The Institute for Collaborative Environment Studies (ICES)
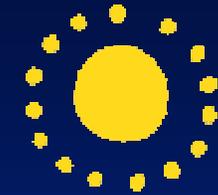
Michael Zyda, Zyda@acm.org

Overview

Rationale based on NRC study

Vision for the Institute

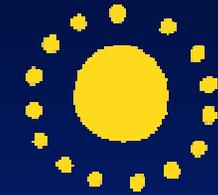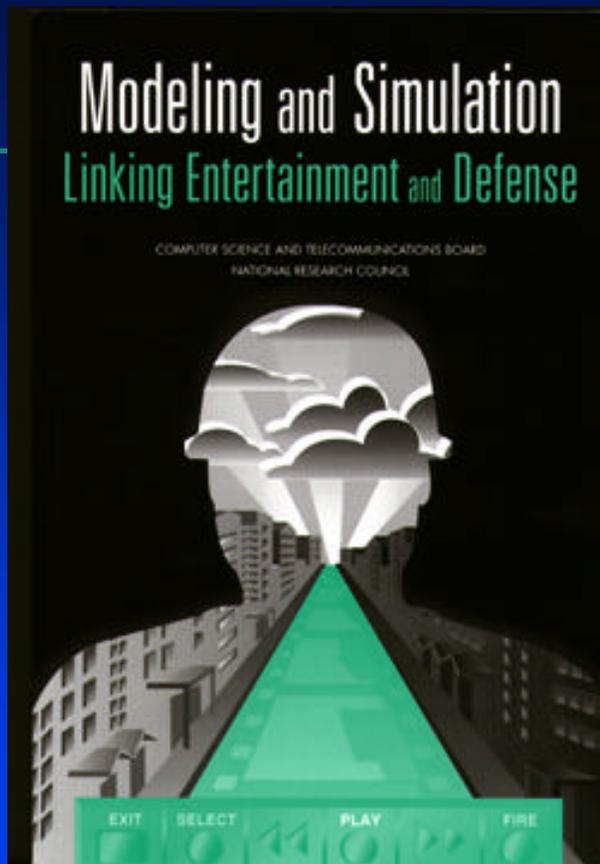*Research - Directions & Application*

Industry Interaction

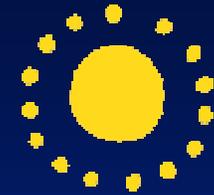*Technology Transition*

Intellectual Property

Organization

Industry Affiliates

Facilities, Size & Costs

Institute Rationale - the NRC Study "Modeling & Simulation - Linking Entertainment & Defense"

Modeling & Simulation:
Linking Entertainment & Defense

The Director of Defense Research & Engineering (DDR&E), Dr. Anita Jones, funded a study through the National Research Council Computer Science & Telecommunications Board (NRC CSTB).

- A committee was formed representing the virtual environment, computer graphics, networked videogame, LBE, film & entertainment communities.
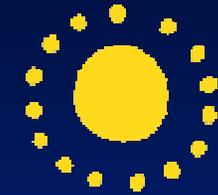
Goal of the NRC Committee

To explore how the Entertainment Industry (EI) and the Department of Defense (DoD) and its associated industries can develop a stronger technology base for modeling & simulation and profit from a closer working relationship.

Modeling & Simulation:
the Overlap of DoD & EI
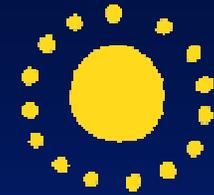
Many of the future challenges that face the movie industry, the games industry and the DoD are the same.

The task of the committee was to try and help the DoD and EI move forward in a more coordinated, and hence more efficient, manner, learning from each other's successes and taking advantage of commonalties.
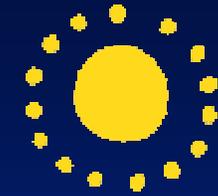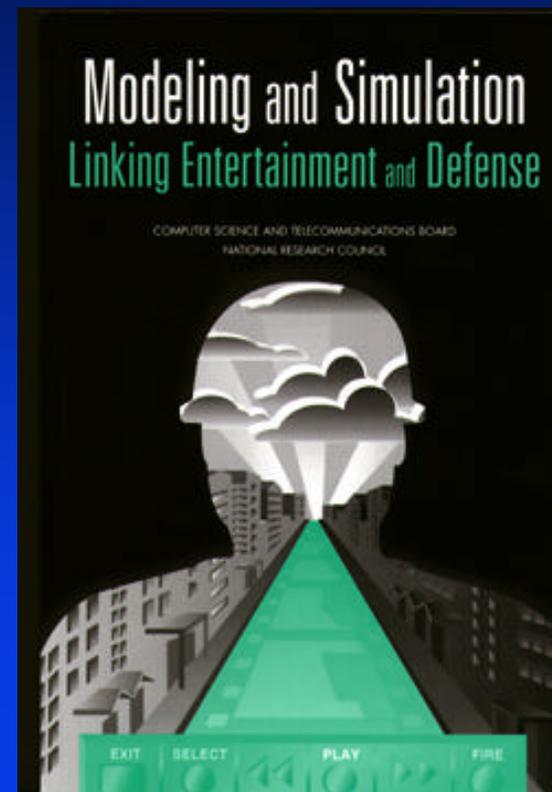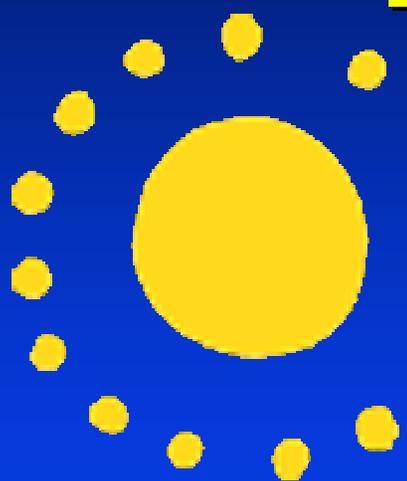
Research Agenda

Technologies for Immersion

Networked Simulation

Standards for Interoperability

Computer Generated Characters

Tools for Creating Simulated Environments

Modeling and Simulation
Linking Entertainment and Defense

COMPUTER SCIENCE AND TELECOMMUNICATIONS BOARD
NATIONAL RESEARCH COUNCIL

The Institute for Collaborative Environment Studies (ICES)
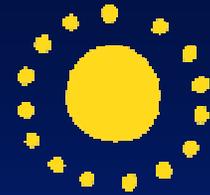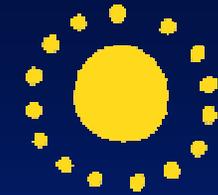
Vision

To create THE world-class facility for research, application and education in computer graphics and virtual environment technologies for the defense and entertainment modeling and simulation (M&S) communities.
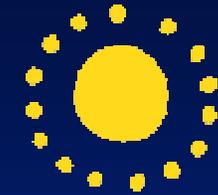
What we will carry out ...

Basic & Applied Research of Defense and Entertainment Industry M&S Interest

Advanced Prototypes for Defense and Entertainment M&S

We're going to build things ...

Following the Entertainment Industry "Big Idea Concept", we are going to prove out our ideas in computer graphics and virtual environments by constructing and evaluating real systems for defense and entertainment M&S interests.

Technology transition
is part of the plan ...
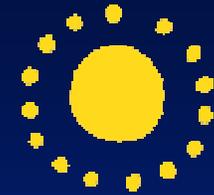
We will transition our developed technologies and applications to the defense and entertainment M&S communities.

Directions
- Research & Application

Our institute research plan is based on the agenda described in the NRC report "Modeling and Simulation - Linking Entertainment and Defense" ...
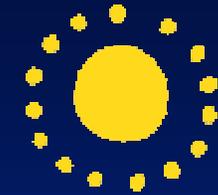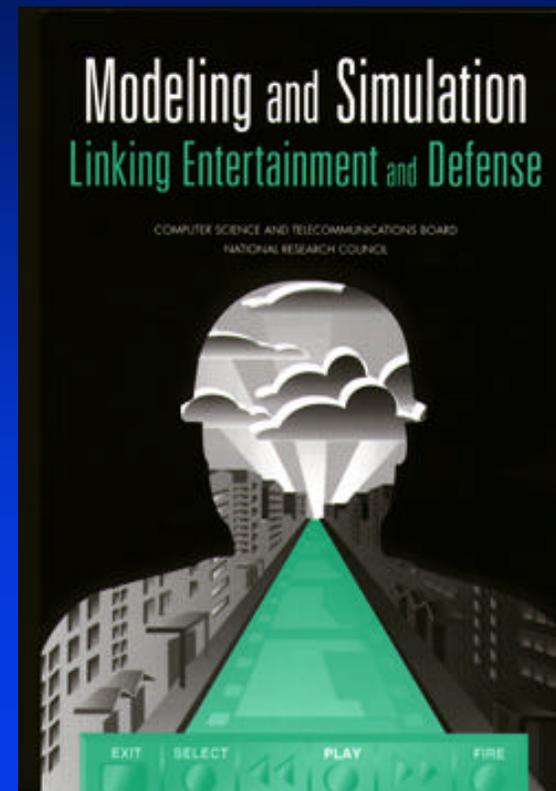
Technologies for Immersion

Image generation - real-time, computer graphic generation of complex imagery, HDTV, DVD, next generation delivery systems, novel display technologies, handheld and body-worn devices.
Tracking - technologies for keeping track of human participants in virtual environments.
Locomotion - technologies that allow participants to walk through virtual environments while experiencing hills, bumps, obstructions, etc. **Full sensory interfaces** - technologies for providing a wide range of sensory stimuli: visual, auditory, olfactory, and haptic. **Novel sound systems** - generation and delivery for both interactive and recorded media.
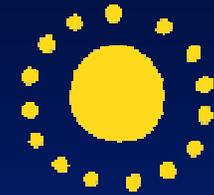
Networked Simulation

Multicast and area of interest managers - to facilitate the development of large-scale, media-rich, interactive, networked VEs.
High bandwidth networks - experimentation and utilization of next-generation Internet technologies for large-scale, networked virtual environments, and collaborative M&S development and application.
Wireless - handheld delivery systems.
Latency-reduction - techniques for predictive modeling in distributed simulations.
VE architectures for interoperability - Network software architectures for scalability, composability & dynamic extensibility.
Standards for interoperability

# Directions - Research & Application

Tools for Creating Simulated Environments

Virtual environment generation & manipulation - tools for managing the development of large-scale, high fidelity, computer graphics databases, tools that allow rapid retrieval of information, feature extraction, creation, & simplification. **Compositing** - hardware & software tools that allow designers to form composite images with images taken from multiple sources (live-action footage, 3D models, sensors) . **Interactive tools** - tools that use a variety of input devices to construct models and simulations. **Production tools** - rapid digitization & construction of virtual sets & interactive environments, interactive exploration of camera angles, lighting, exploration of effects & their integration with film/video/interactive.

# Directions - Research & Application
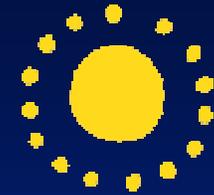
Computer-Generated Autonomy

Adaptability - computer generated characters that can modify their behavior automatically. **Learning** - computer generated characters that can modify their behavior over time. **Individual behaviors** - computer-generated characters that accurately portray the actions & responses of individual participants in a simulation. **Human representations & models** - authentic avatars that look, move, and speak like humans. **Spectator roles** - ways of allowing observers into a simulation. **Aggregation & deaggregation** - the capability to coalesce smaller units into larger ones and separate them back into smaller ones. **Story line engines** - content production and simulation prototyping. Technologies for autonomous, real-time story direction and interaction. **Physically-Based Modeling**

Research & Application - Common Directions
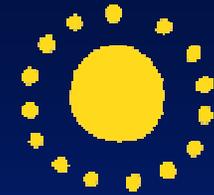
Army Focus

- Training with technology
- Advanced concept development and analysis
- Acquisition - virtual prototyping, rapid product development and technology transition

Entertainment Industry Focus

- Film
- Television
- Effects
- Interactive games
- Location-Based Entertainment

## Research & Application - Common Directions

- Technologies for immersion
- Networked simulation & standards for interoperability
- Tools for creating synthetic environments
- Computer-generated autonomy

Army Applicability of the Research & Application Directions
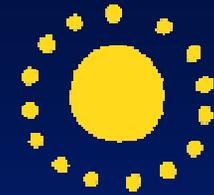
- Advanced Tactical Engagement Simulations

- Computer Generated Forces (ModSAF/OneSAF)

- Individual Combatant Simulation Technologies

- Inter-Vehicle Embedded Simulation Technology

- High Level Architecture (HLA)

- Synthetic Environment Data Representation & Interchange Specification (SEDRIS)
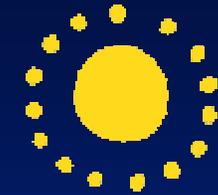
Army Applicability
- Potential Product Mix
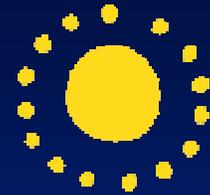
Mission Rehearsal for Strike Force

Core Instrumentation for NTC

Web-based Distributed Learning

Embedded Simulation

Simulations and databases to enable SBA/SMART
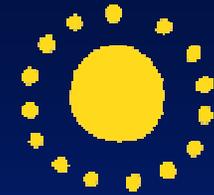
Strategic Objectives

World's Best Technology for World's Best Army

Provide a Path for New Products

Develop Partnerships across the DoD, the International arena, and with the Academy

Exploit Commercial Tech

# Entertainment Applicability of the Research & Application Directions

- Film/Television pre-production

- Effects planning and pre-production

- Interactive gaming, Internet-based gaming and communication

- Location-based entertainment prototyping & development

- Virtual set design and development

Synthesis - Research & Application - where we will be in ten years ...
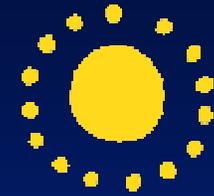
The research developed in the four core areas will be utilized in building our interpretation of the "Digital Sound Stage of the Future".

- We foresee this sound stage as an empty shell into which we can pour content - this week we can fabricate main street USA, next week the deck of the Enterprise, the next the streets of Baghdad - all in the same space.
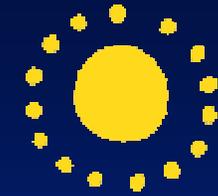
Digital Sound Stage of the Future

Our Digital Sound Stage is an infrastructure that supports the rapid construction of digital artifacts -

- networked virtual environments,

- imbued with autonomous characters,

- characters guided by a story line engine,

- interactively playable on any locomotion interface or VR cubicle,

- fully physically modeled,

- with spatial sound &

- viewable on any display technology or media.
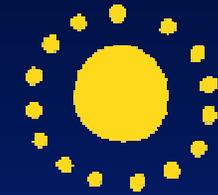
Digital Sound Stage of the Future

Instead of physical production we will have digital production.

- Where we now have a physical sound stage, the set of the future will take a digital form.

- We need an infrastructure to make this new medium possible. We will not only need the tools, but the workers and artists who use them.

- We will need the delivery and distribution mechanisms to get them to the audience. We will need new aesthetics that future media will mold and shape.

ICES & the Evolution of Infrastructure
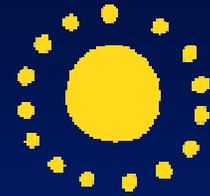
The Institute for Collaborative Environment Studies will contribute in a concentrated way to the evolution of the infrastructure needed to create tomorrow's media—from inventing and building the digital tools, to developing the artistic and aesthetic forms.

It will nurture and provide a neutral ground for this to take place. It will involve the most creative and inventive minds to do so, coupled with the most promising student talent.

ICES & the Evolution of Our Country
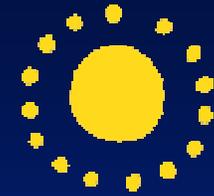
The work of this Institute will create results beneficial to our country in terms of defense technology and training, and also for its people, in new forms of entertainment and education for the future.

Working together we can build on the best both worlds have to offer, and in a remarkable collaborative effort, anticipate and influence what we can only guess is to come.
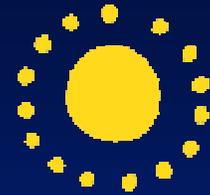
Interactions, Affiliations & Organization
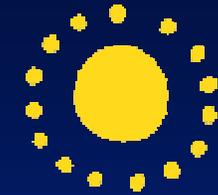
Industry Interaction

Collaborative technology transfer is the goal with this co-location.

- Sufficient office, laboratory space, and innovation zones for our collaborating entertainment industry and M&S partners.

  - Used for shared projects and research relevant to the goals of the Institute, for conversations with our in-house staff and faculty, and as sabbatical homes.

- Innovative theater space for communicating and exploring progress and idea sharing.
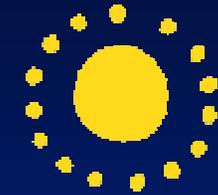
University Affiliation

- Our institute is to be affiliated with a university, with the faculty and staff being employees of that university.

- Institute faculty will receive tenure with the institute as their home department.
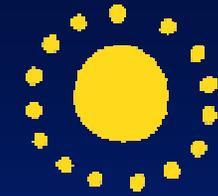
University Affiliation

- University affiliation provides us an avenue for increasing the national tech base via the publication and dissemination of research results and via the graduation of students who have worked on institute problems.

- University affiliation also contributes to the frontiers of knowledge through academia's traditions of publication and presentation.

- In addition, university affiliation provides access to pre-competitive development.
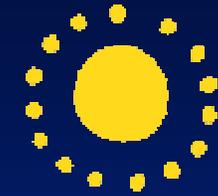
Institute Faculty

*The Institute's Faculty and Staff will be an interdisciplinary collection.*

- We expect that 50% of the institute's members will be creative and 50% technical.

  - Departments/Schools of Computer Science, Design, Art, Cinema & Film, Cognitive Psychology, Creative Writing, Electrical Engineering ...

  - The Institute will need to hire faculty and staff specific to the Institute's focus & vision.
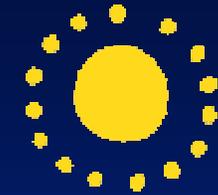
Interdisciplinary Degree Programs

The institute requires an interdisciplinary university infrastructure, offering degrees with new names.

- Entertainment Technology & Content

- Computer Graphics & Virtual Environment Authoring

- Modeling, Virtual Environments & Simulation
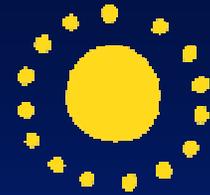
Technology Transition

- A technology transition plan will be an embedded part of each proposed institute project.

- Regular coordination meetings will be held to make sure technology transition can occur.

- An Army representative will be provided to the institute whose full-time job is technology transition.
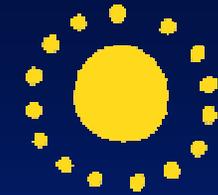
Intellectual Property

The institute has the freedom to establish its own intellectual property agreements with its partners and members.

Institute developed IP will be licensable to the commercial sector, with members and partners able to benefit.
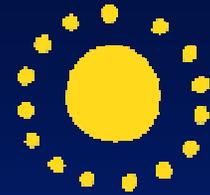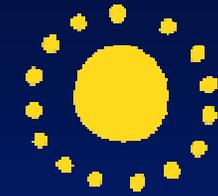
Institute Organization

Institute Board

Institute Faculty (interdisciplinary)

Technical Advisory Board

Institute Affiliates Board
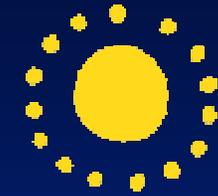
Institute Board

Institute Director

Assistant Director

Director, Industry Relations
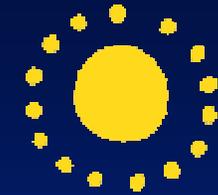
Facilities Mgmt

*Chair, Technical Advisory Board*

Chair, Institute Affiliates Board

Technical Advisory Board

External industry, government and academic advisors whose purpose is to review the technical directions and plans of the Institute.

Institute Affiliates Board

External advisors who provide entertainment industry and modeling and simulation community perspective and financial guidance/support. Army chairs the board and selects the members in conjunction with the Institute Director.
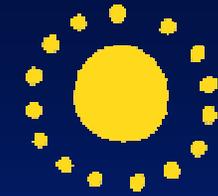
Proposed Affiliates - Entertainment

Disney

Sony

Industrial Light &
  Magic

Dreamworks

**Key entertainment
leaders.**

Pixar

Blue Sky/VIFX

Rhythm & Hues

Paramount

Pacific Data Images

Film, television, effects, interactive games and location-based entertainment.
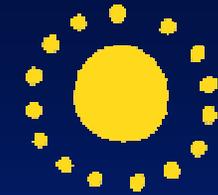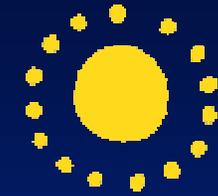
Proposed Affiliates - Government

USA STRICOM

US Army Research Office

Other Army and Other Service Research Organizations

...

*State of California*

Los Angeles EIDC

...

Facilities, Size & Costs
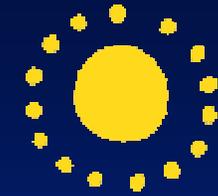
Facilities

In reviewing the research directions of the institute and through discussions with entertainment industry partners, the finding is that a large amount of space is needed.

- This space can be university-owned, industry-donated or City of Los Angeles owned/offered.

- This space needs to be near the entertainment industry Burbank/Glendale, Hollywood or West side.
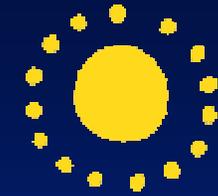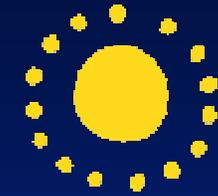
Facilities - Offices

The Institute needs:

- 300 square feet per researcher, for private offices, and conference facilities.

- Multiple conference rooms with the latest in VTC facilities.
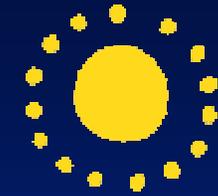
Facilities - Offices

All the offices and conference rooms should be connected optically to an Institute LAN with high-speed connections to the Internet/Internet-2.

Facilities - Laboratories

Latest toys and ways to build new ones

- Laboratories should be outfitted with the latest in:
    - Computer graphics hardware & software,
    - Film & video production hardware & software,
    - Virtual environment input & output devices & places,
    - Spatial sound production & generation facilities,
    - And all manner of the latest high-tech support.
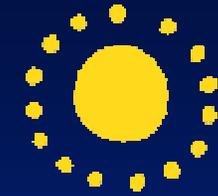
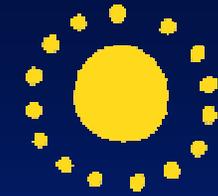# Facilities - Special Requirements

VR Theater

- The Institute requires a 150 seat VR theater, with 180 degree curved screen and embedded spatial sound capabilities. Size approximately 4,000 square feet (40 x 100).

- This theater will be utilized for Institute public events, small workshops and experiments.

- The theater requires the latest in projection capabilities, room for an SGI Reality Monster class machine, and a high enough ceiling for tracker placement.

Facilities - Special Requirements

High Bay Facility & Testbed Center

- The Institute requires a high bay facility suitable for constructing advanced prototypes of location-based entertainment and simulation mockup systems. A space 100,000 square feet.

- Part of that facility will contain a next-generation "VR CAVE". The "VR CAVE" requires a 30 x 30 x 30 foot space.

- Shop support for the High Bay Facility.
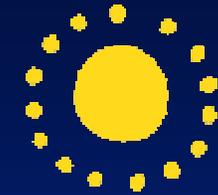
Facilities - Special Requirements

VIP Center

- The institute expects to host delegations of entertainment industry and modeling and simulation executives. A suitable facility for their reception would be invaluable.

  – Conference and welcome room area.

  – Kitchen, small dining facility.
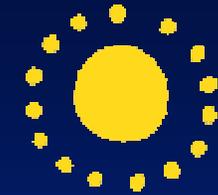
Expected Institute Size

	2000	2001	2002	2003	2004
Faculty	7	13	13	13	13
Staff	4	12	16	20	20
Grad. Stdnts	3	12	15	20	22
El On-site	3	12	15	20	22
Total =	17	49	59	73	77
Office Space	5100	14700	17700	21900	23100
VR Theater	4000	4000	4000	4000	4000
High Bay	100000	100000	100000	100000	100000
Total =	109100	118700	121700	125900	127100
Cost	$5,076,000	$9,581,000	$10,083,000	$10,024,000	$10,198,000

The Institute for Collaborative Environment Studies (ICES)

http://www.ICES.edu