

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



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## Report Documentation Page

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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**
- **21<sup>ST</sup> 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



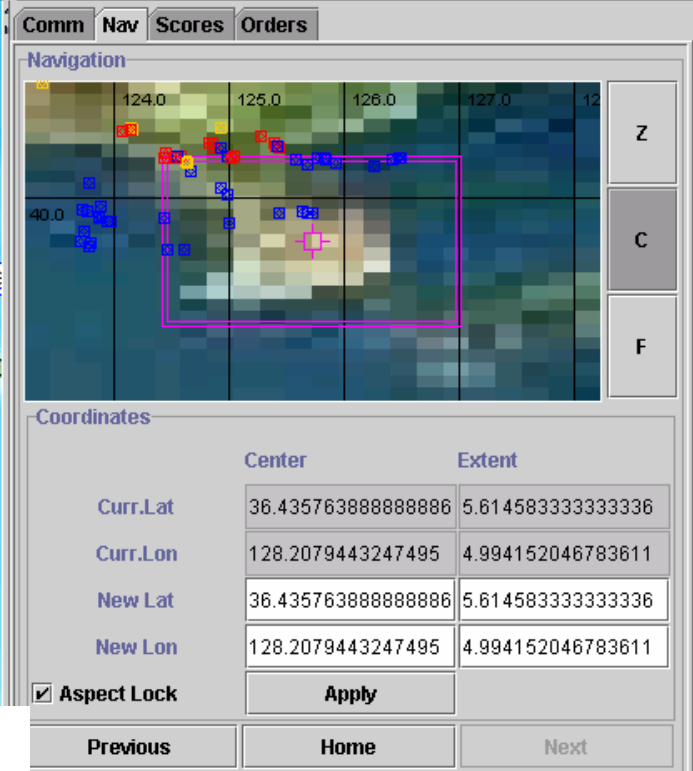
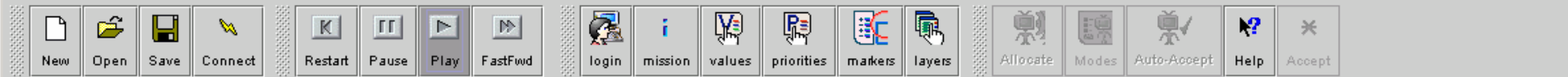
- **Experiment**
  - **SS: Lts awaiting ABM training, Tyndall AFB**
    - **10 3-person teams**
    - **TDY one week– 40 HOURS training**
      - **C4ISR roles / tactics**
      - **AEDGE interface**
      - **Cognitive tests (asymptote)**
    - **Experimental session : Friday 6pm to 10am Saturday**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



# Communications: Initial Coding

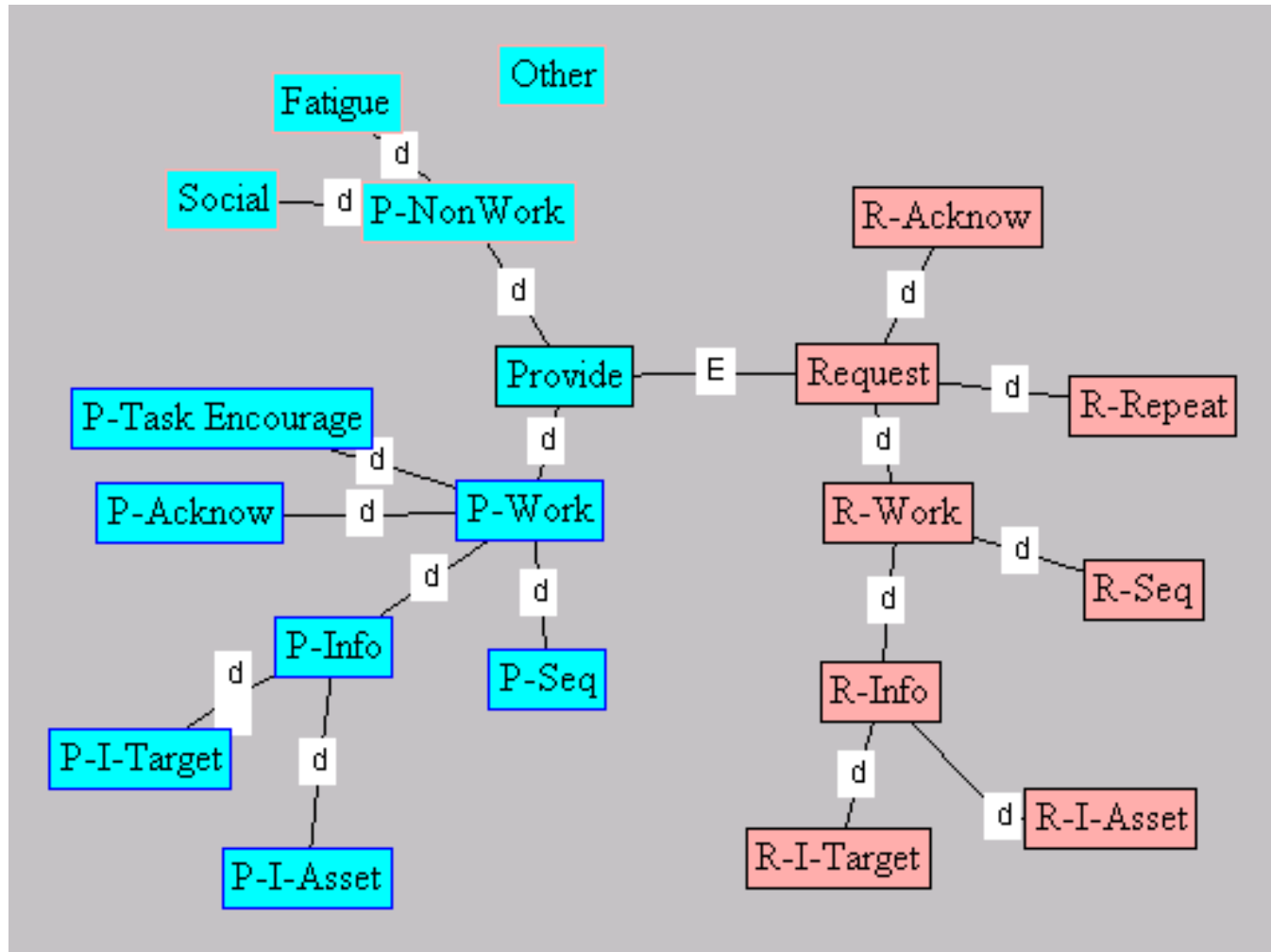


Figure 3. Representation of communication concepts



# 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**

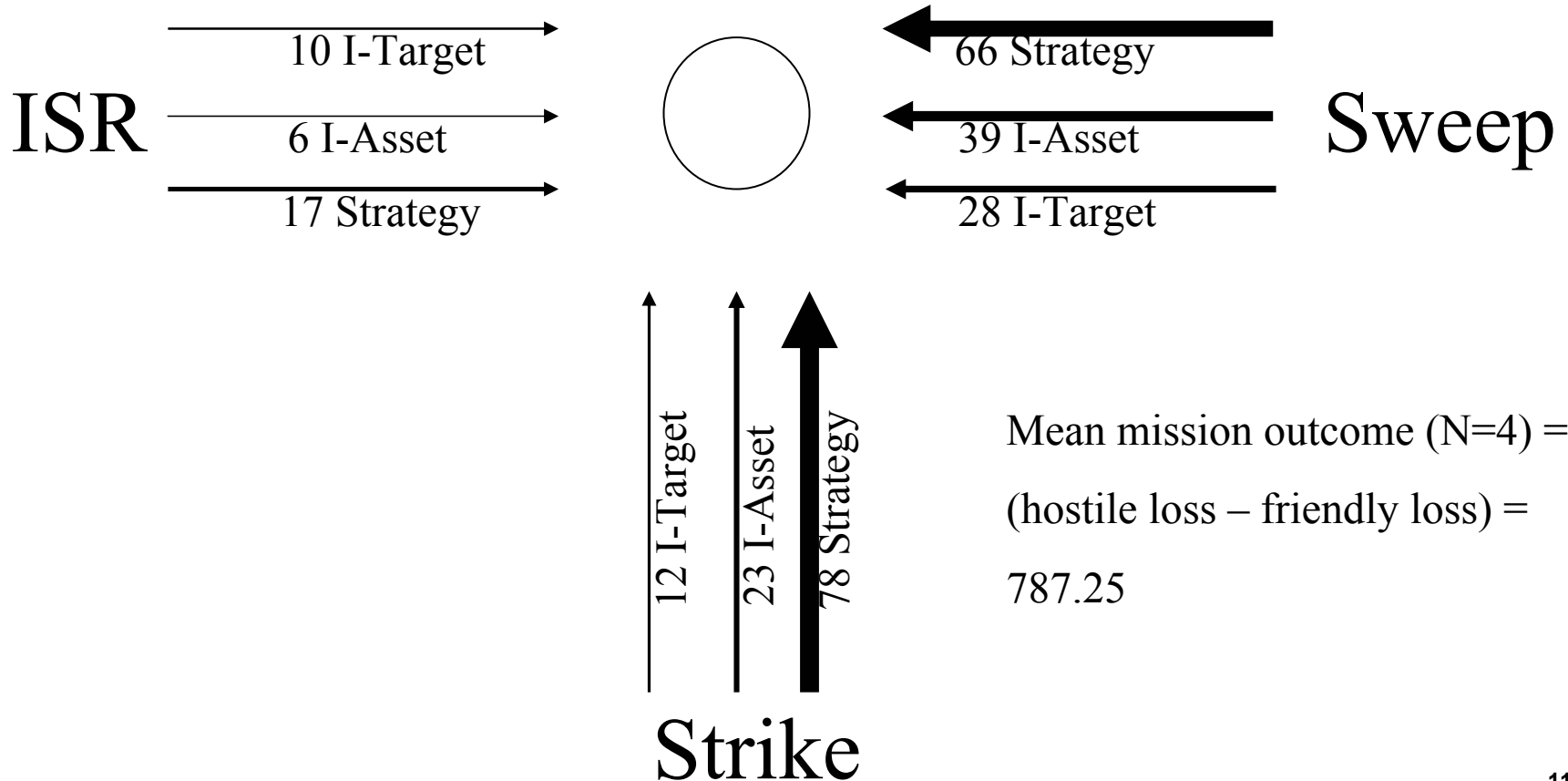


# Provide Information and Strategy

## Scenario 1 Preliminary Data



### HVAA



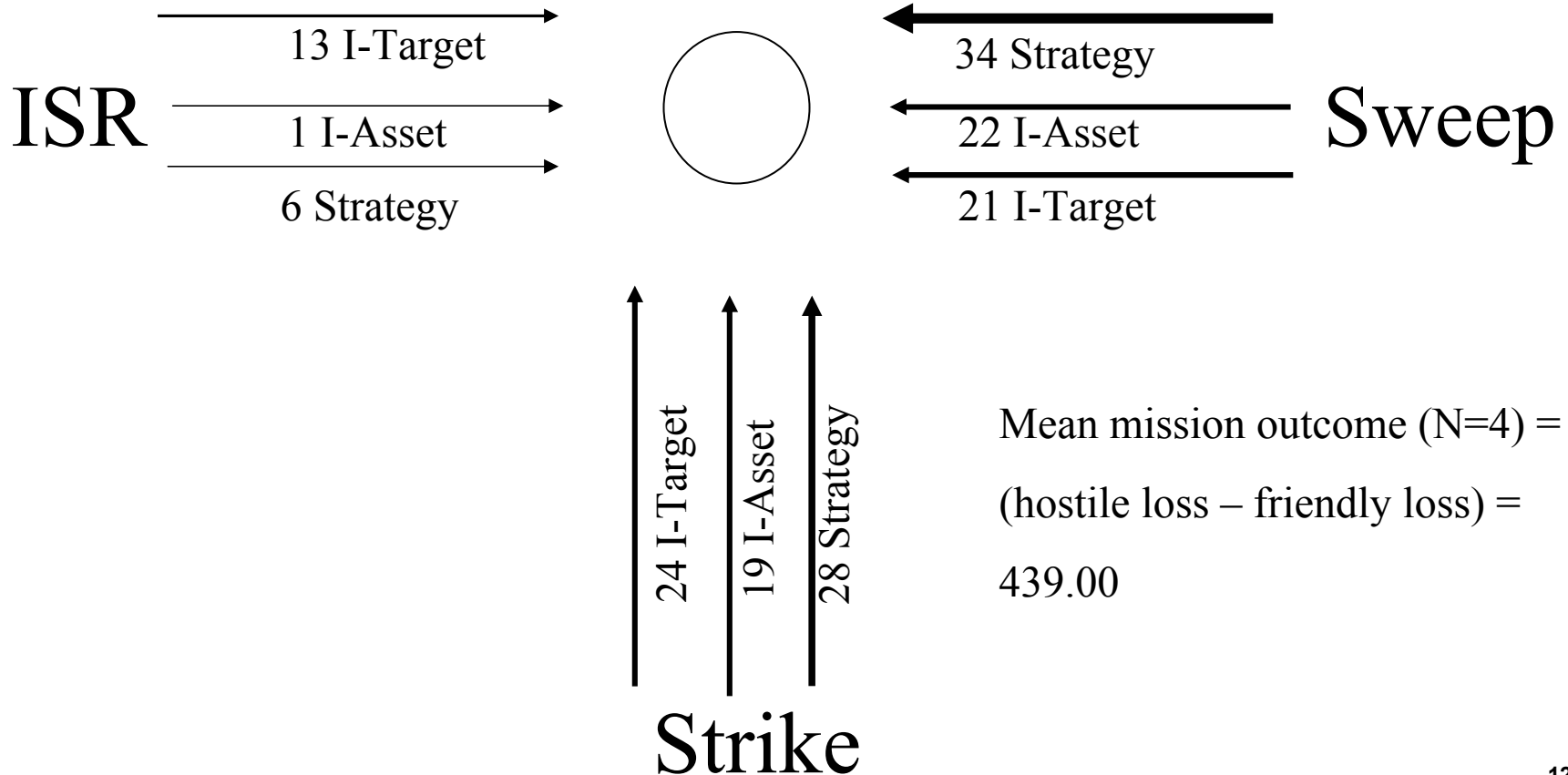


# Provide Information and Strategy

## Scenario 6 Preliminary Data



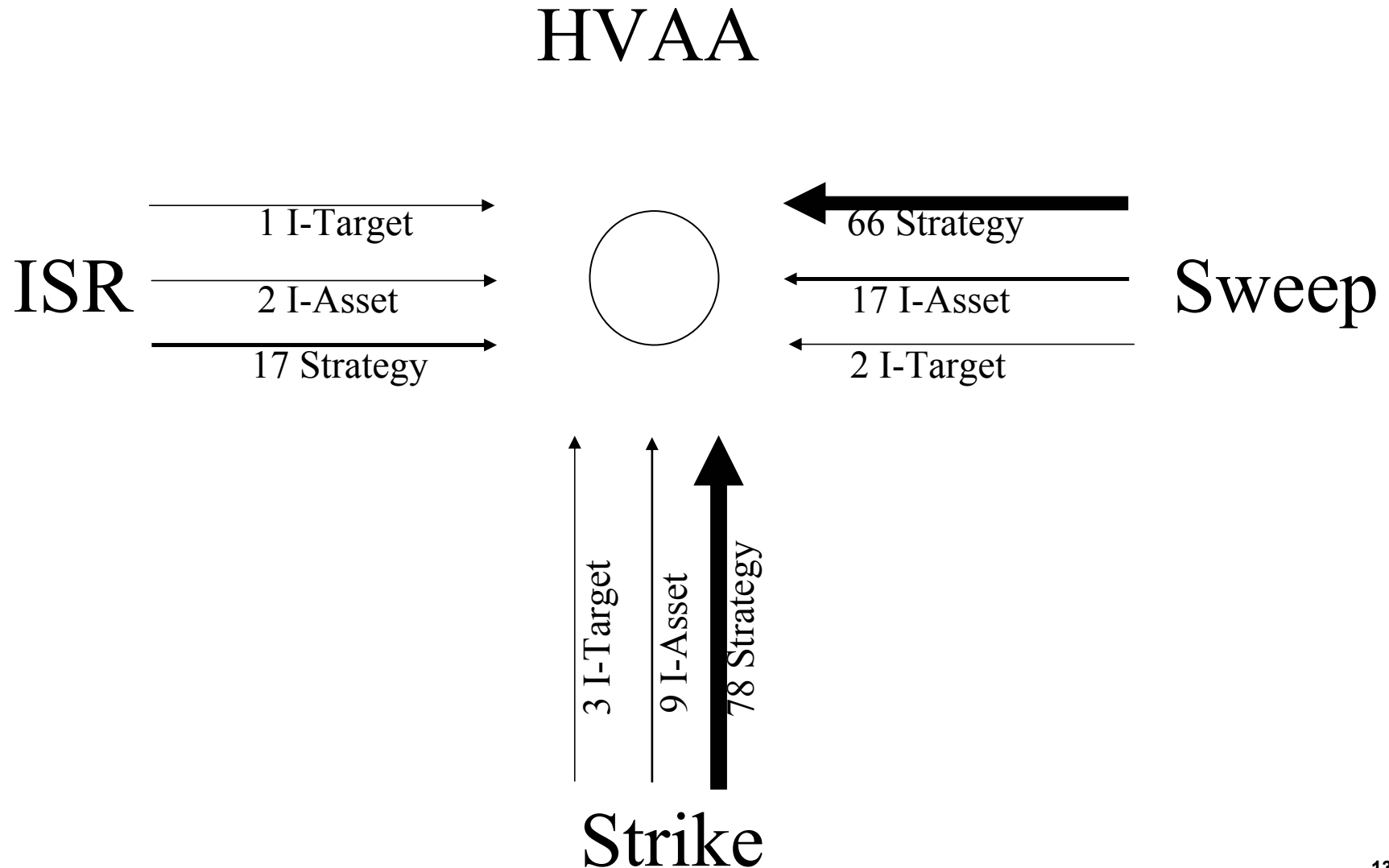
### HVAA





# Request Information and Strategy

## Scenario 1 Preliminary Data



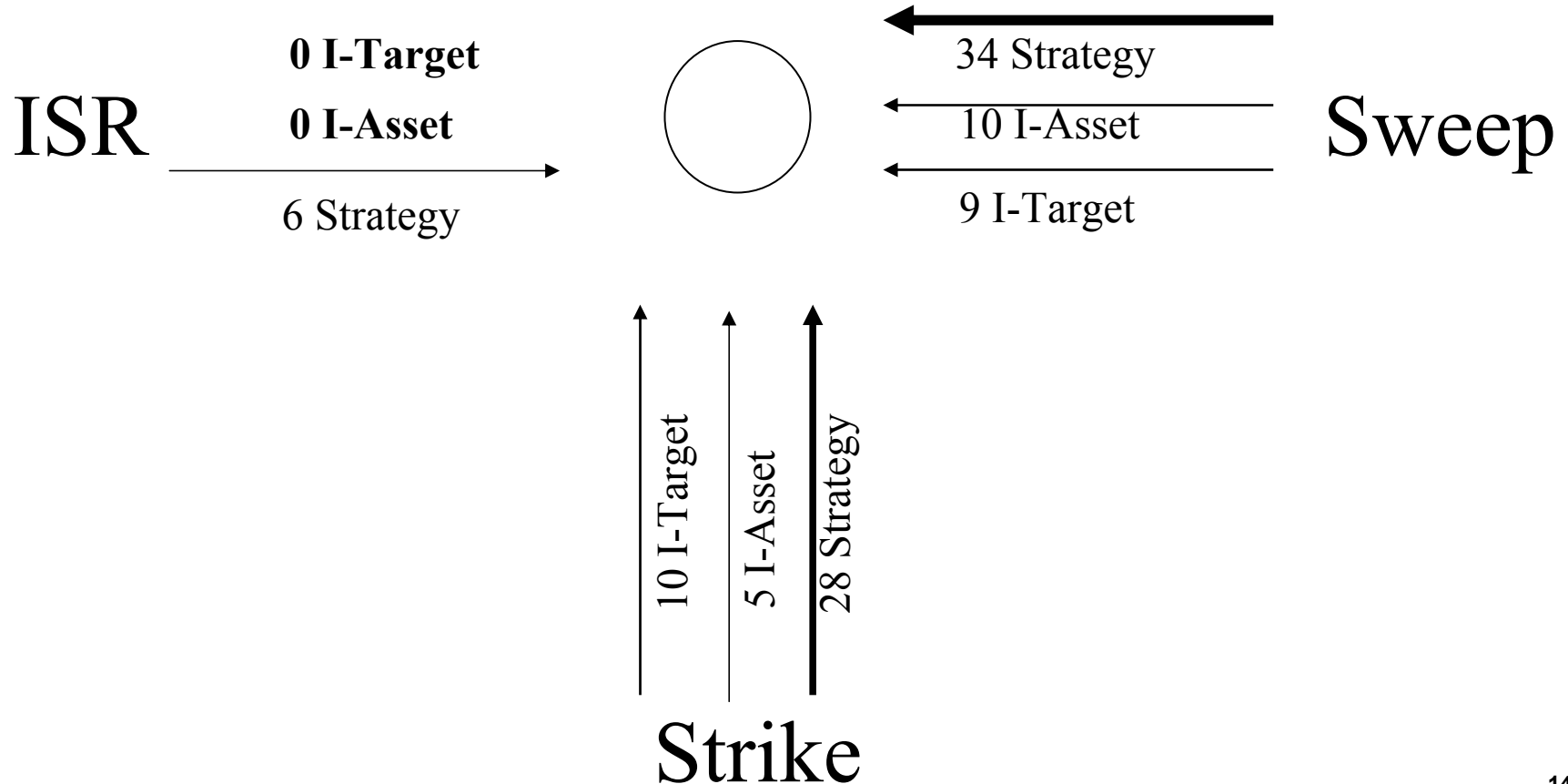


# Request Information and Strategy

## Scenario 6 Preliminary Data



### HVAA



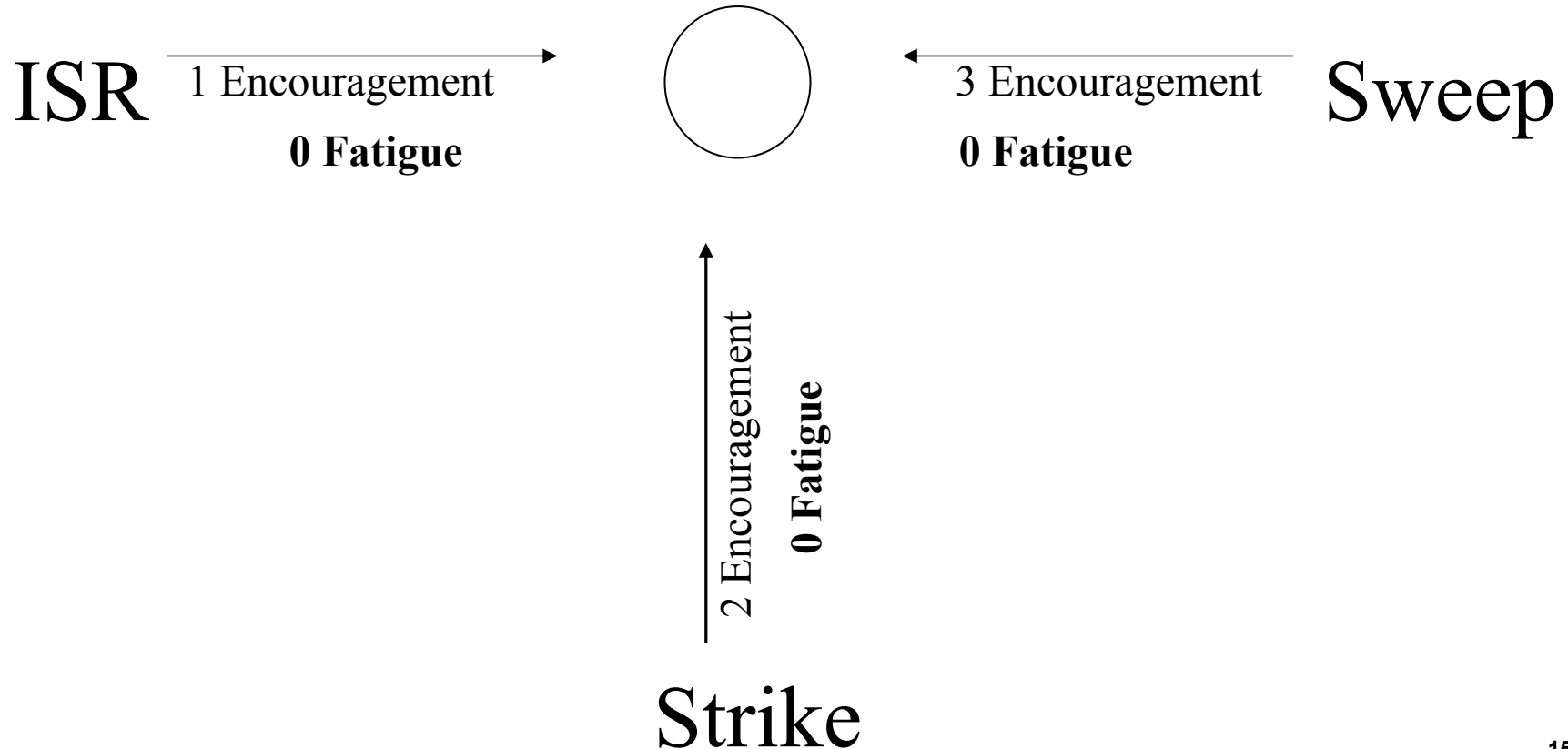


# Encouragement and Fatigue

## Scenario 1 Preliminary Data



HVAA



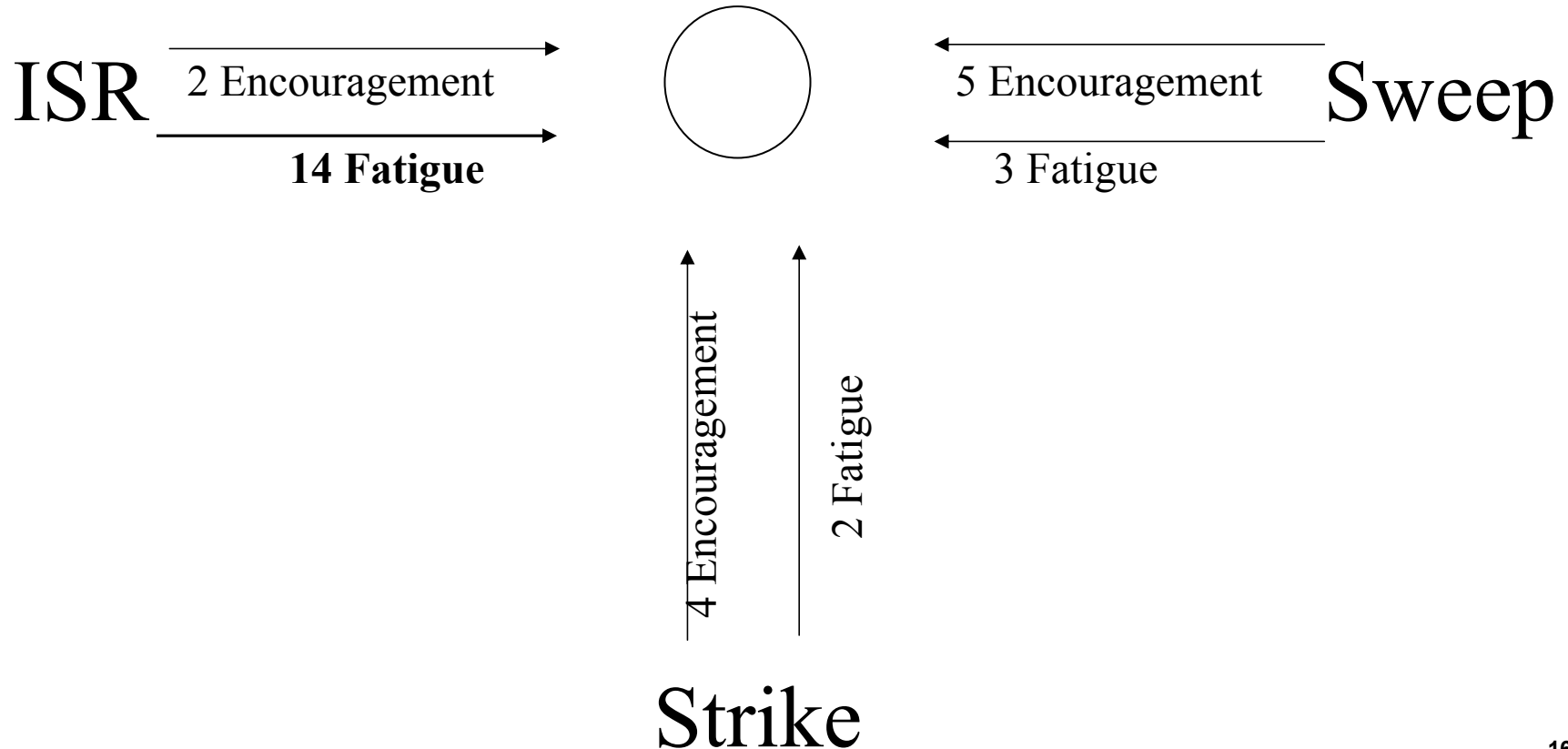


# Encouragement and Fatigue

## Scenario 6 Preliminary Data



HVAA





# Fatigue Effects on Mission Outcomes (N=4)



	Scenario 1 Means, SD	Scenario 6 Means, SD	p
Mission Outcome (hostile lost – friendlies lost)	787.25, 293.54	439.00, 88.62	.001
Friendly fuel outs	48.75, 33.26	22.50, 28.72	.004
Friendly jammers lost	7.5, 15.00	0, 0	.015



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