

MODELING PERFORMANCE IN C4ISR SUSTAINED OPERATIONS: A MULTI- LEVEL APPROACH



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Credits



- **Dr. James C. Miller: Air Force Research Laboratory Warfighter Fatigue Countermeasures R&D Program**
- **Dr. Linda Elliott: Veridian Engineering**
- **Dr. Michael Coover: University of South Florida**
- **21ST Century Systems, Inc., providing the Agent Enabled Decision Group Environment (AEDGE) software**



Issues



- **Modeling**
 - **Agent-based Software Architecture**
- **Assessment**
 - **Scenario Design**
 - **Construct Validity / Measures**
 - **Multi-level Modeling of Interrelationships**
- **Application**
 - **Criterion Performance (Training)**
 - **Fatigue Models**



Software Architecture



- **AEDGE- Agent-Enabled Decision Group Environment**
 - **Federation of IA agents**
 - **Heterogenous / Distributed / Autonomous / Concurrent**
 - **Component-based Architecture**
 - **Hierarchical Collective Agents Network (HCAN)**
 - **4 Modules**
 - * **Data Management**
 - * **Control and Adaptation**
 - * **Reasoning**
 - * **User Interface/Visualization**



Data Fusion and Decision Support

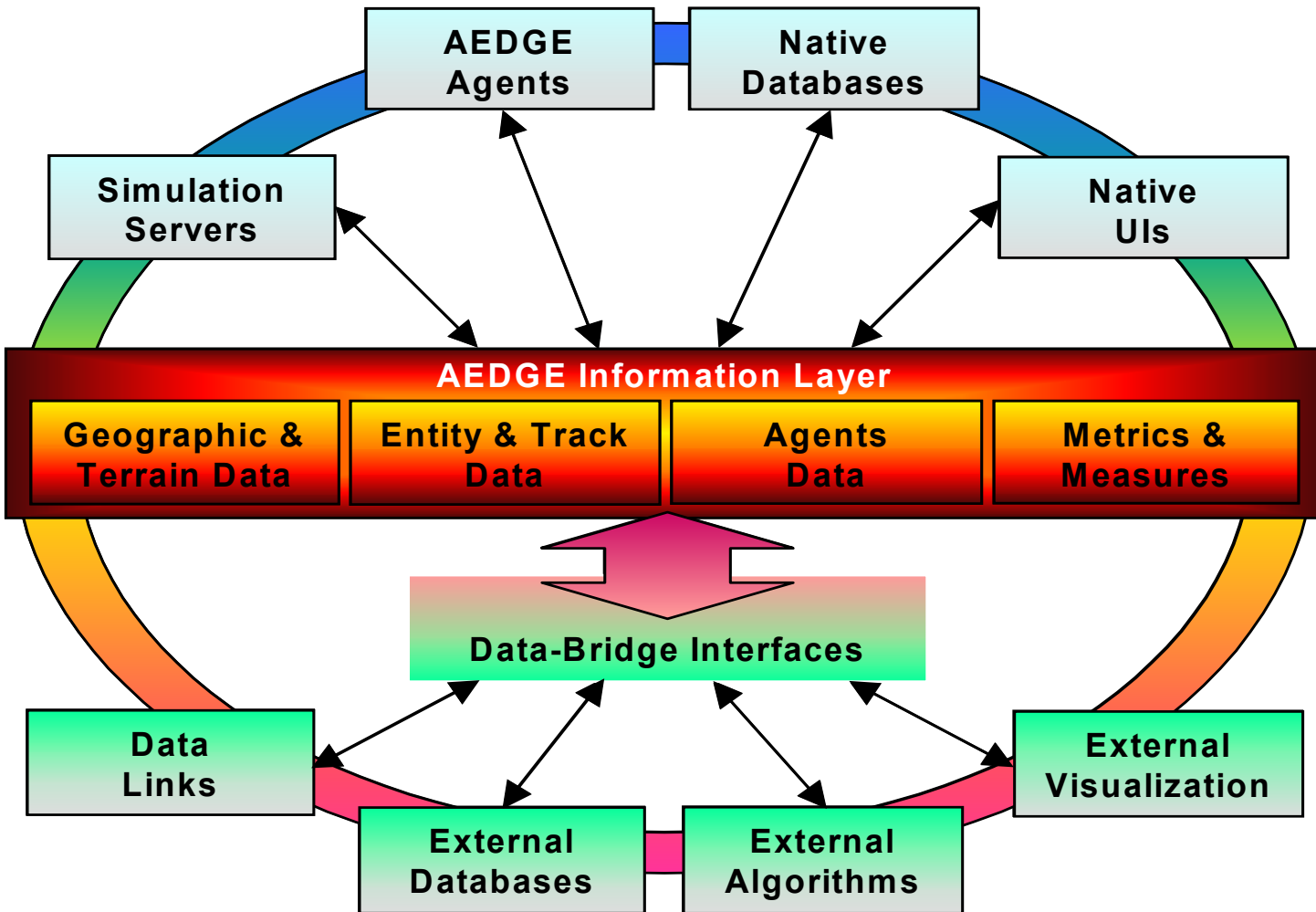
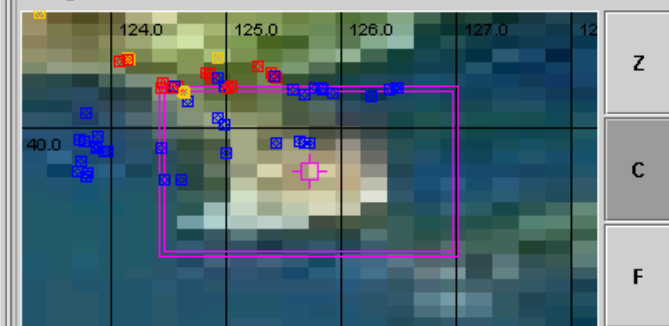


Figure 1. 21CSI's AEDGE™ Product



Comm Nav Scores Orders

Navigation



Coordinates

	Center	Extent
Curr.Lat	36.435763888888886	5.614583333333336
Curr.Lon	128.2079443247495	4.994152046783611
New Lat	36.435763888888886	5.614583333333336
New Lon	128.2079443247495	4.994152046783611
☒ Aspect Lock	Apply	
Previous	Home	Next

Global View





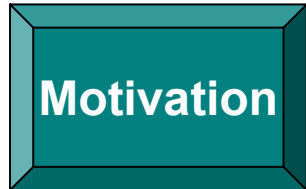
Scenario Design



- **Operational Relevance**
 - **C4ISR assets / roles**
- **Construct Validity:**
 - Need to ELICIT**
 - **Individual Decision-making**
 - **Type / Timing of Decision Errors**
 - **Team Planning**
 - **Team Communication**
 - **Team Coordination**
 - **Team Adaptive Decision-making**



Current Research Goal Modeling of:



MOTIVATION

Measured by:

Team Efficacy survey

Communication data

**-Encouragements to
each other**

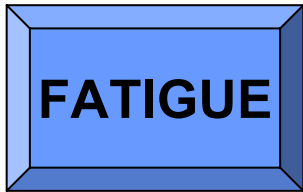
**-Conscientiousness
(Neo PI)**



Current Research Goal Modeling of:



FATIGUE



Measured by:

Stanford Sleepiness Scale

Profile of Mood States

Time



Current Research Goal Modeling of:



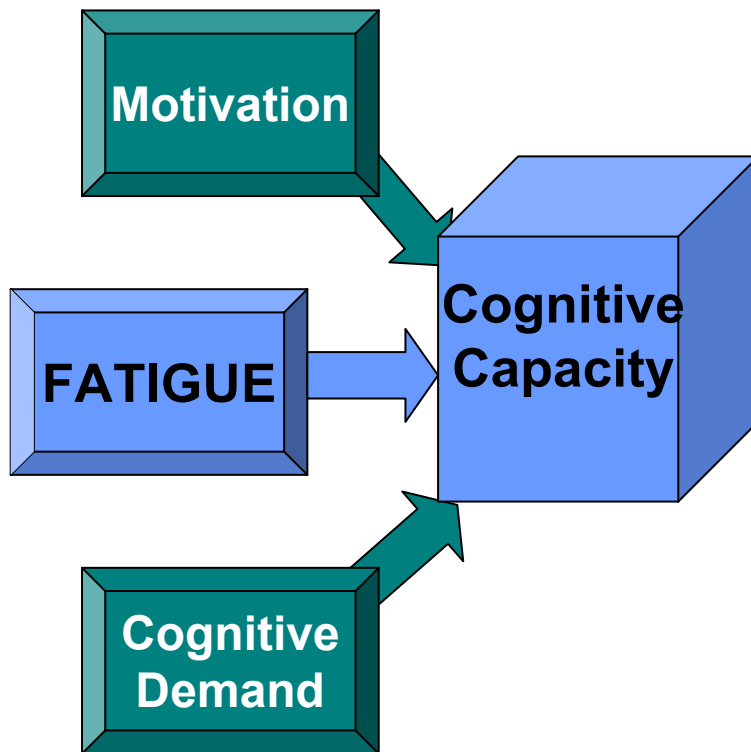
COGNITIVE DEMAND

Determined by complexity
of scenario





Current Research Goal Modeling of:



COGNITIVE CAPACITY

In part measured by
experience:

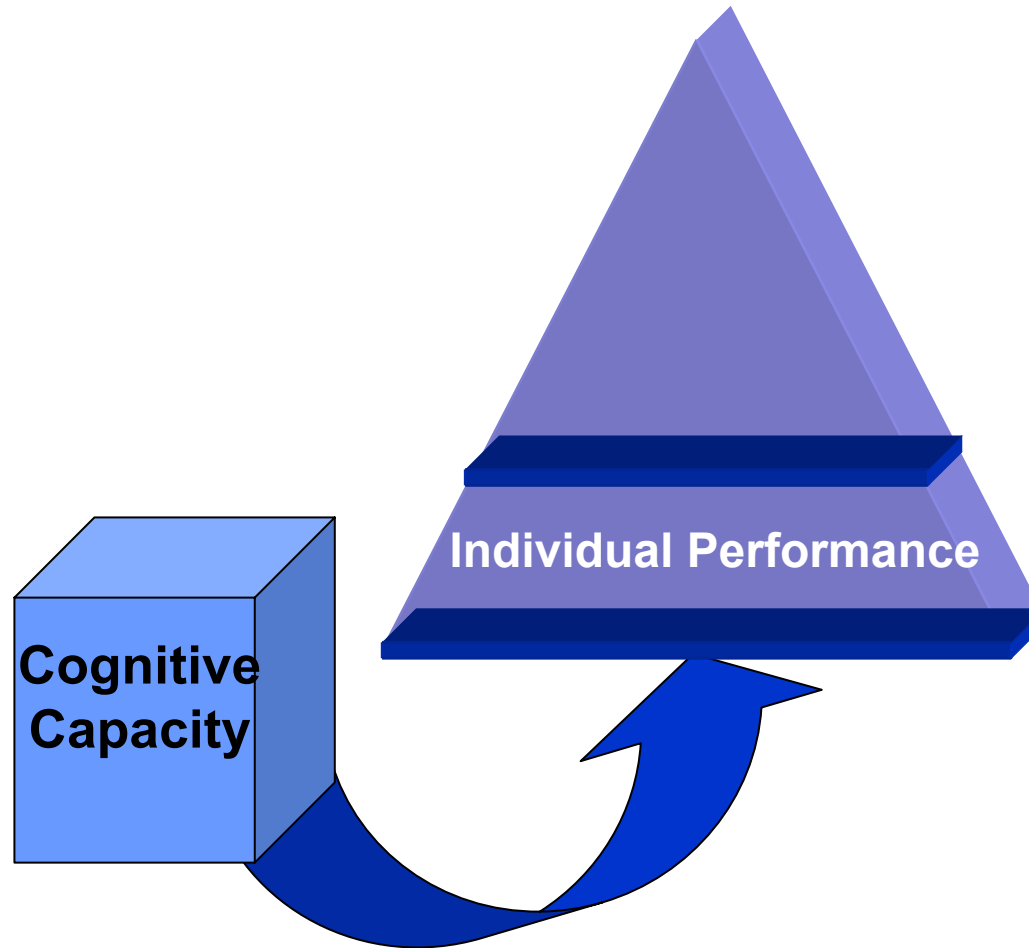
ABC Course

1 week AEDGE training

Biographical data



Current Research Goal Modeling of:





Current Research Goal Modeling of:



Individual Performance and Decision-Making

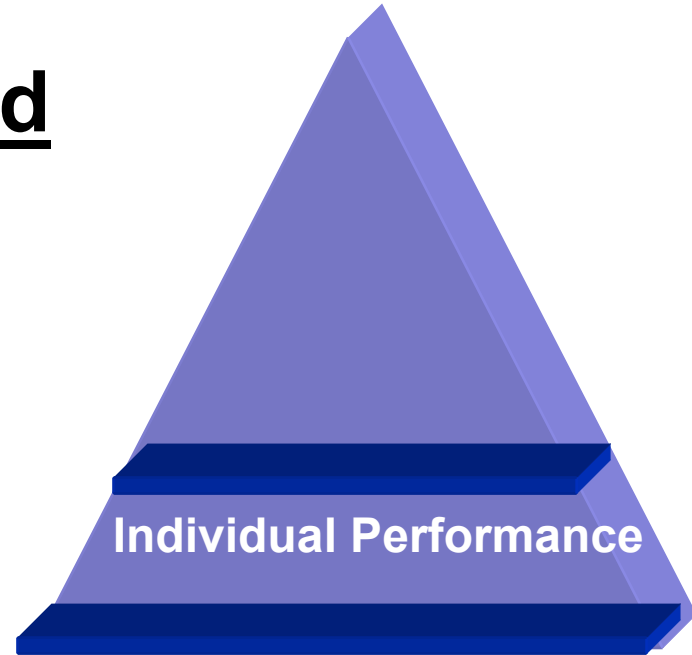
Measured by:

Fuel management

Asset ownership

Latency

ANAM battery: reaction time,
short term memory, multitasking





Current Research Goal Modeling of:



Team

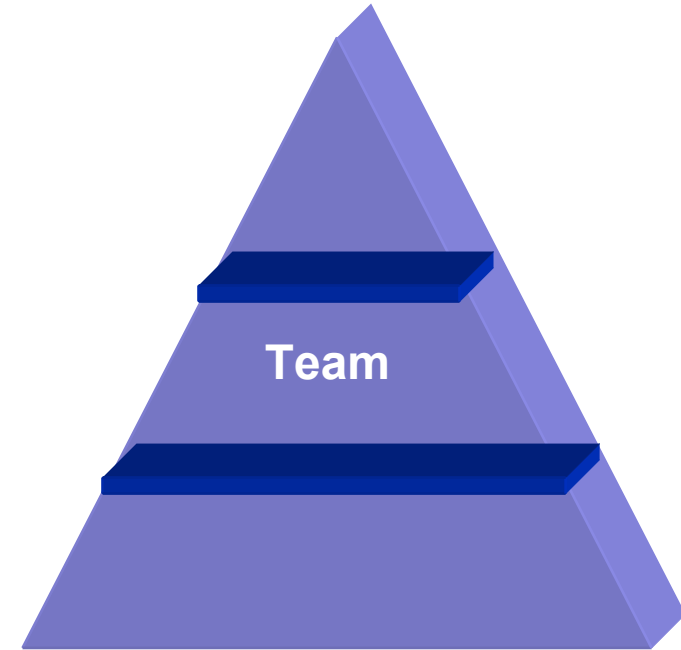
Measured by:

Communications

-Strategy

-Sequencing of assets and
targets

Handovers





Current Research Goal Modeling of:



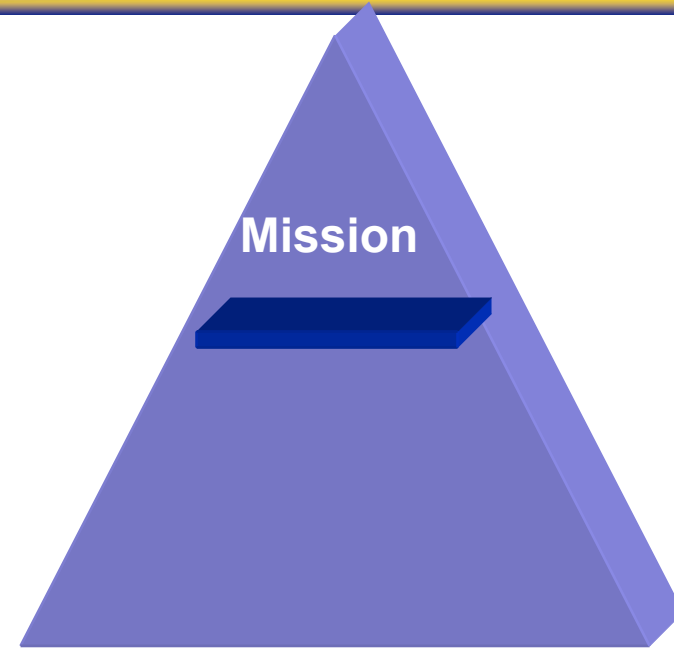
Mission

Measured by outcomes:

Assets lost

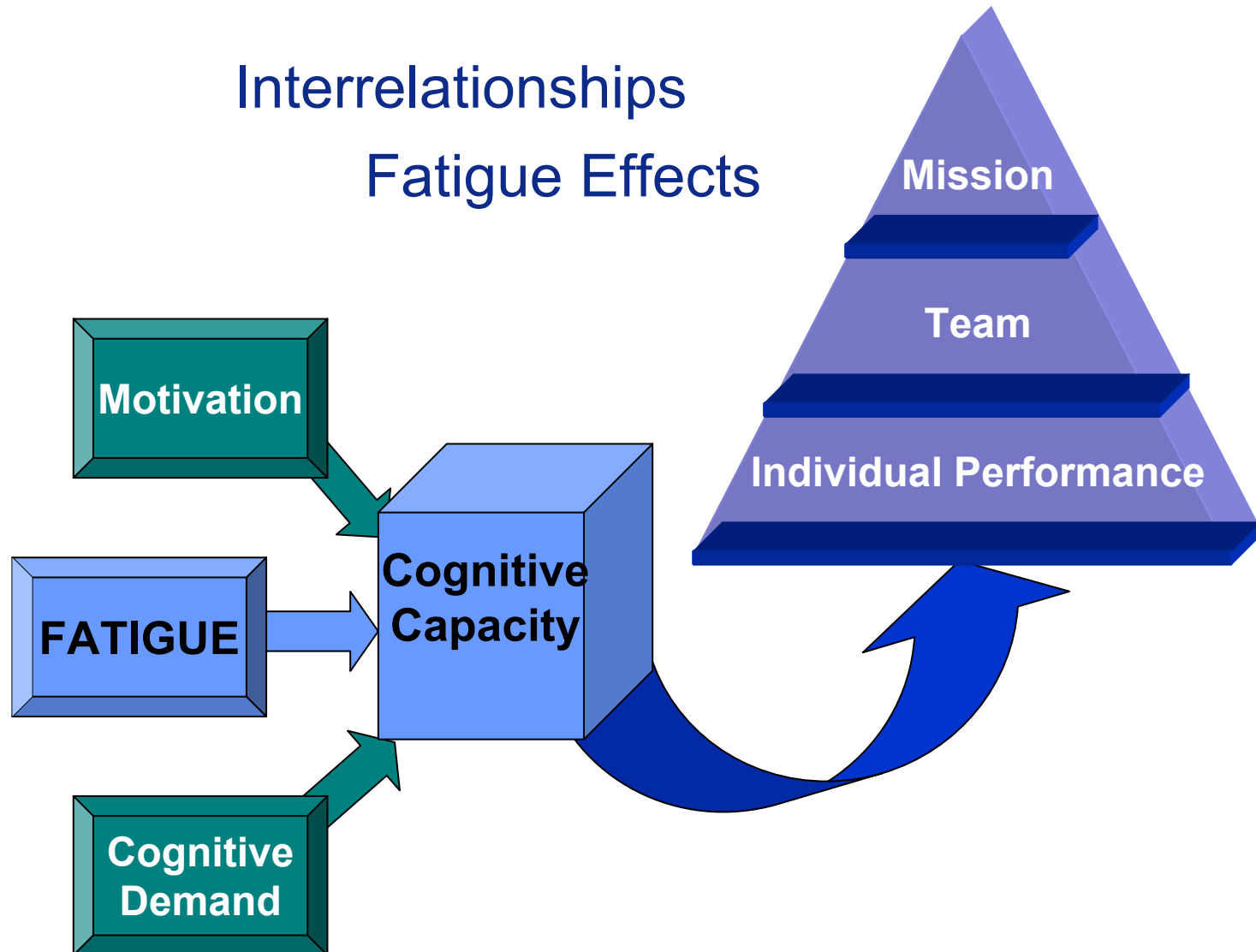
Enemies destroyed

Objectives fulfilled





Current Research Goal Modeling of:





Multi-Level Modeling of Data



- **Multiple Measures at different levels & across time**
 - Individual Differences
 - Individual performance
 - Team performance
 - Team Outcomes
- **MLWin**
 - <http://multilevel.ioe.ac.uk/features/index.html>
 - **The Third Edition of Multilevel Statistical Models is to be published early in 2003. For details and a preview visit http://www.ioe.ac.uk/hgpersonal/multmodels-edition3/multilevel_statistical_models-third_edition.htm**
- **Consultant: Michael Coover, USF**



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