COMMUNICATION AND DECISION MAKING IN C4ISR SUSTAINED OPERATIONS: AN EXPERIMENTAL APPROACH

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Warfighter Fatigue Countermeasures

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Credits

• Dr. Donald Harville: Air Force Research Laboratory Warfighter Training Research Division

• Dr. James C. Miller: Air Force Research Laboratory Warfighter Fatigue Countermeasures R&D Program

• Dr. Linda Elliott: Veridian Engineering

• 21ST Century Systems, Inc., providing the Agent Enabled Decision Group Environment (AEDGE) software
People and Facilities
DoD Unique

- Staff – Government and Contractor Psychologists, Physiologists, Technicians, and Research Assistants
- Research conducted primarily in 10,000 sq ft Chronobiology and Sleep Lab (CASL) complex
  - Control, Prep, Testing, Medical Exam rooms, Biochemistry Lab, Bedrooms (5)
  - 2,100 sq ft of temporal-isolation living and testing space
- Fatigue in C4ISR Performance Lab
- 83-ft Rail Garrison habitat
Current Study

• Experiment
  – SS: Lts awaiting ABM training, Tyndall AFB
  • 10 3-person teams
  • TDY one week— 40 HOURS training
    – C4ISR roles / tactics
    – AEDGE interface
    – Cognitive tests (asymptote)
  • Experimental session : Friday 6pm to 10am Saturday
    – Taxied back to quarters
    – Return to Tyndall
Current Study: C4ISR Context

- Effects of Sleep Deprivation on C4ISR team communication, coordination, decision making, and problem solving
  - AEDGE Platform: Capture Generic Functions
  - 3 human roles & agent-based role
    - ISR (Predator UAVs, Global Hawk, JSTARS)
    - Strike (Bombers, Jammers, Fighters)
    - Sweep (Fighters, AWACS)
    - HVAA (RJ, Tankers, SAMS, Carrier)
Event-based assessment of interdependent team coordination / decisionmaking
ISR assets must confirm targets (50% decoys)
STRIKE jammers must target SAM sites, to protect SWEEP fighters
STRIKE bombers must target SAM sites
SWEEP fighter assets must protect STRIKE assets
All communications and decision events captured
Assessment of Teamwork

- Coordination/Sequencing of Events
- Dynamic Problemsolving

Immediate Indicators
- Handovers (asset re-allocation)
- Communication
  - Email
  - Audio
Audio Capture of Communications

• Digitally recorded communications are a critical source of assessment
  – Sequencing
  – Assets
  – Other
    • Encouragement
    • Fatigue
Figure 3. Representation of communication concepts
Predictions and Analyses

• Ascertain fatigue effects on Communication and Coordination processes
  – Mission Planning
  – Mission Execution
    • Communications
    • Sequencing of events
    • Allocation of Assets among teammembers
  – After-action Reviews
Provide Information and Strategy
Scenario 1 Preliminary Data

HVAA

ISR
10 I-Target
6 I-Asset
17 Strategy

66 Strategy
39 I-Asset
28 I-Target

Sweep

12 I-Target
23 I-Asset
78 Strategy

Strike

Mean mission outcome (N=4) = (hostile loss – friendly loss) = 787.25
Provide Information and Strategy
Scenario 6 Preliminary Data

Mean mission outcome \((N=4) = (hostile loss − friendly loss) = 439.00\)
Request Information and Strategy
Scenario 6 Preliminary Data

HVAA

ISR
- 0 I-Target
- 0 I-Asset
- 6 Strategy

Sweep
- 34 Strategy
- 10 I-Asset
- 9 I-Target

Strike
- 10 I-Target
- 5 I-Asset
- 28 Strategy
Encouragement and Fatigue
Scenario 1 Preliminary Data

HVAA

ISR 1 Encouragement 0 Fatigue

Sweep 3 Encouragement 0 Fatigue

Strike 2 Encouragement 0 Fatigue
Encouragement and Fatigue
Scenario 6 Preliminary Data

HVAA

ISR → 2 Encouragement
14 Fatigue

Sweep

5 Encouragement
3 Fatigue

Strike

4 Encouragement

2 Fatigue
Fatigue Effects on Mission Outcomes (N=4)

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<th>Scenario 1 Means, SD</th>
<th>Scenario 6 Means, SD</th>
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<tbody>
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<td>Mission Outcome (hostile lost – friendlies lost)</td>
<td>787.25, 293.54</td>
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<td>Friendly fuel outs</td>
<td>48.75, 33.26</td>
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<td>Friendly jammers lost</td>
<td>7.5, 15.00</td>
<td>0, 0</td>
<td>.015</td>
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