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Presentation before the National Research Council
Basic Research Committee
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The 21st Century Research University

- USC’s draft strategic plan contains the following assertions about a 21st Century Research University:
  - Must develop strategic capabilities to respond to uncertain environments & quickly developing trends
  - Must be positioned to meet society’s needs today and in the future
  - Expect society will look to research universities for solutions to intractable problems, creating new demands for research and teaching and for its alumni.
  - At USC our future is inextricably linked to our contributions to society
Meeting 21st Century Demands

- Define a new strategic relationship between fundamental research and its practical applications;

- Overcome internal barriers between academic units and disciplines; and

- Recognize and reward an interdisciplinary approach to research and education
Meeting 21st Century Demands

- Foster a closer relationship between fundamental and applied research and researchers to stimulate and inform each other.

- Applications suggest directions of fundamental research, while the results of fundamental research inform and enable applications.

- Education at all levels should reflect this paradigm and education must be a learning centered experience.
How does this relate to the DOD Research Issue for the NRC?

- DOD mission: To provide for national defense today and tomorrow;

- Research and training enables universities to educate and re-educate the workforce vital to the DOD enterprise and address new problems

- The locus and tactics of our adversaries have changed requiring new approaches and increased innovation to meet these challenges;

- This creates greater opportunities and needs for increased University-DOD collaboration.
Federal R&D Funding at USC in 2003

All Federal Sponsored Project Support Amounted To $302.6.2 Million at USC in Fiscal Year 2003

(Presented in Millions of Dollars by Supporting Agency)
Examples of DOD Research Supported at USC

- Internet development at the Information Sciences Institute;

- USC’s Institute for Creative Technologies (ICT);

- Neural Prosthetics in the Center for Neural Engineering
Research Thrusts at ICT

- Immersion -- Providing compellingly realistic experiences
- Networking and Databases -- Organizing, storing and distributing simulation content
- Story -- Providing compelling interactive narratives that impel simulation
- Characters -- Replacing (some) human participants with automated ones
- Setup -- Authoring and initializing experiences
- Direction -- Monitoring, directing, and understanding experiences
Photoreal rendering of virtual Parthenon model with light captured at USC ICT
Mission Rehearsal Exercise System
ICT Awards and Recognitions

- 2003 Best Paper Award: IEEE Asilomar Conference on Signals and Systems (C. Kyriakakis)
- 2003 Full Spectrum Warrior: Electronic Entertainment Expo (E3); Korris & van Lent; Best Original Game; Best Simulation
- 2003 eCybermission: Web Marketing Assn’s “Best Gov’t Interactive Application” Korris, Hendrie & Hawkins
- 2002 “TR100” - among top innovators under 35 in the world -- MIT’s Technology Review Magazine; Debevec
- 2001 Significant New Researcher Award -- ACM SIGGRAPH; Debevec
- 2003 “Best Innovative System Application Paper” International Joint Conference on Autonomous Agents and Multi-Agent Systems; (Traum et al.)
- NSF Career award, 2003 (S. Narayanan)
- 2002 Outstanding Paper Computer Generated Forces Conference; (Marsella & Gratch)
- 2002 Best Paper Innovative Applications of Artificial Intelligence Conference; (Hill, Han & van Lent)
- 2001 First place award at International conference on Autonomous Agents; (Swartout et al.)
- 2001 Outstanding Paper Computer Generated Forces Conference; (Gratch & Marsella)
- 2001 DMSO/NTSA Outstanding Achievement Award in Modeling and Simulation; (Swartout et al.)
- Co-Author, Distinguished Paper Award, AIEd, 2001 (L. Johnson)
Brain-Implantable Microchips to Restore Cognitive Function Lost Due to Damage or Degenerative Disease

Center for Neural Engineering, University of Southern California (DARPA, ONR)

1. microsensor arrays designed to fit the “architecture” of the brain record electrical activity from nerve cells within undamaged brain regions
2. nerve cell activity is transmitted to microchips that mathematically model the function of damaged brain regions
3. microchip output is used to electrically stimulate undamaged brain and restore cognitive function
4. current applications being developed for hippocampus to restore memory function lost due to brain trauma, stroke, epilepsy, Alzheimer’s disease
Applications of Brain Modeling and Neural Processing

Algorithms to DoD Needs

Voice-Actuation of the Command Tactical Information Management System (CTIMS) for Submarine Command Centers
transition partner: NUWC, RI

Pocketable Language Translation System for Use in Noisy Environments
transition partner: Speech Gear Inc.

Noise-Robust Voice Command-and-Control of Robotic Systems in Space
transition partner: NASA Ames

Analysis of Nonlinearity in Sonar Signal Propagation
transition partner: NUWC RI

Acoustic Sound Identification for Security Breaching
Noise Detection and Perimeter Protection
transition partners: Safety Dynamics (LLR), Army, Navy
Conclusion

- At the University of Southern California, we welcome a healthy mix of fundamental and applied research challenges from DOD.

- This enables researchers to be more responsive and productive while also educating and training the workforce to help the Nation meet its national security needs today and tomorrow.