



An Operating Plan for the Institute for Collaborative Environment Studies

Introduction, Background & Rationale

The Director of Defense Research and Engineering (DDR&E) funded a study through the National Research Council Computer Science and Telecommunications Board (NRC CSTB) and a committee was formed representing the virtual environment, computer graphics, location-based entertainment, networked video game, film and entertainment communities.

At the end of that effort, the National Research Council published a report entitled “Modeling and Simulation – Linking Entertainment and Defense”¹. In that report, a recommendation is made that the Department of Defense create a research institute to explore how the Entertainment Industry and the Department of Defense and its associated industries can develop a stronger technology base for modeling and simulation and profit from a closer working relationship. The US Army has decided to invest in an institute focused on the research agenda of that study. We call that institute the Institute for Collaborative Environment Studies (ICES).

Institute Vision

The vision for ICES is to create THE world-class institute for research, application and education in computer graphics and virtual environment technologies for the defense and entertainment modeling and simulation (M&S) communities. The institute will carry out basic and applied research of defense and entertainment industry M&S interest, and advanced prototypes for defense and entertainment M&S.

ICES will build things. Following the entertainment industry “Big Idea Concept”, we are going to test 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. The following lists are suggestive of our agenda:

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.

¹ Zyda, Michael and Sheehan, Jerry (eds.), Modeling and Simulation: Linking Entertainment & Defense, National Academy Press, September 1997, ISBN 0-309-05842-2, 181 pages.

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

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

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.

While the research agenda is common between the entertainment industry and the defense M&S communities, the applications are clearly different. The Army focus is on training with technology, advanced concept development and analysis, acquisition, virtual prototyping, rapid product development and technology transition. The Entertainment Industry focus is on the creation of imagery and sound for film, television, effects, interactive games, and location-based entertainment, as well as on new delivery methods for these applications.

The Army's applicability of the research and application directions is to:

- Advanced Tactical Engagement Simulations,
- Computer Generated Forces (ModSAF/OneSAF),
- Individual Combatant Simulation Technologies,
- Inter-Vehicle Embedded Simulation Technology,
- High Level Architecture (HLA) and
- Synthetic Environment Data Representation & Interchange Specification (SEDRIS).

Army applicability with respect to potential product mix is for:

- Mission Rehearsal for Strike Force,
- Core Instrumentation for NTC,
- Web-Based Distributed Learning,
- Embedded Simulation,
- Simulations and Databases to enable SBA/SMART.

All of this is to meet the Army's strategic objectives which include: the 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, and Exploit Commercial Technology.

The entertainment applicability of the research and application directions is for: film/television pre-production and post-production, effects planning pre-production and post-production, Interactive gaming, Internet-based gaming and communication, location-based entertainment prototyping and development, virtual set design and development, new delivery methods, and new entertainment modalities.

Synthesis - Research & Application

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.²

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 and viewable on any display technology or media.

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 the final product (training or entertainment) to the audience. We will need new aesthetics that future media will mold and shape.

² An alternate name for this could be Synthetic Theater of War, were that name not already associated with an pre-existing project.

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

Entertainment Industry Interaction

Our institute plans to be half technical (researchers in computer graphics and virtual environments) and half creative (collaborators from the entertainment industry). Collaborative technology transfer is the goal with this co-location. To carry this out, we need sufficient office, laboratory space, and innovation zones for our collaborating entertainment industry and M&S partners. This space will be 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. Part of our plan is to have an 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. Institute faculty will be interdisciplinary.

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. We expect to utilize faculty who may be homed in the institute or faculty homed in a variety of departments, e.g. 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 and vision. The institute and the affiliated university will cooperate in developing faculty hiring plans for relevant departments.

Interdisciplinary Degree Programs

The institute requires an interdisciplinary university infrastructure, offering degrees with new names. Entertainment Technology and Content, Computer Graphics and Virtual Environment

Authoring, and Modeling, Virtual Environments and Simulation are three of the areas we expect to develop as degree programs.

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 (IP) agreements with its partners and members, separate from the affiliated institution. Institute developed IP will be licensable to the commercial sector, with members and partners able to benefit. Institute members and partners will have the right of first refusal on IP. IP not developed by members/partners will be licensable to outside organizations.

Institute Organization

The institute will have a director. That director will report to the provost of the affiliated institution. Such a chain-of-command facilitates the interdisciplinary goals of the institute. The institute is to be governed by an Institute Board consisting of the Director, the Assistant Director, the Director of Entertainment Industry Relations, the Director of Facilities, the Chair of the Technical Advisory Board, and the Chair of the Institute Affiliates Board. Salary structures for institute employees will be determined by the institute.

A Technical Advisory Board will be appointed by the Director and will consist of external industry, government and academic advisors whose purpose is to review the technical directions and plans of the institute.

An Institute Affiliates Board will be appointed and will consist of external advisors who provide entertainment industry and modeling and simulation community perspective and financial guidance/support. The Army chairs the Institute Affiliates Board and selects the members in conjunction with the Institute Director.

Proposed Affiliates - Entertainment

- Disney
- Sony
- Industrial Light & Magic
- Dreamworks
- Pixar
- Blue Sky/VIFX
- Rhythm & Hues
- Paramount
- Pacific Data Images
- RFX
- Electronic Arts
- Microprose
- Key entertainment leaders.

Proposed Affiliates - Government

- USA STRICOM
- US Army Research Office
- Other Army and Other Service Research Organizations
- State of California
- Los Angeles Entertainment Industry Development Corporation

Facilities, Size & Costs

In reviewing the research directions of the institute and through discussions with entertainment industry partners, we find 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, in either Burbank/Glendale, Hollywood or the 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.

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

The laboratories will contain the latest toys and ways to build new ones. The 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,
- Support capabilities for innovative new devices.

It is expected that the laboratory equipment will either be purchased from the institute's available funding or obtained via donations from affiliates.

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.

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, with an estimated requirement of a 100,000 square foot space. 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 is additionally required.

Air Conditioned Machine Space – The institute requires an air conditioned space for its expected high-end SGI Reality Monster class machines.

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. There should be a conference and welcome room area and a kitchen, and small dining facility.

Expected Institute Size

The institute growth profile looks like the following:

	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 sq.ft.
VR Theater	4000	4000	4000	4000	4000 sq.ft.
High Bay	100000	100000	100000	100000	100000 sq.ft.
Total =	109100	118700	121700	125900	127100 sq.ft.
Cost	\$5.07M	\$9.58M	\$10.08M	\$10.02M	\$10.19M