



# Institute for Neurocognitive Science & Technology

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Artist Rendering of Building Project

# Presentation Overview \*not scientific\*

- Evolution: Existing MSU Cognitive Science Research
- Institute for Neurocognitive Science & Technology (INST)
  - Mission and Focus
  - MSU Faculty and Biological Imaging Resources
  - Research Applications
- Business and Research Partnership
  - Premier Radiology
  - Partnership Facilitates Research, Education, Outreach



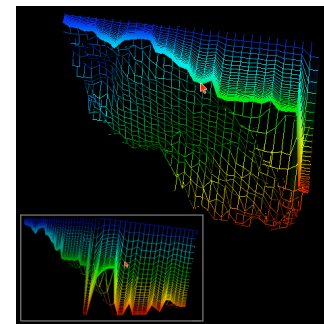
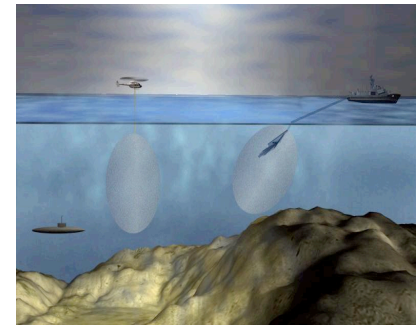
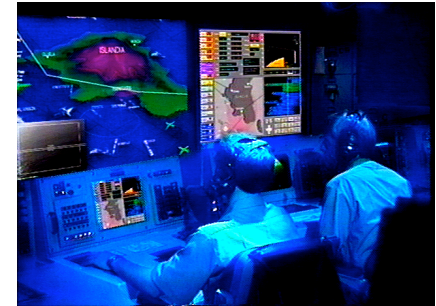
# MSU Cognitive Science Funded by ONR Optimizing Adaptive Warrior Performance

- Basic Science: Applied to Solve DoD Problems
  - Balanced basic and applied research program
  - Focused on human systems issues relevant to military (and civilian) manpower, personnel, and training
  - Optimization of human-system integration for warrior adaptation



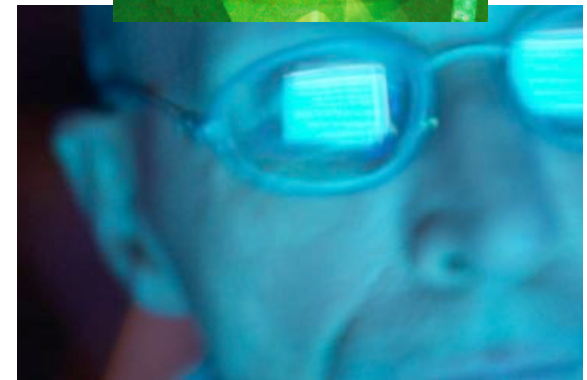
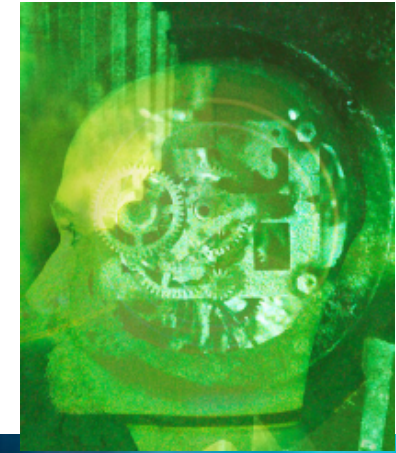
## The Need for Basic Science

- Military (and civilians) encountering new threats and new situations--OSD wants a "transformed" military
  - New platforms and weapons systems designed for quick, flexible, or "adaptive" response
- Manpower, Personnel, and Training Issues
  - If you redesign the Platforms and Weapon Systems, you need to redesign the Force!
  - Understand new concepts in fighting, training, selection
- Need for Basic Science Applied to Real Problems
  - Broad base science is the way to get to the right answer to apply to manpower, personnel, training



## Approach

- Human cognitive abilities take advantage of routines
- If we determine mechanisms that govern processing of routine and novel information then we will have answers to guide the development of new concepts in manpower, personnel, and training for adaptation.



## Example Research Topics

- Real-Time cognitive tutoring: of aviation pilot training for routine and emergency flight situations (Jodlowski & Doane, 2004)
- Strategic Discrimination Skills: Training difficulty influences on strategic skill acquisition and transfer (Michigan, NSMRL, Doane et al in press)
- Individual Diff. LTWM and WM in Aviation pilot ability to build and maintain “flight situation awareness” (NAMRL, Sohn & Doane, 2004a,b)
  - Submarine sonar operator ability to build and maintain awareness of their contact(s) (NSMRL)
- Individual Differences in Spatial Cognition: Oceanographer viz of littoral underwater oceanographic situation (NRL-NAVO, Brou & Doane, 2004)
- Real-Time Team Performance Assessment: Team performance in real-time interactive task environments (NPRST)



## INST Mission

- Foster the Role of Mississippi State University
  - in state-of-the-art research, education, and service provision in the areas of
    - Human Systems
      - » Cognitive Neuroscience
      - » Biological Imaging/Visualization Technology
      - » Computational Biology
    - Medical Systems
      - » Biomedical engineering
      - » Veterinary medicine
  - Promoting economic development of the state by serving as a magnet for high tech industries and federally funded research projects

## INST Research Focus

- Scientific research focused on optimizing human performance and improving the quality of human life
  - Human Systems
    - Cognitive Science/Neuroscience
    - Computational Biology
    - Biological Viz
  - Medical Systems
    - Biomedical Engineering
    - Veterinary Medicine





## INST Faculty Researchers

- 22 Faculty representing 4 Colleges
  - **Engineering**
    - Computer Science
    - Electrical and Computer Engineering
  - **Agriculture**
    - Agriculture and Biological Engineering
  - **Veterinary Medicine**
    - Clinical Sciences
    - Basic Sciences
  - **Arts and Sciences**
    - Biology
    - Psychology

## INST Biological Imaging Resources

- High-End Computational Resources
- A 3Tesla Magnetic Resonance Imaging Machine (**3T MRI**)
- 64-slice CT scan
- Ultrasound, C-arm, etc

New MRI



## 3T MRI Research Applications

- Research to be conducted at MSU has applications in
  - facilitating the human interface through controls and instrumentation for complex systems such as
    - aircraft, weapons, and automobiles,
    - as well as in medical applications.
- Seed Projects
  - fMRI - multitasking in pilots during simulated flight
  - Biological viz - interface dev. tools for display wall
  - fMRI - stroop interference

## Business/Research Partnership

- Partnering with Premier Radiology - with Magnetic Resonance Imaging (MRI) expertise is
  - Augmenting MSU research capabilities.
  - Facilitating MSU competition for funding from agencies (e.g., NIH ) that require physician collaborators.
- Partnership will leverage current funding and reduce Institute costs.
  - Premier is constructing the INST building and investing in additional imaging equipment.
  - Premier will reimburse MSU for use of MRI.



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## Partnership Enables Outreach

- The Institute will provide critical services to the community and the state by
  - making biological imaging equipment available for diagnostic and therapeutic use to
    - area physicians through referrals to Premier Radiology
    - private practice veterinarians and pet owners through referrals to MSU Veterinary Medicine.
- Imaging equipment used 2/3 for research, 1/3 for clinical





## Partnership Resources

- 10,000 sq. ft. of Imaging/clinical Space
- 10,000 sq. ft. of Research Space
- 3T MRI and Additional Imaging Equipment
- Multiple Computational Resources
- High Speed Internet Connection
- Conference Room
- Classroom



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