

Review

**INSTITUTE for
SIMULATION
& TRAINING**

IST and Visible Productions to produce 3D anatomical images

Beginning in the early nineties, the National Library of Medicine's Visible Human project acquired CT, MRI and photographic cross sections of two human cadavers. From this combination of imaging techniques NLM produced digitized anatomical models of a representative human male and female.

IST and Visible Productions of Fort Collins, CO, are working together to create a practical way to use these models to produce 3D anatomical images specific to a patient undergoing diagnosis or treatment. IST's current assignment involves only the human skull.

IST researcher Guy Schiavone, Ph.D. is exploring ways to use 3D modeling based on surface measurements of a specific patient to adjust the images provided by the Visible Human generic models.

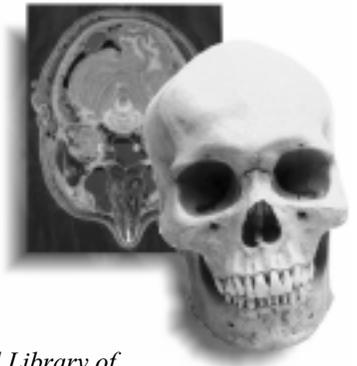
The method under study fine-tunes the representative model into a patient-

specific model over four stages.

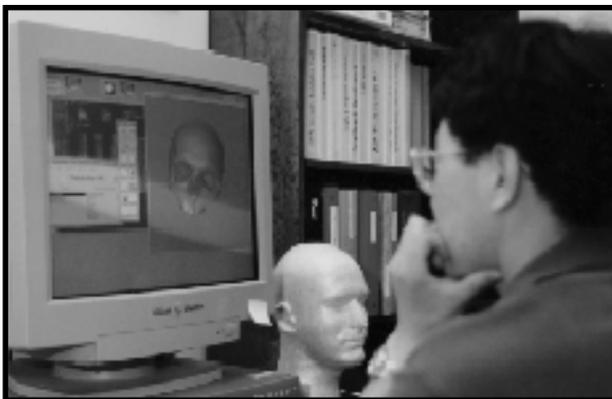
Stage one applies an initial transformation to register a "best fit" to the new imagery. A second stage sees the 3D model used as an initial approximation for the image segmentation step. Thirdly, the initial segmentation is improved based on a compatible image segmentation method. Then researchers apply additional transformations and alterations based on the updated segmentation to produce the final model.

Several groups are already developing approaches to using a *priori* knowledge in medical image segmentation. IST's approach differs from most of these efforts in that we are using 3D surface models for the initial approximations.

Point of contact for this effort is Guy Schiavone, Ph.D.



National Library of Medicine's Visible Human project acquired CT, MRI and photographic cross sections of human cadavers.



Research assistant Shiyuan Jin, studying for his masters in computer engineering, assists in stage one of 3D patient-specific modeling research.

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IST Helping to Develop Future Spaceport Concepts

NASA began the Vision Spaceport Project at Kennedy Space Center to help create reliable and affordable access to space. The project is a five-year partnership formed to evaluate concepts for a new spaceport facility. It combines the expertise and resources of IST, NASA (Kennedy Space Center and Ames Research Center) and industry (Boeing, Lockheed Martin, Command and Control Technologies, Science Applications International Corporation and Quantum Technologies Services International).

Kennedy Space Center formed this Spaceport Synergy Team, operating under an innovative Joint Sponsored Research Agreement, to develop revolutionary concepts for spaceport architectures and space launch operations capability needed for affordable space transportation.

Coming up with real-world, bottom line figures for a future spaceport whose space vehicles do not yet exist is no small task. Literally thousands of variables need to be considered. The best solutions will combine initial investment, cost of annual operation, cost per pound to launch a vehicle, cost per flight, number of flights per year and the minimum number of vehicles and people needed to operate such a port. Safety, ease of launch and recovery, accessibility, recycling time and conservation of resources, all factors critical to the cost of getting into space and back

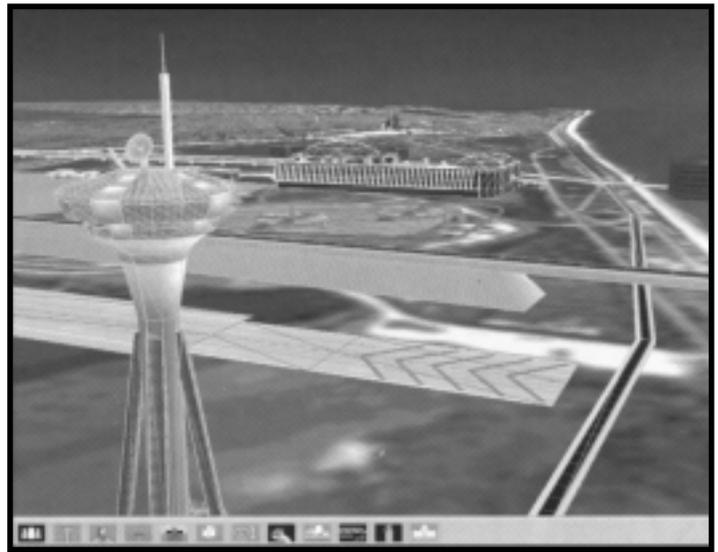
also come into play.

To apply numbers to the alternatives, the partners applied current understanding of what it takes to run a spaceport to develop a core model based on those

many requirements. Researchers feed the core model information on alternative vehicles' capabilities and support needs and the core model cranks out data based on each of the alternatives.

IST's participation in the partnership is to create a module to help people visualize that data. This graphic representation of core model outputs will promote better understanding and encourage collaboration to make future concepts a present reality.

IST's visual module application is not just an imaginative virtual reality tour of a possible spaceport. It provides a graphical extension of the core model created by the team as a whole. The core model is meant to be a generic design and planning tool with a host of uses at facilities beyond Kennedy Space Center. IST's initial proof of concept visualization module includes a library of visual images of present day KSC facilities and function-



Artist Pat Rawlings developed this futuristic vision of a launch pad facility for use in the visualisation module.

ality that show various levels of detail.

This becomes a starting point for a more general purpose visual representation of data from the core model. The current visual object library consists of more than 340 facilities at KSC modeled by UCF graduate students in a 3D CAD (Computer-Aided Design) program using over 1,500 digital images for detailed texture. Using the visual module application, all models and data can be viewed at a number of levels. The viewer can navigate through the 3D visual representation of the core model data using either spatial (geographic) or functional modes for representing spaceport operations.

Also, the viewer can simultaneously compare the current KSC site and a proposed spaceport concept with one site superimposed on the other. The team looks forward to expanding the library

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IST Review

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IST's Mission:

Be a focal point for the expanding modeling and simulation community

◆ Develop and conduct M&S research and related services

◆ Identify M&S directions and trends

◆ Facilitate moving M&S into new areas

◆ Be a research and development access point to industry for technology transfer

◆ Create and participate in partnerships

◆ Provide an environment conducive for student and faculty participation in M&S research and development

◆ Provide continuing education services.



Fire/Rescue Station, Advanced Emergency Management Training Facility

In a unique partnership between UCF and Orange and Seminole counties, fire fighters from both counties will operate out of Central Florida's newest fire station, located on the University of Central Florida campus. The fire/rescue station is set to open in late summer. An adjacent high-tech training center, administered by IST, will begin operation in the fall.

The facilities are at the dividing line between Orange and Seminole counties, which also is UCF's northern boundary. Staffed by both counties, the fire/rescue station will answer emergency calls to campus and surrounding areas in both counties.

Population Growth a Factor

University and county officials have long been concerned about the area's considerable population growth and the resulting impact on emergency services. A joint fire/rescue facility serving all three entities promises to be a cost-effective solution.

The 900-square-foot training center is an added benefit that fits in nicely with UCF and IST emergency management training initiatives. The state-of-the-art center will serve two major functions: training and developmental research.

Training

Training will focus on "train the trainer" applications coordinated with Orange and Seminole County fire/rescue departments. Plans are to link the center's computers via telephone and satellite communications to fire stations throughout the two counties. The links will provide countywide access to distance education courses developed by IST, UCF and others.

Research

Developmental research will focus on new, custom-made instructional programs. IST researchers envision that these programs will fulfill a need for advanced emergency management training for professionals and fire safety education for the general public.

The center could become the core of a model county fire safety program for local communities and schools. School children can attend a class at the facility as part of a field trip.

Access to actual fire safety equipment at the nearby station will reinforce the films, videos and interactive computer-based programs available at the center.

Prototype for Advanced-Level Training

IST also hopes the training center can serve as a prototype for advanced, management-level instruction. With the growing public demand for well-managed crisis teams that can respond to large-scale emergencies, educators see a need for a program that can provide that level of training and complement the training now available at the local community colleges. To support the center, IST envisions the development of a variety of computer-based simulation programs and interactive courseware. IST already has coordinated with Orange and Seminole County fire/rescue and with UCF Nursing to train EMTs and nurses at the facility, using the institute's human patient simulator. The \$75,000 simulator is a sophisticated, computer-animated mannequin that can be used to teach emergency medical procedures.

Principal scientist Peter Kincaid, Ph.D. is the IST researcher charged with operating the training center. Dr. Kincaid's plans to use computers to model and simulate such catastrophic events as a tornado, hurricane or train wreck are intended to demonstrate practical and cost-effective



New two-county fire/rescue station on UCF site includes IST training facility.

ways to train emergency response professionals at all levels to prepare for and respond to crises.

The center's collection of medical simulator software will help bring high technology into nursing and emergency medical technician training. Both IST and the university see emergency management as a growth area for training and research. The training center will be equipped with some of the latest in instructional media technology. It has the potential to become a resource for seminars for fire and emergency managers around the nation.

The state-of-the-art, live patient simulation and other opportunities for training made available through the IST facility will add a 21st Century dimension to the project. Ultimately, the taxpayer will benefit from better-trained emergency managers, nurses and emergency medical technicians, more effective community safety education and enhanced response to area emergencies.

IST will look to outside sources to help fund the training center. A combination of grants, revenues from seminars and state and local funding will support research and educational programs.



Ph.D.s conferred on three staff members

Robert Franceschini, who works with the Distributed Simulation group on multi-resolution simulation using Eagle/ModSAF and Distributed Simulation project proposals, earned his Ph.D. in Computer Science this past May.

His immediate plans are to build on his dissertation work through externally sponsored projects at IST and continue productive involvement with faculty from School of Computer Science. He has

worked with IST as a student (1991-93) and as faculty (1993-present). He holds a BS in Computer Science from UCF.

Hector Morelos-Borja earned his Ph.D. in computer Science July 9, 1999. He is currently working on the RAVEN project with researcher Jim Parsons. He will shortly be returning to Mexico to a teaching position at a university in Mexico. Hector has been a graduate assistant at IST since May 1995. He holds a

BS in Computer Science, an MB in Business Administration and an MS in Computer Science.

Guru Prasad is IST's most recent Ph.D., having attained his doctoral degree in Industrial Engineering July 16. Dr. Prasad will continue his work on synthetic environments with the Distributed Simulation group. He holds an MS and BS in Mechanical Engineering.



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with visual objects from others across the world who contribute their expertise and ideas for the collaborative development of spaceport concepts.

Design concepts for spacecraft include single stage rockets (no boosters) and commercial vehicles that can be re-scheduled with minimum turnaround time. IST has added digital versions of these vehicle designs to the visualization module library for use in representing future spaceport concepts.

Using the Kennedy Space Center as a base, the visualization module can create a virtual reality world showing how a future spaceport at KSC might look.

One concept includes an airport-like control tower, a seaport for bringing in cargo by water, an integrated terminal for cargo and people, a vertical launch facility and a magnetically levitated track for horizontal vehicle launches.

Researchers hope this work will lead to advanced and visionary spaceports that

can support mixed fleets and function more like an airport. IST members of the Spaceport Synergy Team include Art Cortes, general manager of the Visual Systems Laboratory, Jim Parsons, principle investigator and Ron Hofer, co-principle investigator.

Jason Huepenbecker, Chris Kachurak, Sean Waldron and Jason Daly assisted in developing the model library, menus and display icons. Brian Kline developed the pointing device interface.



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