Chapter II

Air Force Research Laboratory Autonomy Science & Technology Strategy

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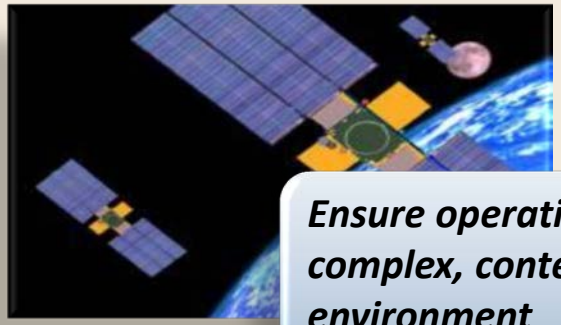
Integrity ★ Service ★ Excellence

AFRL Autonomy Vision & Goals



Ensure operations in complex, contested environment

Demonstrate highly effective human-machine teaming

Intelligent machines seamlessly integrated with humans - maximizing mission performance in complex and contested environments

Create actively coordinated teams of multiple machines

Ensure safe and effective systems in unanticipated & dynamic environments

AFRL Autonomy
Human-Machine Teaming

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AFRL Autonomy
Human-Machine Teaming

Ensure operations in complex, contested environment

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ENDURING PROBLEMS

- **Enable & Calibrate trust between human and machines**
- **Develop common understanding and shared perception between humans and machines**
- **Create an environment for flexible and effective decision making**

Ensure safe and effective systems in unanticipated & dynamic environments

HUMAN MACHINE TEAMING

ADVANCEMENT OF AUTONOMOUS SYSTEM THROUGH HUMAN-MACHINE TEAMING

TODAY

Machines as Tools

- Non-intuitive interfaces
- One-way information flow
- Uncertainty and limited trust

Hello?

01001 10110

SITUATION NORMAL

Calibrated Trust

Joint Learning

Common Understanding and Shared Perception

Flexible and Effective Decision-Making

Common language

NEW NORMAL

ISR Analyst

Space

RPA Operations

Cyber

Command & Control OPs

Weapons Operator

VISION

BUILDING TRUST AND KNOWLEDGE OVER GENERATIONS

SHARED DECISION -MAKING

CAPITALIZES EACH PARTNER'S STRENGTHS

BI-DIRECTIONAL FLOW OF INFORMATION

2030

SEAMLESS HUMAN-MACHINE PARTNERSHIPS

Farewell, old friend

Intelligent Machines as Team-Mates

Continuing Evolution

- Natural user interfaces
- Mutual awareness of team-mate condition
- Shared situational understanding

TECHNOLOGY CHALLENGES

HUMAN STATE SENSING & ASSESSMENT

- *Objectively measure and assess human's state (physiological, performance, behavioral)*

HUMAN–MACHINE INTERACTION

- *Enable human and machines to communicate and share information*

TASK & COGNITIVE MODELING

- Task and function allocation for workload and decision-making balance

HUMAN & MACHINE LEARNING

- Adaptive, learning and extended mutual training between human and machine

DATA FUSION & UNDERSTANDING

- Integrate human and machine data (context, time, format) for a shared world model

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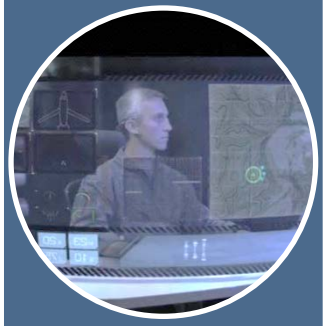
★ MAXIMIZING PERFORMANCE IN COMPLEX AND CONTESTED ENVIRONMENTS ★

Human-Machine Teaming Technology Challenges

Human State Sensing & Assessment

- Objectively measure and assess human's state (physiological, performance, behavioral)



Human-Machine Interaction

- Enable human and machines to communicate and share information

Task & Cognitive Modeling

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Human & Machine Learning

- Adaptive, learning and extended mutual training between H & M

Data Fusion & Understanding

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Inter-relationship