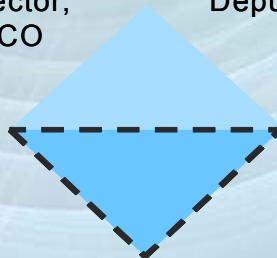
DHS People Screening IPT

Kathy Kraninger
Director,
SCO

Jock Scharfen
Deputy Director,
CIS

Acquisition

Sharla Rausch
Director,
Human Factors

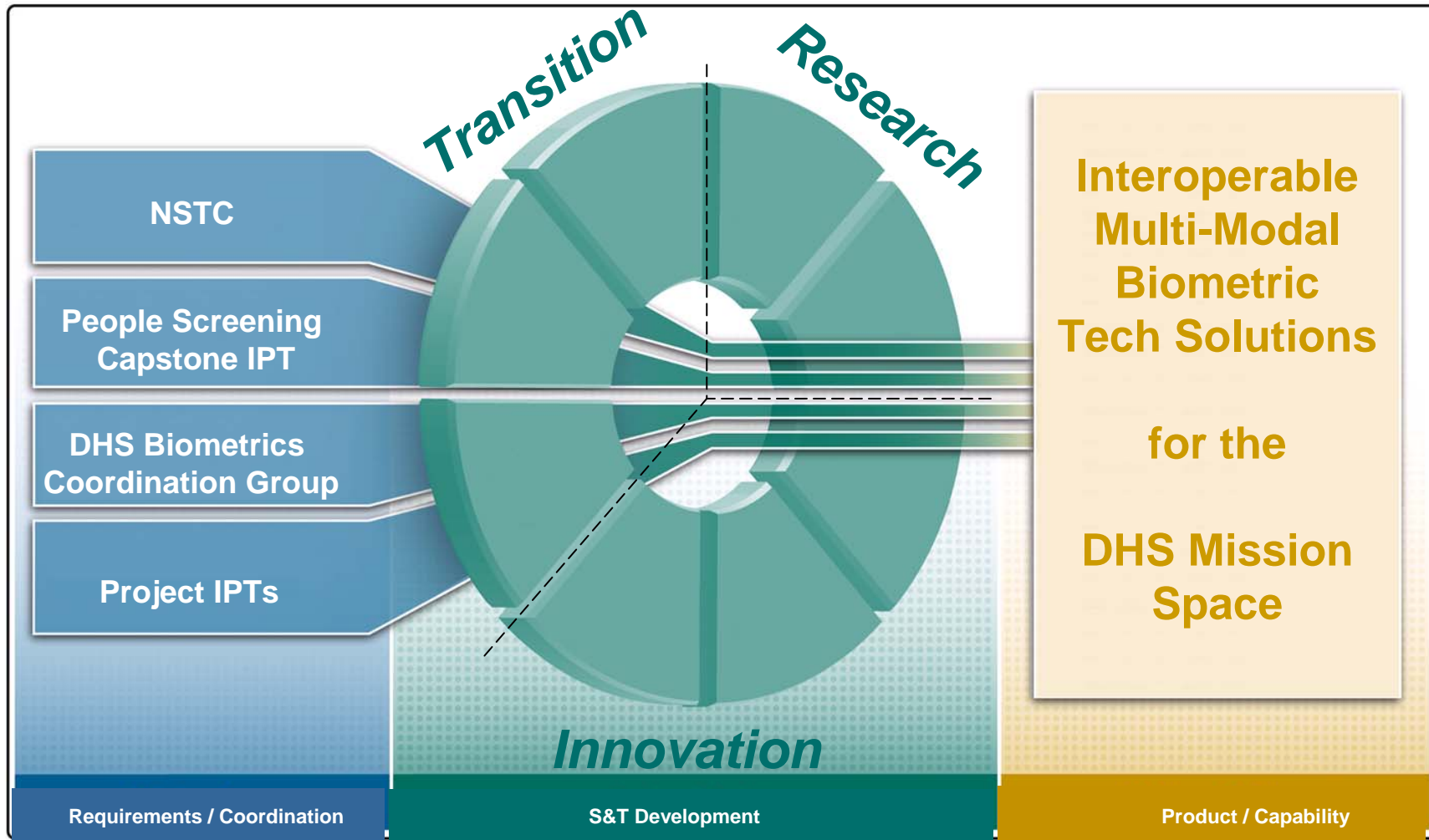


Bob Mocny
Director, US-VISIT



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Biometrics at S&T, DHS



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Biometric Portfolio Focus Areas

Collection Systems: Improve effectiveness, efficiency, and suitability of collection systems in DHS operational environments.

- Example: Mona Pass

Sensors: Develop and improve sensor technologies to improve fidelity of salient features in biometric samples (e.g. face/iris capture at a distance, roll equivalent prints)

- Example: Remote SBIR (3), Contactless Fingerprint, Rapid DNA

Algorithms: Develop and improve algorithms for biometric feature detection, segmentation, quality assessment, compression, sample processing, and multi-biometric fusion.

- Example: Biometric sample quality, Biometric sample compression

Information Sharing/Identity Resolution: Develop and improve mechanisms for secure and efficient exchange of interoperable data.

- Example: Multi-biometric Framework, Interoperable standardized data, Integrated Search capability

Testing and Evaluation: Development of test capabilities (methodologies and tools) to evaluate biometric components (sensors, algorithms, etc.)

- Example: Multi-Biometric Grand Challenge



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Biometrics Project Evaluation

Informal Criteria




- Does the candidate project have a DHS “Customer”?
 - Is there a capability gap identified within a Capstone IPT that the project proposes to address?
- Does the candidate project have an S&T focus?
 - Does it require effort to progress technology readiness level?
- Will the candidate project provide the appropriate mission impact?
 - Does the project align to an operational/strategic initiative?
- Is there a potential partnership with USG partners or other entities?
 - Is there an opportunity to leverage other organization requirements or resources?



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Current State of Multi-modal Biometrics

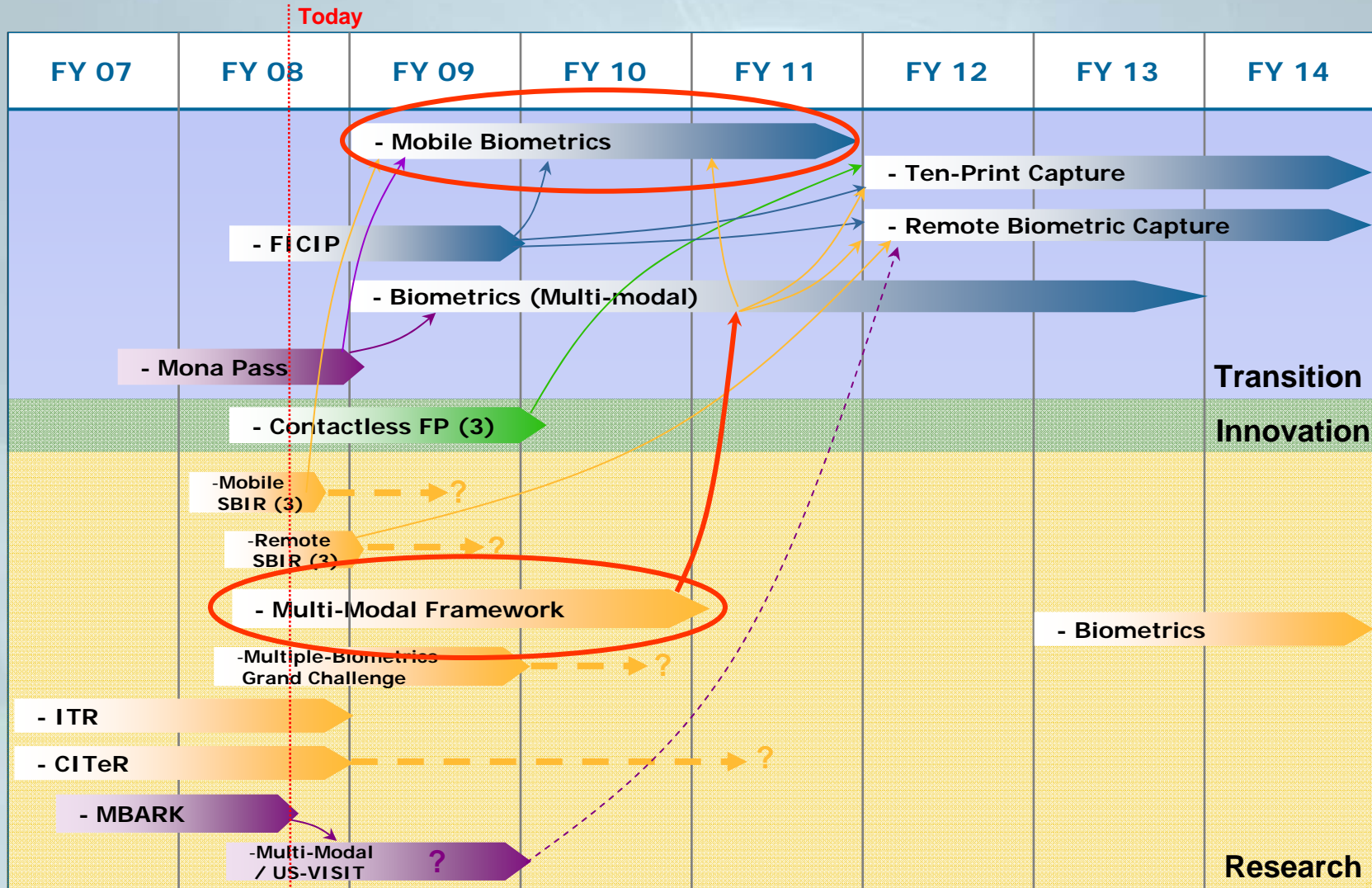
R&D Remains to be Done

-  Existing Capability
-  R&D remains
-  Much R&D remains

	Fingerprint	Other Biometric Modalities		
		Iris	Face	Novel Biometrics (Vascular pattern, Dynamic signature, etc.)
Interoperable Data	Data standards exist and are proven in operational use	Non-proprietary Data Standards are under revision and have not been demonstrated	Non-proprietary Data Standards are under revision and have not been demonstrated	Data Standards are under development
Specifications for Collection Sensors	Specifications for some types of sensors exist. Work required for other sensors.	Specifications do not exist. Work is required to initiate this effort.	Specifications do not exist. Work is required to initiate this effort.	Specifications do not exist. Work is required to initiate this effort.
Well-defined Definition of Quality	No consensus on definition of quality	No consensus on definition of quality	No consensus on definition of quality	No consensus on definition of quality
Large-scale identification Capability	Capability using non-proprietary data is demonstrated and proven	No capability has been demonstrated using non-proprietary data. Capability demonstrated using proprietary data	No capability exists	No capability exists



DHS S&T Biometrics Program Timeline



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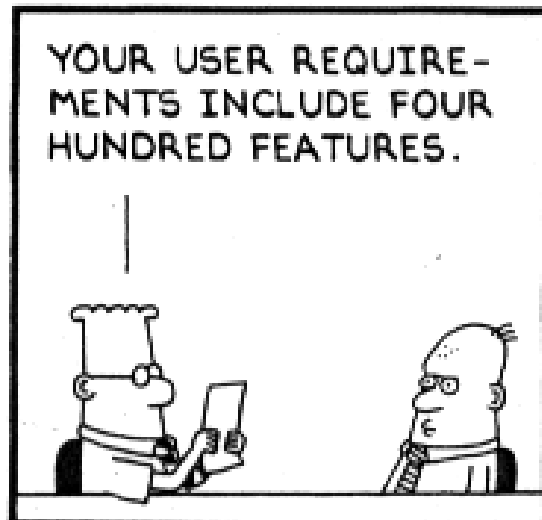
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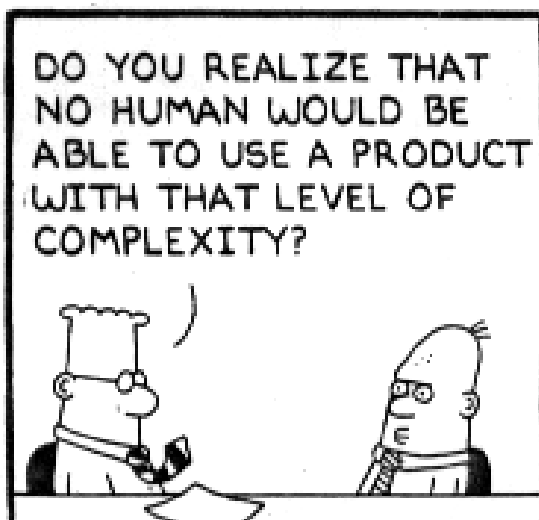
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Human Systems Integration An Overview

DILBERT by Scott Adams



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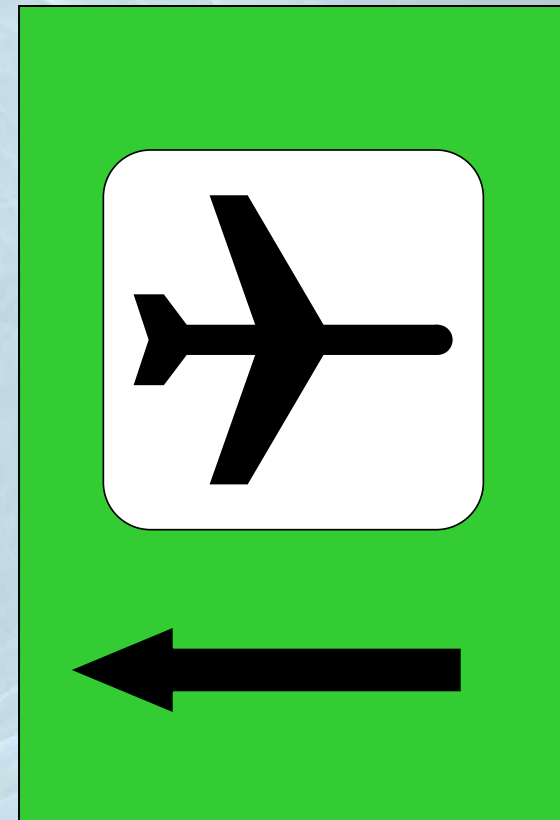
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Human Systems Research & Engineering (HS R&E)

- Pertains to knowledge of human physical, sensory and cognitive capabilities and limitations to design of systems and equipment.
- Commonly referred to as ergonomics and human engineering, human factors, human-system integration
- Ensures appropriate match between human operator and maintainer capabilities and limitations, and system requirements.
- Applicable at levels from individual operator to *systems-of-systems*.
- A specialty engineering discipline within the overall systems engineering process.



Which way?



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Human Systems Research & Engineering (HSR&E)

- All DHS systems are designed, built, operated or maintained by humans; therefore the potential for human error is a risk that should be addressed from the creation of the designated contract vehicle (BAA/RFP/RFI/SOW), and managed as the technology matures from TRL1-9



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HS R&E Impact on The Department of Homeland Security

- **Cost Effective**
 - *Reduction in Total Ownership Cost*
- **Supports Strategy for Technology Transition**
 - *Provides a means of ensuring transition of technology that meets mission, operational, and performance requirements*
- **Supports a Risk-Based Approach**
 - *Systematic approach to managing risk associated with human performance*
- **Development of Reliable and Usable Systems**
 - *Support decision-making, team coordinated tasks, and reduction in human error*
 - *Systems that are acceptable to the public and end USERS*



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Human Systems Research & Engineering Program

Goal

- Incorporate Human Systems Integration into the contracts, planning and execution of DHS research and acquisitions by conducting Human Systems Integration analysis, design and testing throughout the system life-cycle

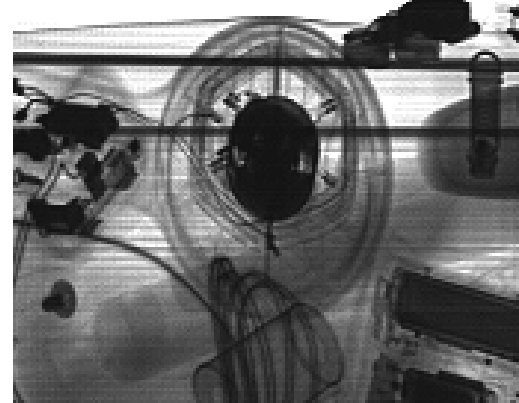
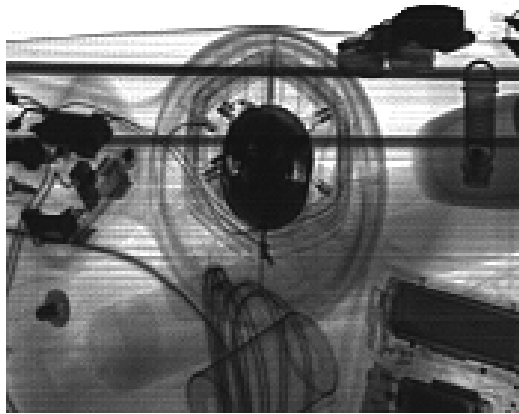
Approach

- Working with program managers
- Connecting and collaborating with Human Systems Integration focals and end users within all DHS components by establishing a Community of Practice
- Education
- Management Directive/Policy
- Internal and External Outreach



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KDE X-ray Images



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Human Systems Research funded through the Transportation Security Laboratory (TSL)

Motion X-Ray

- Motion provides the best perceptual clue for object identification
- Motion X-Ray images showed an increase in hits and decrease in false alarms over Static X-Ray images

Screeners Performance

- X-Ray Priming Method (XPM) designed to overcome the decrease in performance associated with low target prevalence
- Result in Increased Screener Vigilance and Threat Detection Performance

Fatigue

- Created new 3-minute version of Performance Vigilance Test (PVT) that is sensitive to fatigue and X-ray performance deficits caused by fatigue



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Human Systems Research funded through the Transportation Security Laboratory (TSL) cont.

Automation Effects on Weapons Detection

- Assess the effect that automated explosive alarms have on the detection of other unidentified explosives, guns, knives, liquids, etc
- Expected to result in an increase in weapons detection accuracy when using an Advanced Technology X-ray at security checkpoints

Discrimination Pilot Training

- Training Reduced False Alarm Rate by 50%
- Exposure and Identification Training:
 - Increased Correct Rejection rates \approx 59% to 75%
- Perceptual Discrimination Training:
 - Increased Hit rates for Difficult Targets \approx 65% to 80%



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Human Systems Research & Engineering Technology Acceptance and Integration Program

Community Perceptions of Technologies (CPT) Panel

- CPT Panels seek to successfully develop and adopt application specific, publicly acceptable technologies and processes. Uniquely aims to understand the interaction between the technology and the affected communities, not just the users of the technology.
- Panels mitigate risk for efforts in the transition program.
- Input from the panel will help DHS understand potential obstacles to the successful development and deployment of technologies.
- The Homeland Security Institute will conduct 3-4 panels per year.



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Human Systems Research & Engineering Technology Acceptance and Integration Program

Goal

- To successfully develop and adopt application specific, publicly acceptable technologies and processes.

Approach

- Each panel will focus upon on a selected technology.
- Expert panelists from industry, public interest, and community-oriented organizations will participate.
- The qualitative data collection method will be utilized to inform operational processes, development and deployment of technology, and be used to guide the design of additional research tools (i.e. broad based surveys).

Questions for Panel:

- What are the limiting factors in developing and deploying a federally funded technology?
- How can qualitative data inform concepts of operations and the collection of requirements data?
- What are the research gaps in the field of public perception/community acceptance with special attention to minority communities and cultural understandings of privacy, civil liberties, and national security?
- How does the agency develop an education/communications strategy around a specific application?



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