Air Force Research Laboratory

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Human-Machine Trust Research

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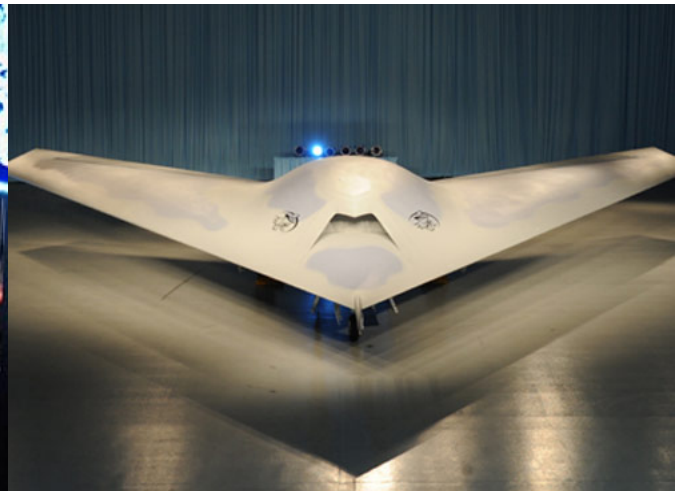
Operational Context: What do we work on?



Higher complexity may foster more distrust

Automation may foster complacency
(Rovira et al., 2007; Parasuraman & Riley, 1997)

Analysts are resistant to new automated tools

Which has a big cost (Onnasch et al., 2013)

For H-M teaming: trust antecedents > reliability & task elements
(Groom & Nass, 2007; Ososky et al. 2013)

Support Today's Need **Lead Tomorrow's Science**

What is Trust?

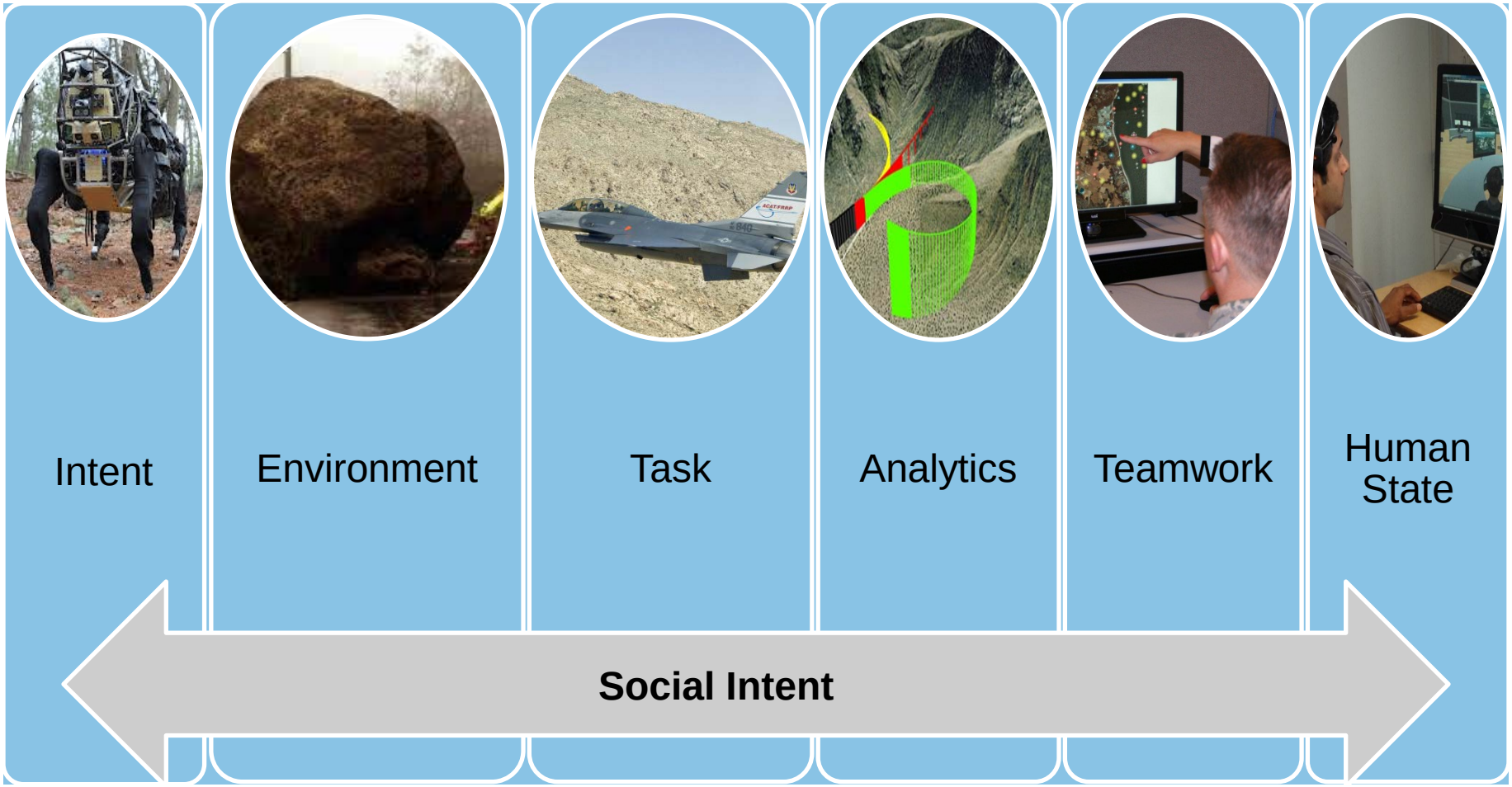
Trust = willingness of individuals to accept vulnerabilities from the actions of others with little ability to monitor their actions (Mayer et al., 1995)

Assumptions:

- Trust as a human phenomenon
- Trust is dynamic (Levine et al., 2006)
  - Factors that predict initial trust may differ from those that predict trust maintenance (Li et al., 2008)
  - Drivers of initial trust critical to technology acceptance
    - Performance - strong predictor in HRI (Hancock et al., 2011)
    - Social norms, institutional norms, reputation, perceived benefits/risks (Li et al., 2008)
    - Cognitive Schemas (Merritt, 2013)
    - Anthropomorphism (Waytz et al., 2014)
- Trust leads to reliance behavior (Lee & See, 2004; Mayer & Gavin, 2005)

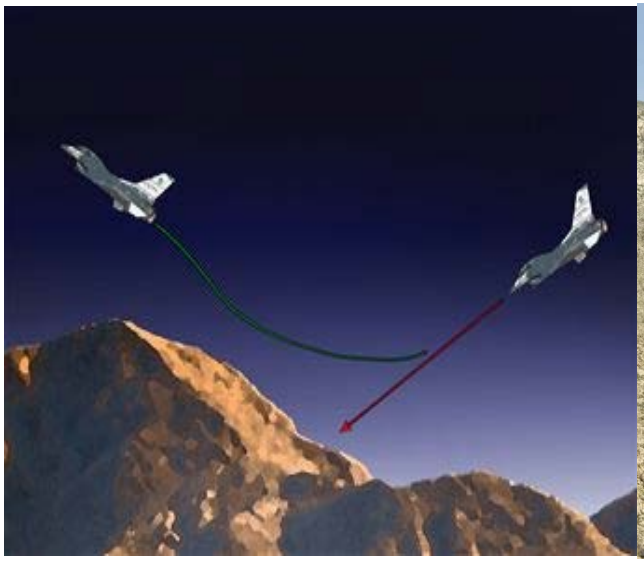
Transparency

- **Human-Robot Transparency (Lyons, 2013)**



Field Study of Automated Ground Collision Avoidance System (GCAS)

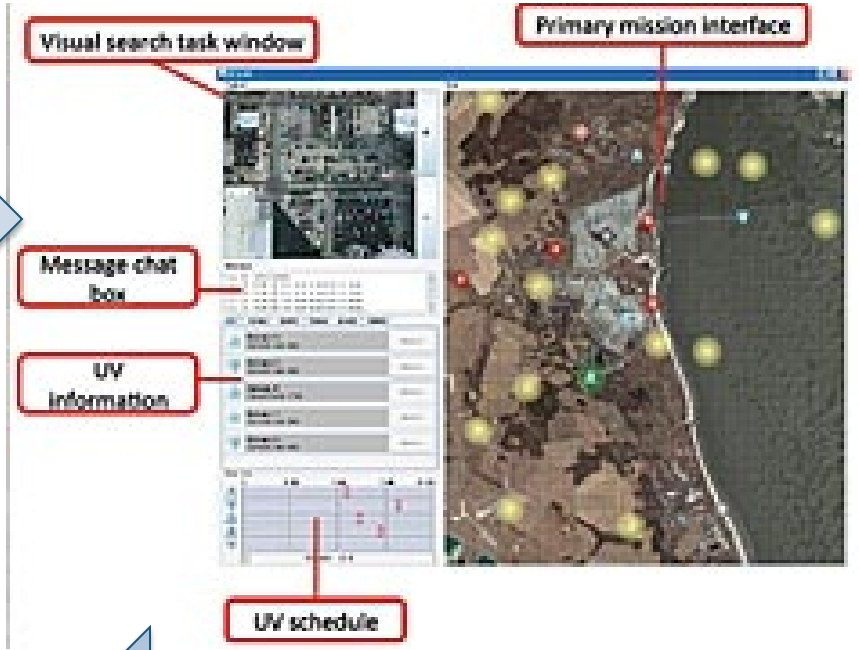
- **Objective: Understanding antecedents of trust among test pilots, managers, and engineers**
- **Findings:**
  - **Trust enablers: Nuisance avoidance, reliability, experience, familiarity, emotional ties to fallen Airmen, data-driven approach**
  - **Concerns: operational community acceptance/rejection largely unknown**
    - Chevrons
    - Rumors; misuse and disuse; pilot culture; carry over from previous systems

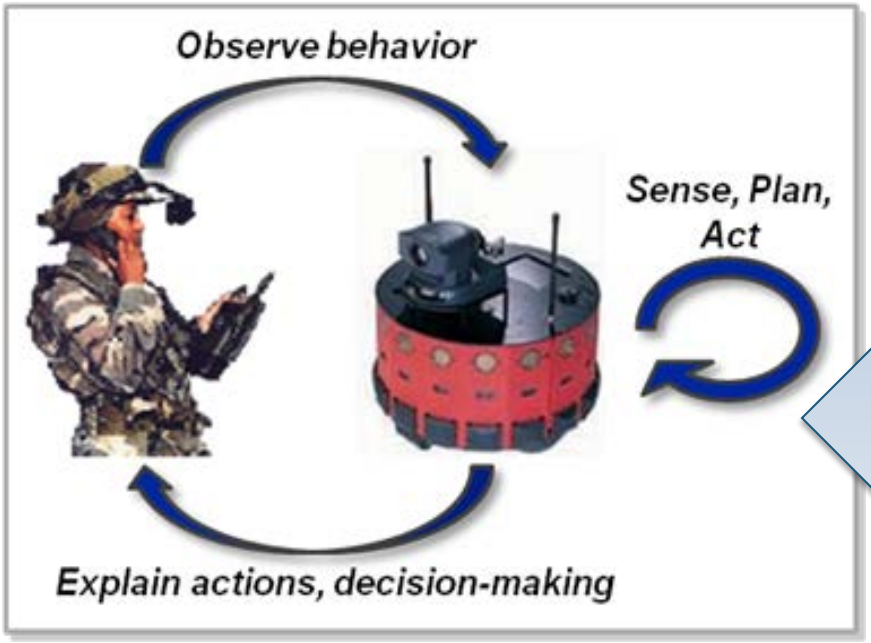


Research Examples

Executive Function (EF)

- Protect against complacency?
- Study 1: RESCHU Study
- 2x2 design (Reliability, Workload)
- Data collection – May 15





Human-Robot Dialogue

- LM Explaining Robot Actions ERA) technology
- Manipulate social style of dialogue: none, continuous, key decision points, by solicitation
- Data collection phase

Research Examples

Trust and Suspicion

- Trust, distrust, suspicion are orthogonal (Lyons et al., 2011)
- Suspicion conceptual model developed (Bobko et al., 2013)
- Anterior Cingulate Cortex may be a physiological marker for suspicion (Hirshfield et al., 2014)

```
1. <reverse_string+0x28> movzbl -0x1(%rax),%esi       movzbl (%rcx),%edi
2. <reverse_string+0x2c> movzbl (%rbx,%rdx,1),%ecx   movzbl (%rbx,%rdx,1),%esi
3. <reverse_string+0x30> mov    %sil,(%rbx,%rdx,1)   mov    %dil,(%rbx,%rdx,1)
4. <reverse_string+0x34> add    $0x1,%rdx            add    $0x1,%rdx
5. <reverse_string+0x38> mov    %cl,-0x1(%rax)       mov    %sil,(%rcx)
6. <reverse_string+0x3b> sub    $0x1,%rax            sub    $0x1,%rcx
7. <reverse_string+0x3f> cmp    %rdi,%rdx            cmp    %r8,%rdx
8. <reverse_string+0x42> jne    <reverse_string+0x28> jne   <reverse_string_neg_offset+0
```

Trustworthiness of Software Code

- How do coders evaluate trustworthiness of code?
- Individual differences
- Differences due to automation

Thanks!

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