EASTERN VIRGINIA
MEDICAL SCHOOL

THE VIRGINIA MODELING AND SIMULATION INITIATIVE (VIMSIM)

REPORT ON THE BUILDING OF RESEARCH CAPACITY IN MEDICAL MODELING AND SIMULATION FOR THE FISCAL YEAR ENDING JUNE 30, 2007

Presented to:

The Honorable Vincent F. Callahan, Jr.
Chairman
House Appropriations Committee

And

The Honorable John H. Chichester
Chairman
Senate Finance Committee

By

C. Donald Combs, Ph.D.
Associate Dean for Planning and Health Professions
Eastern Virginia Medical School

October 1, 2007

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October 1, 2007

The Honorable Vincent F. Callahan, Jr.
Chairman, House Appropriations Committee
Commonwealth of Virginia
9th Floor, General Assembly Building
910 Capitol Street
Richmond, VA 23218

The Honorable John H. Chichester
Chairman, Senate Finance Committee
Commonwealth of Virginia
10th Floor, General Assembly Building
910 Capitol Street
Richmond, VA 23218

Dear Delegate Callahan and Senator Chichester,

Under Item Number 242, paragraph I, of Chapter 847 of the 2007 Acts of Assembly, the Eastern Virginia Medical School (EVMS) is required to report to the Chairmen of the House Appropriations and Senate Finance Committees by October 1, 2007 on the use of $1,500,000 from the general fund and $1,200,000 from nongeneral funds in state fiscal year 2007 to build research capacity in medical modeling and simulation.

A recent headline in *The Virginian-Pilot* newspaper stated "MODSIM Expo's Turnout Exceeds Expectations", referring to the unexpectedly large turnout of attendees for the inaugural modeling and simulation conference we co-sponsored in September in Virginia Beach. This headline would also be apropriate to describe the first year of the medical modeling and simulation component of the Virginia Modeling and Simulation Initiative (VIMSIM). All the projects we had planned to undertake were indeed started and we exceeded the $1.2 million required in nongeneral matching funds by 500%.

The report requested has been included in the required format along with several attachments that highlight the recent accomplishments of EVMS and its medical modeling and simulation research partner, the Old Dominion University Virginia Modeling, Analysis and Simulation Center.

Please do not hesitate to contact me for any further information that may be required.

With best regards,

C. Donald Combs, Ph.D.
Associate Dean for
Planning and Health Professions

Attachments
c: Katherine K. Hanley, Secretary of the Commonwealth

Building Research Capacity in Medical Modeling and Simulation

Report to the

House Appropriations Committee

and

Senate Finance Committee

Eastern Virginia Medical School

October 1, 2007

Background and Problem Statement

Several studies have revealed that the U.S. health care system is not as safe as it should be. For instance, in a study of Medicare data collected from over 5,000 hospitals across all 50 states from 2002-2005, the HealthGrades organization (2007) found that 284,798 patients had died from safety incidents (e.g., failure to rescue, foreign bodies left during a procedure, infections due to medical care, etc.) with an estimated cost of $8.6 billion. Further, more than 85% of those deaths were potentially preventable. Research has shown that equipment and instruments, the ergonomic design of equipment, individual performance, team and group behavior, organizational practices, legal and regulatory constraints, and societal and cultural pressures all contribute to errors in the health care system (Bogner, 1994). Further, the American Medical Association's Accreditation Council for Graduate Medical Education, the organization that accredits graduate medical education programs in the U.S., recently set restrictions on the working hours of medical residents. These restrictions have raised new concerns about how to provide adequate training opportunities for residents.

In many high-risk occupations (e.g., aviation, military operations, nuclear power plant operations, etc.), computer-based simulators have been an historical and fundamental component of training. Not only do simulators provide a safe environment for trainees to acquire skills, but they also facilitate our understanding of human performance in those contexts.

By contrast, computer-based simulator systems for training healthcare providers have only become commercially viable within the last 10 years. However, the number and variety of medical simulator systems are increasing rapidly. These simulator-based training systems promise many advantages. They enable trainees to learn fundamental procedures without putting patients at risk. They allow greater opportunities for training to be matched to individual needs and can expose trainees to rare or unusual conditions. They also reduce the need for cadavers and animal models. Moreover, evidence is beginning to show that clinicians who train with this technology are more skillful when they perform procedures on genuine patients. Consequently, a growing number of residency review committees are now considering how to use this technology for assessment and certification.

Unfortunately, simulation technology has not yet had the impact on medical curricula that one might hope. There are a number of issues that continue to impede its acceptance. First, there are few studies demonstrating training effectiveness that are grounded in fundamental principles of skill acquisition or learning. Thus, many systems are not designed to take full advantage of an individual's potential for learning. Similarly, training regimens do not include current methods for validating skills and expertise. Second there are large gaps between those systems that are currently available and the needs of medical educators. For instance, most current commercial systems address the psychomotor skills needed to perform individual procedures. There are few systems, however, that target the problem-solving and decision-making skills of more advanced trainees. Third, there are also gaps between current commercial systems and the needs across all medical specialties. The vast majority of systems available today target anesthesiology, airway management, and laparoscopic surgery. Few systems exist for training in specialties such as family medicine or obstetrics and gynecology.

Bogner, M.S. (1994). Human error in medicine. Hillsdale, NJ: Erlbaum.
HealthGrades, Inc. (2007). HealthGrades quality study: Fourth annual patient safety in American hospitals. Lakewood, CO: Author.

Virginia's Response in the FY 2006-2008 Biennium

On April 12, 2005 former Governor Mark R. Warner announced the Virginia Modeling and Simulation Initiative, known by the acronym VIMSIM, at the opening of Lockheed Martin's Center for Innovation in northern Suffolk. Governor Warner described the potential impact of VIMSIM on that day as follows:

"VIMSIM has the potential to dramatically transform and strengthen the economy of this region and the Commonwealth as a whole by attracting more high-tech, high-wage jobs... We can make this the beginning of the biggest economic development force, not only for Hampton Roads, but for all of Virginia".

In December of 2005 Governor Warner announced a $27 million package of budget proposals to broaden and build upon the growing modeling and simulation activity in South Hampton Roads. The package included funds to recruit and hire additional faculty and staff to expand research and training programs in modeling and simulation at Old Dominion University (ODU), Eastern Virginia Medical School (EVMS), and Tidewater Community College (TCC).

EVMS developed a six-year initial funding plan for investment in medical modeling and simulation in coordination with the ODU Virginia Modeling, Analysis and Simulation Center (VMASC), its research partner, as follows:

	GF	NGF
FY07	$1.85M	$1.00M
FY08	1.85M	1.25M
FY09	1.50M	1.50M
FY10	1.00M	2.00M
FY11	.750M	2.50M
FY12	.750M	3.00M

The initial EVMS request was for a total of $7.7 million in general funds over the six-year period, that would, in turn, leverage $11.25 million in nongeneral funds while establishing the Commonwealth and Hampton Roads as a national and international center of excellence in medical modeling and simulation.

With the support of Governor Timothy M. Kaine and the General Assembly, EVMS was appropriated $1.5 million from the general fund and $1.2 million from nongeneral funds in each year of the 2006-2008 biennium to build research capacity in medical modeling and simulation. While the general funds appropriated fell somewhat short of what was requested, EVMS has made the most of the investment and has exceeded the goal of $1.2 million in nongeneral matching funds for the first year of the biennium by 500%.

For the upcoming 2008-2010 biennium, EVMS is requesting a modest increase in funding to $2.0 million in general funds for each year of the biennium and plans to leverage these dollars with a minimum of $2.0 million in nongeneral funds in FY 2009 and $2.5 million in nongeneral funds in FY 2010. This funding would cover years 3 and 4 of the initial six-year medical modeling and simulation investment plan and would be a prudent use of the Commonwealth's funding considering the results obtained with the $1.5 million in general funds invested in medical modeling and simulation activities at EVMS in FY 2007. If past is prologue, the nongeneral fund return on investment will substantially exceed the conservative estimate used in this proposal.

The General Assembly included language in the Appropriations Act for the FY2006-2008 biennium stipulating that EVMS should report on the use of the medical modeling and simulation research capacity-building funds on an annual basis. The report must include the following information: 1) how the funds were used, 2) the amount of federal and private funds that were leveraged, 3) collaborative efforts in support of private industry, 4) the number of junior and senior faculty recruited in each field, 5) the amount of federal or other grant funds received as the result of those recruitments, 6) additional grants or contracts being pursued, 7) the level of instructional activity conducted by these faculty, 8) the impact of research activities on undergraduate instruction, 9) the use of graduate student aid funds, and 10) recommendations for future investment.

A brief synopsis of this information is presented here for FY 2007 to highlight the impact that the $1.5 million investment in medical modeling and simulation research capacity has already had on the Commonwealth, in this first year of investment. Supplementary information has also been provided where noted in the narrative.

1) How the funds were used.
   At Old Dominion University (ODU), funds were used to support the hiring of five (5) new ODU faculty members with medical modeling and simulation research interests and the reallocation of effort of an additional six current ODU faculty members and two staff project scientists. In addition the funds supported four (4) master's level students and three (3) doctoral level students. At EVMS, the funds were used to reallocate the research effort of eleven (11) current EVMS faculty along with several staff members, and to support the work of three (3) master's level students and three (3) doctoral level students. In addition, $187,000 in funds were used to purchase medical modeling and simulation research equipment.

2) The amount of federal and private funds that were leveraged.
   A total of $6,793,759 in federal and private funds were leveraged by the $1.5 million in general funds provided by the Commonwealth in FY 2007. Several examples of this funding include the following:

   - $1.2 million from NASA for research to Richard A. Britten, Ph.D., on modeling the effects of cosmic radiation on the human brain as part of the NASA Mission to Mars project with potential to unravel the biomechanics of brain damage, potentially benefiting patients with degenerative neurological conditions like Alzheimer's disease. Please refer to Tab #3 for additional information.

   - $84,430 from the Office for Naval Research to provide general support for medical modeling and simulation research efforts.

   - $1.138 million from federal grants and private foundations to support the work of Richard R. Drake, Jr., Ph.D., on modeling the protein profiles of breast and prostate cancers and of infections caused by pathogens associated with weapons of mass destruction as well as influenza infections associated with a flu pandemic.

2) The amount of federal and private funds that were leveraged. (Continued)

- $50,000 (anticipated) from the Baptist General Convention of Virginia Disaster Relief Services to support development of a chainsaw simulator to help prevent medical injuries to relief workers providing support after natural disasters. Please refer to Tab #4 for additional information.

- $3.754 million from federal grants, private foundations and other private sources to support the work of O. John Semmes, Ph.D., on modeling the early detection of cancer using clinical proteomic techniques for diseases including Adult T-cell leukemia.

3) Collaborative efforts in support of private industry.
EVMS and ODU faculty and staff have jointly worked to secure a licensing agreement with Cardionics, Inc., of Webster, TX, to commercialize the Virtual Pathology Stethoscope (VPS) based on technology developed by EVMS and ODU and protected by two patents pending. Please refer to Tab #5 for additional information.

EVMS and ODU faculty and staff have jointly worked with MYMIC, LLC, of Portsmouth, VA, and Professional Software Engineering, Inc. (PROSOFT), of Virginia Beach, to develop the Medical Track of the MODSIM World 2007 Conference and Exposition held in September 2007 in Virginia Beach, which drew 600 conference attendees, an outstanding number for an inaugural conference. Please refer to Tab #6 for additional information.

EVMS and ODU faculty and staff have worked to prepare a joint agreement with Sentara Healthcare to develop modeling and simulation technology for medical applications in the Labor and Delivery environment.

EVMS and ODU faculty and staff are concluding an agreement to obtain partnership funding in the amount of $50,000 from the Southern Baptist Convention of Virginia to build a Simulator for Chainsaw Operation Safety Training. Please refer to Tab #4 for additional information.

3) Collaborative efforts in support of private industry. (Continued)

EVMS has entered into a Master Marketing Agreement with Science Applications International Corporation, of San Diego, CA, to seek funding for continued research, development, and maturation of known science and technology to discover radiation exposure biomarkers to enable more accurate modeling of human exposure to radiation that will further EVMS as an institution and SAIC as a business.

EVMS has partnered with the American College of Surgeons, a private, professional organization, to develop the "Medical Modeling and Simulation Database" and an associated website to serve as international resources to further collaboration in the medical modeling and simulation field. Please refer to Tab #7 for additional information.

4) The number of junior and senior faculty recruited in each field.

At Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC), VIMSIM funds facilitated the recruitment of five (5) new faculty members for medical modeling and simulation related research and the reallocation of research effort of six additional current faculty members to focus on medical modeling and simulation research.

One new ODU faculty member, Stacie I. Ringleb, Ph.D., Research Assistant Professor in Modeling and Simulation, is a biomedical engineer specializing in biomechanics recruited from the Mayo Clinic to focus on medical modeling and simulation research at VMASC. A new Endowed Professor of Physical Therapy and Director of the Physical Therapy Program at ODU, Steven Morrison, Ph.D., was recruited from Griffith University in Queensland, Australia to work on medical modeling and simulation and related projects. Poornima Madhavan, Ph.D., Assistant Professor of Psychology, was recruited from the Dynamic Decision Making Laboratory at Carnegie Mellon University in Pittsburgh. Dr. Madhavan's research is dedicated to the study of human decision making in simulated environments including the areas of medicine and healthcare. Gianluca De Leo, Ph.D., Assistant Professor of Medical Laboratory and Radiation Sciences, was recruited from the Department of Chemistry at Washington University in St. Louis. Dr. De Leo is a biomedical engineer and has research interests in biomedical informatics and the use of virtual reality in medicine. Holly D. Gaff, Ph.D., Assistant Professor of Community and Environmental Health, was recruited to ODU from the University of Maryland School of Medicine's Department of Epidemiology and Preventive Medicine. Dr. Gaff's research utilizes mathematical models to determine how fast diseases are spread throughout a community.

Six (6) current faculty members affiliated with the Virginia Modeling, Analysis and Simulation Center (VMASC) at ODU reallocated their research efforts to perform research related to medical modeling and simulation. These faculty are as follows: Mark W. Scerbo, Ph.D., Professor of Psychology; Lee A. Belfore, II, Ph.D., Associate Professor of Electrical and Computer Engineering; Frederick D. McKenzie, Ph.D., Associate Professor of Electrical and Computer Engineering; Yuzhong Shen, Ph.D., Assistant Professor of Electrical and Computer Engineering;

4) The number of junior and senior faculty recruited in each field. (Continued)

James P. Bliss, Ph.D., Associate Professor of Psychology, and Jessica R. Crouch, Ph.D., Assistant Professor of Computer Science.

Among the ODU VMASC staff included in the VIMSIM Initiative are Hector M. Garcia, M.Arch., and Jennifer A. Seevinck, M.A.E.A., who serve as Project Scientists for medical modeling and simulation.

At EVMS, VIMSIM funds facilitated the reallocation of effort of eleven faculty and several staff members to focus on medical modeling and simulation.

The eleven (11) EVMS faculty included in the VIMSIM Initiative are Thomas W. Hubbard, M.D., M.P.H., J.D., Professor of Clinical Pediatrics; Richard R. Drake, Ph.D., Professor of Microbiology and Molecular Cell Biology; O. John Semmes, Ph.D., Professor of Microbiology and Molecular Cell Biology; Leonard J. Weireter, Jr., M.D., Professor of Surgery; C. Donald Combs, Ph.D., Professor of Health Professions and Associate Dean for Planning and Health Professions; Gayatri Kapur, M.D., Assistant Professor of Obstetrics and Gynecology; Stephen S. Davis, M.D., Assistant Professor of Obstetrics and Gynecology; Adair R. Heyl, Ph.D., Assistant Professor of Obstetrics and Gynecology; John A. Ullian, Ph.D., Associate Professor of Family and Community Medicine; Gavin W. Welch, Ph.D., Assistant Professor of Health Professions and Richard A. Britten, Ph.D., Associate Professor of Radiation Oncology and Biophysics.

Among the EVMS staff members included in the VIMSIM Initiative are Gayle A. Gliva-McConvey, Director of the Theresa A. Thomas Professional Skills Teaching and Assessment Center, Robert J. Alpino who serves as a part-time grant writer, Richard L. DiPeppe who is responsible for the Medical Modeling and Simulation Database, and research support staff including Meenal K. Walia, who serves as a research assistant.

5) The amount of federal or other grant funds received as the result of those recruitments.
$274,012 of the total of $6,793,759 in federal and grant funds generated in fiscal year 2007 were received as a result of the new faculty recruitments funded by the VIMSIM medical modeling and simulation research capacity funding. The balance of the funds were attributable to the reallocation of current faculty effort to medical modeling and simulation research.

6) Additional grants or contracts being pursued.
Among the additional grants or contracts being pursued by medical modeling and simulation researchers funded by VIMSIM funding are the following:

- Department of Defense (DoD) Congressionally Directed Prostate Cancer Research Program
- National Institutes of Health (NIH) National Institute of Biomedical Imaging and Bioengineering (NIBIB), Small Business Innovation Research (SBIR) funding and NIH National Institute for Arthritis and Musculoskeletal and Skin Diseases (NIAMS) funding
- National Science Foundation International Education and Research Grant
- National Board of Medical Examiners Stemmler Medical Education Research Fund Phase II Funding
- Haptics Fidelity Evaluation Funding from SimQuest, Inc.
- Funding from the University of Wisconsin for the Virtual Standardized Patient Program

7) The level of instructional activity conducted by these faculty.
Of the five (5) new VMASC affiliated faculty members with a medical focus, two (2) were employed in the 2006-07 academic year with the remaining three (3) beginning their duties in the 2007-08 academic year. Each of these two faculty members taught one class in their home department and will teach one class in the medical modeling and simulation program in the 2007-08 academic year.

The one (1) research faculty member hired at VMASC to focus on medical modeling and simulation (Stacie I. Ringleb, Ph.D., recruited from the Mayo Clinic) taught the course MSIM 695 Special Topics in Modeling and Simulation: Modeling in Musculoskeletal Biomechanics, in Spring 2007.

C. Donald Combs, Ph.D., from EVMS and Frederick D. McKenzie, Ph.D., from ODU jointly developed the new course Electrical and Computer Engineering (ECE) 495/595/695 "Topics in Medical Imaging and Simulation" and have jointly taught the course during the summers of 2006 and 2007. Thomas W. Hubbard, M.D., M.P.H., J.D., Professor of Clinical Pediatrics at EVMS, also participated in the course as a guest lecturer on standardized (simulated) patients.

C. Donald Combs, Ph.D., presented "The Emerging Importance of Using Medical Simulation in Resident Education" as part of the EVMS Faculty Development Grand Rounds "Improving Your Teaching" series on April 19, 2007. The presentation was simulcast over the Eastern Virginia Telemedicine Network to the Veterans Affairs Medical Center in Hampton, VA as well as to other EVTN network sites.

7) The level of instructional activity conducted by these faculty. (Continued)

In addition to the direct instructional activity listed above, Dr. Combs and the other faculty supported by the VIMSIM initiative published numerous scholarly papers during the year and conducted presentations at key conferences in the field such as the Medicine Meets Virtual Reality conference, the Society for Simulation in Healthcare conference and the IPSI conferences. A select list of faculty scholarly activities in medical modeling and simulation has been attached behind Tab #8.

8) The impact of research activities on undergraduate instruction.
One ODU undergraduate student and one undergraduate from Spelman College are working on medical modeling and simulation research through the ODU Department of Psychology.

9) The use of graduate student aid funds.
Three ODU doctoral level graduate students (Emre Baydogan (Electrical and Computer Engineering), Saurav Mazumdar (Electrical and Computer Engineering) and Amber T. Nalu (Psychology) were supported in the Spring 2007 and Summer 2007 semesters for medical modeling and simulation research projects with the graduate student funds along with four master's level students (Brittany L. Anderson (Psychology), Taryn T. Cuper (Modeling and Simulation), Elizabeth Newlin (Psychology) and Gina Yan (Electrical and Computer Engineering) throughout the year. Three EVMS Master of Public Health students (Renee Scott Walker, Tony Barkey and Bettina Velena) were employed as Research Assistants in medical modeling and simulation research with the funds. Three doctoral students (Hope A. Hanner-Bailey (Psychology), Melissa L. Mannion (Medicine) and Elizabeth A. Schmidt (Psychology)) were supported by EVMS funds.

10) Recommendations for future investment.
We have identified four core areas of medical modeling and simulation activities being conducted in the Hampton Roads area: 1) modeling and simulation for education and training to improve patient safety and the quality of healthcare, 2) modeling and simulation for treatment, 3) modeling and simulation for disease modeling, and, 4) modeling and simulation for hospital management and homeland security issues involving health care. The current funding is supporting the use of modeling and simulation for education and training. We would like to see additional funds invested to support the other three areas of medical modeling and simulation, which will be addressed in a separate budget request through ODU. In line with these investments, funds should be identified to help generate pilot data to generate additional funding, to increase our number of research support staff, including both technical support staff (2-3 per area) as well as a dedicated grant writer to help with preparation of research proposals.

On the training side, we would like to see an investment of funds in high-tech medical simulator systems that can be integrated into our virtual environments. The investment should include any resources necessary to allow researchers to gain effective access to simulator proprietary interfaces and data formats. Please refer to the Virtual Operating Room information provided behind Tab #9.

10) Recommendations for future investment. (Continued)

The final area of future investment is to invest in additional medical course development.

In the area of capital investment, the MERIT (Medical Education and Research in Translation) Project at EVMS supports the mission and strategic direction of the medical school in a variety of ways, one of which is medical modeling and simulation. MERIT will substantially expand and improve the space available for the education and research programs at EVMS. Specifically, MERIT involves the construction of a new, 105,000 square foot building at EVMS that will house the biomedical research programs in a state-of-the-art facility and consolidates the educational support programs onto the main campus. A major component of MERIT will be the development of a regional state-of-the-art medical modeling and simulation training center that will be utilized by first responders through medical residents and fellows for hands-on medical modeling and simulation training. Please refer to information on the potential economic impact of modeling and simulation located behind Tab #10.

About EVMS

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Map of Eastern Virginia Medical Center PDF

Driving Directions

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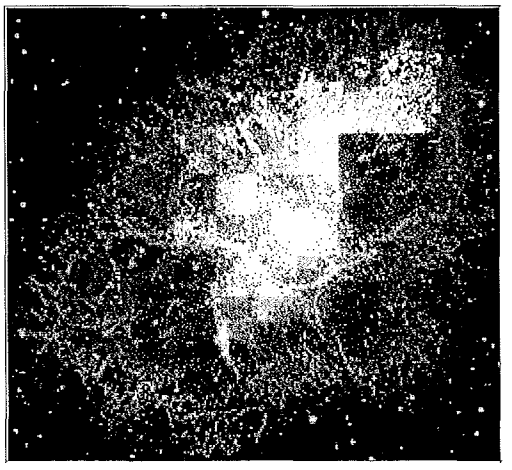
Mars Mission Risk 29: Scientists Research Ways to Reduce Radiation-Induced Brain Damage

Research could lead to new treatments for conditions like Alzheimer's disease

September 27, 2006

NORFOLK—Among the gravest risks of a manned flight to Mars ranks the possibility that massive amounts of solar and cosmic radiation will decimate the brains of astronauts, leaving them in a vegetative state, if they survive at all.



Supernova explosions like this one accelerate atomic nuclei to nearly light speed. The resulting "cosmic rays" pose a potential hazard to astronauts. *Photo courtesy Science@NASA*.

Dubbed "Risk 29" by NASA's Mars scientists, the cosmic radiation risk remains a show-stopper because shielding a spacecraft from all radiation could make it too heavy to reach Mars, which, at its closest, is 38 million miles from Earth.

Now, medical scientists at EVMS have been tasked with determining the human brain's maximum safe cosmic radiation dose and to decipher precisely how radiation causes cognitive impairment — part of a quest for biological countermeasures to reduce radiation-related cognitive impairment.

The NASA-funded $1.2 million research project could not only help eliminate the risks to astronauts, but it could unravel the biomechanics of brain damage, potentially benefiting patients with degenerative neurological conditions like Alzheimer's disease.

"This research may not only help make it safer to go to Mars, it could lead us to a deeper understanding of how the brain functions," said principal investigator Richard A. Britten, Ph.D.,

associate professor of radiation oncology and biophysics. "That eventually could help patients dealing with conditions that cause dementia."

The idea of a manned mission to Mars has captured the imagination for decades. But flying to Mars, even without humans aboard, is a monumentally risky feat. Since 1998, the United States has completed seven Mars missions. Four of those failed when the Mars landers were lost on arrival.

As part of a new push to put a man on Mars, NASA has sketched out a roadmap laying out 45 risks to astronauts on a two-year space mission. Risk 29 addresses the fact that Mars astronauts will be bombarded by high-energy cosmic radiation — shielded on Earth by the atmosphere and the Van Allen Radiation Belts — that few medical scientists have studied.

"These are very obscure kinds of radiation that on Earth we would only see in the event of a nuclear disaster," said Britten.

While many assume that open space between planets is empty, it's not, Britten notes. The dark realm between planets teems with cosmic particles generated by solar flares, supernovas and astronomical cataclysms dating to the Big Bang, particles that can pass through metal and human tissues, often with enough energy to shred DNA.
To make matters more complex, one possible trajectory involves flying around Venus and using its gravitational pull to sling the spacecraft toward Mars. That means flying closer to the sun, the source of powerful solar radiation.

"The sun is basically a big nuclear reactor," Britten said.

The scientists hope to determine how much shielding the spacecrafts and astronauts will need, and also develop other countermeasures that help to reduce radiation-induced brain damage.

The EVMS team consists of Britten; Larry Sanford, Ph.D., professor of pathology and anatomy; Gyorgy Lonart, Ph.D., associate professor of pathology and anatomy; Sylvia J. Singletary, D.V.M., department of physiological sciences; and Richard R. Drake, Ph.D., associate professor of microbiology and molecular cell biology.

To help determine the brain's maximum acceptable dose of solar and cosmic radiation, Britten's team must replicate the type of radiation astronauts will be exposed to in deep space. They then must calculate how much damage is caused by particles with various energy levels.

"There are only a handful of laboratories in the world where these kinds of high-energy particles can be produced," Britten

said. His team will work closely with scientists at Brookhaven National Laboratory in New York.

As part of his $1.2-million segment of the study, the EVMS team will measure physical and behavioral changes in rats exposed to various levels of the type of radiation that Mars astronauts will encounter in space. They will also conduct proteomic analysis of portions of the irradiated brains to obtain more precise details about the biochemical changes.

To date, many scientists have suggested that reduced cognitive impairment results solely from the death of the brain's neurons. Britten believes other, more complex mechanisms are at work, processes that could be manipulated by NASA's medical staff.

In a very rudimentary sense, the brain can be likened to photo paper. Chemicals allow the photo paper to "fix" the images – in this case, the "images" can be visual, aural, tactile, sonic, emotional or intellectual, often connected. If the chemical stew gets out of whack, the images, dubbed engrams, don't stick or become cloudy and indistinct.

"Once we understand what's not working, then maybe we can fix it," said Britten.

Because radiation damage is similar to the free-radical injury resulting from aging and certain neurological diseases, the research could lead to better treatments for conditions like Alzheimer's disease that cause progressive dementia.

Top

For more information, contact:

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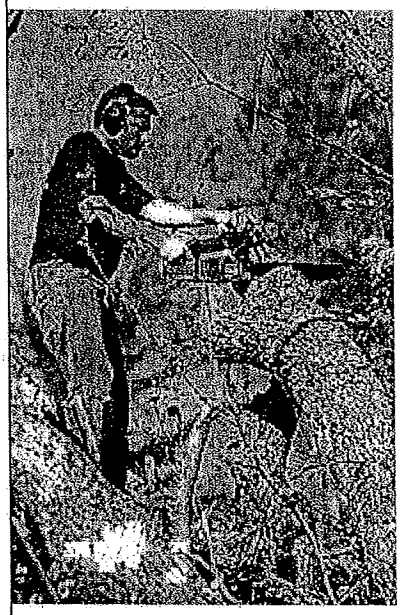
(757) 446-6070 - gardneda@evms.edu

Simulator for chainsaw safety training

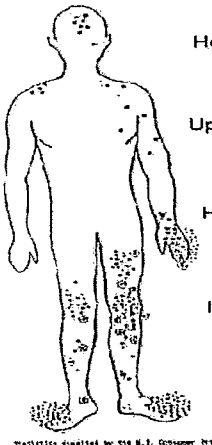


"A chain saw is the most dangerous hand tool that can be purchased on the open market. It requires no license and no training to own or operate. Approximately 40,000 injuries and deaths were reported last year in the United States ... and most could have been prevented." Carl Smith, US Forest Service safety trainer

Injuries

@ 14,000 rpm, each cutter passes 20 times per second. The chain is running @ approx 65mph.

Accident Location and Frequency Related to Chain Saw Use In 1999



Head area - 2,686

Upper body - 2,452

Hand area - 10,200

Upper leg, knee, lower leg - 10,310

Foot area - 1,872

Total - 28,543

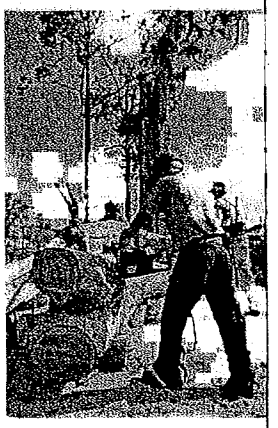
The Need:
A training simulator to teach safe chainsaw use in the felling and bucking of trees

Magnitude:

~3,000,000 chainsaw sales per year

8,000 authorized Stihl distributors in the United States

Sales in 10,000s of hardware, home improvement, and lawn and garden centers



OSHA & PPE

- *As soon as anyone, company, or person fells a tree from the ground, they fall under the OSHA regulations for logging.*

Standard number 1910.266 logging operations.

- *If a company or* ***agency*** *does not fell the tree, but is operating a chain saw, they fall under the*

OSHA 29 CFR 1910.132

General Industry Regulations which include:

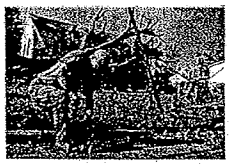
- **Leg Protection; 29 CFR 1910.133**
- **Eye & Face Protection; 29 CFR 1910.135**
- **Head Protection; 29 CFR 1910.135**
- **Foot Protection; 29 CFR 1910.136**
- **Hearing Protection; 29 CFR 1910.95**

Simulator Components

- Saw replica
  - Weight
  - Vibration
  - Balance
- Shoes, gloves and chaps
  - Sensors for grip, posture, and position
- Helmet
  - Virtual reality visor for training images
  - Ear muffs provide saw and cutting sounds

Learning functions

- Worksite evaluation
- Saw starting
- Saw operating speed
- Felling
  - open face cut
  - back cut
  - escape route
- Bucking
  - overcut
  - undercut
  - pinch avoidance
  - kickback avoidance
  - roll avoidance
  - tension release



Possible Funding

- US Dept of Homeland Security
  - Research and Technology Directorate
    - Portfolio - Emergency Preparedness and Response
      - Homeland Security Impact - Training and education for the responder community
- USDA Forest Service
  - Research and Development
    - Vegetation Management and Protection Research
      - Fire Systems Research and Development
      - Forest Operations

Possible Partners

- Industry
  - Trade organization
    - Outdoor Power Equipment Institute (OPEI)
  - Manufacturers
    - Black & Decker, Echo, Electrolux, GCP Sweden, Husqvarna, John Deere, Makita, MTD, Redmax/Komatsu, Shindaiwa, Solo, Stihl, Tanaka, Techtronic
    - Stihl USA based in Virginia Beach
    - Stihl Professional Instruction Program
      - Mid-Atlantic region - Roanoke Rapids, NC

Virtual Reality Chain Saw Safety Trainer

Mark W. Scerbo Hector M. Garcia Amber Nalu Emre Baydogan
Old Dominion University
mscerbo@odu.edu hgarcia@odu.edu analu@odu.edu ebayd001@lions.odu.edu

Abstract

A virtual reality (VR) system is described for instructing the safe operation of a chain saw. The training system incorporates a didactic session on chain saws and chain saw safety, a quiz to verify content knowledge, and an interactive simulation. The VR system incorporates visual, auditory, and haptic displays to reproduce the sights, sounds, and feel of a chain saw. Trainees experience the proper way to cut a log as well as two consequences from improper use: kickback and the log binding the chain. The goal of the VR system is to allow trainees to experience how a chain saw responds under both proper and improper handling techniques without putting them at risk.

BACKGROUND

Training is a necessity in many industries where potentially dangerous scenarios are encountered (e.g., construction, manufacturing, HAZMAT operations, etc.). Workers in these industries must familiarize themselves with hazardous conditions, materials, and procedures as well as learn how to protect themselves and others around them. Training for these jobs is complicated because the goal is to instruct individuals how to perform in hazardous situations while minimizing their exposure to risk. This unique set of competing goals has been addressed by human factors professionals in many other disciplines including aviation, military operations, and nuclear power plant operations.

Human Factors and Safety

Human factors is a discipline concerned with understanding human limits and capabilities and designing equipment and systems that exploit human strengths and support humans where they have limitations. The goals of human factors are to increase efficiency, ease of use, and safety and reduce errors, fatigue, stress, as well as training requirements.

Human factors experts have made significant contributions to the design and safety of thousands of commercial products, many of which are inherently dangerous, because of their extensive knowledge of how humans behave. It is well known that human behavior is variable and not always predictable. Humans make errors and have accidents. Employers and investigators often attempt to analyze how accidents happen in order to prevent similar occurrences in the future. The reality of errors in the workplace, however, is that human error underlies most accidents (Sanders & McCormick, 1993).

Human factors experts have attempted to reduce errors and increase safety through three primary strategies: communication, equipment design, and training.

Communication efforts are typically aimed at designing warnings. A well-designed warning has four objectives: 1) to inform users of the potential danger, 2) to provide information regarding the likelihood and severity of injury, 3) to inform users how to reduce the possibility or severity of injury, and 4) to remind users of the potential danger at the time and place where the danger is most likely to occur

(Sanders & McCormick, 1993). All power tools, including chain saws, are sold to consumers packaged with extensive warning information contained within the user manual and on the tool itself.

Unfortunately, numerous investigations and accident reports indicate that users rarely read and comply with warnings (Wogalter, 2006). There are many reasons why warnings are not heeded. To be effective, warnings must be written in language that is easy to understand, conspicuous, and available/accessible at the very moment that they are needed. Even when all of these conditions are met, not all users comply with the warnings. Research shows that a user's perception of risk is a strong indicator of compliance. Specifically, when users believe they are not likely to be harmed, they tend to ignore warning information and safety protocols (Sanders & McCormick, 1993).

Given that warnings have limited utility, designers have gone to great lengths to improve the safety of products. There are three approaches that can be used to minimize potential harm (Sanders & McCormick, 1993). The first strategy is to exclude the possibility of harm (i.e., design the tool so that it is impossible to injure the user). Unfortunately, exclusionary designs are difficult to achieve and rarely practical. The second approach is to minimize the possibility of injury. For example the chain guard and brake on a chain saw reduce, but do not completely eliminate, the possibility of injury. The third strategy is to create fail-safe designs. These designs do not reduce the probability of errors, but help to minimize the severity of injury. For example, an emergency power-off switch may not prevent an injury, but can limit the severity of the injury.

Given that chain saws are inherently dangerous power tools that already incorporate many warning systems and design features aimed at minimizing risk and severity of injury, it is necessary to consider training as third approach to improving safety.

Virtual Reality Training Systems

Virtual reality (VR) systems offer a unique environment for instructing users how to perform in dangerous circumstances. VR systems have been developed for numerous training applications including aviation, weapons operations, telerobotic applications, and surgical procedures (Stanney, 2002).

There are several advantages to training with VR systems. First, VR systems enable problem-solving and execution of appropriate actions in a setting conducive for engaged, active learning. This differs from a typical classroom setting by involving the individual both cognitively and physically. Second, VR systems foster the combination of semantic knowledge with knowledge of procedural activities. Last, VR systems allow trainees to interact with interface devices in a more natural way. Thus, the procedures and interactions are more like operating genuine equipment than interacting with a computer interface.

Recently, Scerbo, Bliss, Schmidt, Hanner-Bailey, and Weireter (2005) used a VR environment to examine the performance of surgical skills under simulated combat conditions. In their study, medical students were instructed to perform an emergency procedure (a tube thoracostomy) using a mannequin-based simulator. Afterward, the students performed the procedure in a fully immersive virtual environment depicting a small town under fire. The participants had to take cover behind a barricade to avoid being shot by a virtual sniper. The results showed that the participants performed the procedures quickly, but did so by sacrificing quality. More important, there were many instances in which participants were shot and "killed" before they could complete the procedure. Thus, these findings show that virtual environments can be valuable for training because they provide a safe environment for studying performance under simulated hazardous conditions.

Another important element of VR systems concerns performance measures. Most training systems provide a means to capture and analyze user performance that is not easy to replicate with genuine equipment. Consequently, these training systems facilitate data collection and provide objective records of skill acquisition (Stedmon, 2001).

Further, VR training systems can be targeted to novices as well as experts. Novices can benefit from learning fundamental aspects of tasks while experts can practice difficult maneuvers or train for rare events.

By providing a training environment in which the users can focus on the actions that they should take, they are better able to actively problem solve and protect themselves. Training in a virtual environment parallels real-life experiences and that kind of experience-based training leads to improved retention and skills that are less susceptible to stressful conditions (Wickens, 2000). VR systems thus provide an effective training method. Most important, they allow users to learn safe behaviors with dangerous equipment without being subjected to genuine hazards.

Chain Saw Dangers

The U.S. Forest Service relies on volunteers to clear and maintain the trails throughout wooded areas. (TEHCC, 2005) Chain saws are often used in these efforts to remove branches and trees that have overgrown or interrupted walking and biking paths for visitors/campers. Injuries can occur when those using a chain saw are not properly trained. Knowing the dangers and safety regulations when using a chain saw are critical for protecting professionals and volunteers alike. The need for better training concepts and devices is necessary to reduce the incidents of injuries. Figure 1 depicts the overwhelming number of injuries incurred for logging versus any other forestry occupation.

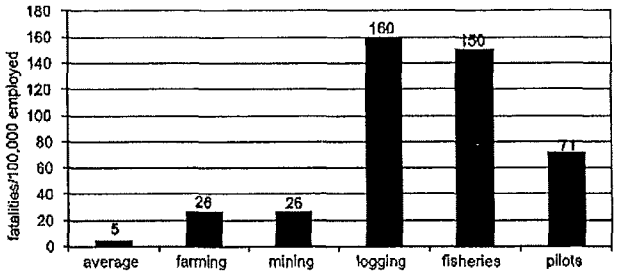


Figure 1. Fatal occupational injuries by selected occupation, USA, 1998-1999 (Enters, 2002)

Chain saws are not only dangerous, but potentially fatal. One way to describe the dangers involved with chain saw use is tied to the areas of the body that are most likely to be injured (see Table 1). While most injuries occur to the lower left leg and arm, leg injuries follow closely with over 16 thousand incidents in one year (OSHA, 1994).

Safety Regulations

Safety issues when operating a chain saw are a key concern. Employers must, at a minimum, abide by federal agency regulations; though they are allowed to adopt further restrictions if necessary. Several manuals and handbooks are available for safety information pertaining to chain saw usage. The Code of Federal Regulations (CFR), the Forest Service Manual and Manual Supplements, and the Forest Service Health and Safety Code Handbook are a few examples (TEHCC, 2005). The minimum federal safety

regulations are published by the Occupational Safety and Health Administration (OSHA) and utilized as a foundation for employers nationwide. An overview of chain saw safety issues include: the dangers of chain saws, parts of a chain saw, safe operation, and personal protective equipment, (OSHA, 1994).

Table 1
Areas of the Body Most Likely to be Injured (OSHA, 1994)

Body Location	Number of Injuries
Head	3,418
Upper Body	2,141
Arm/Hand	17,994
Leg	16,348
Foot	2,885

Safety issues address personal protective equipment consisting of head protection, hearing protection, eye/face protection, leg protection, foot protection, and hand protection. It is important to sufficiently cover all potentially affected areas of the body because of the damage/injury often incurred during chain saw accidents.

Understanding the components of a chain saw facilitates operation of the tool as well as safe practices. For example, the anti-vibration handle system is designed to limit ergonomic stress to the user's joints. The chain brake is necessary for stopping the chain if kickback occurs. A list of safe practices should also be understood and followed before starting the chain saw as well as during operation of the tool. For example, the operator should check the chain saw controls and chain tension to ensure proper functioning before starting. While the chain saw is running, the area should be clear of all interfering objects. The user should also refrain from cutting directly overhead. Even with proper safety information, a link must be made between the knowledge one has acquired and actual operation of the chain saw.

The Virtual Reality Chain Saw Trainer

The present paper describes a virtual chain saw system that will enable operators to experience the sensations of cutting with this power tool prior to operating an actual chain saw and exposing the trainee to genuine safety risks. Old Dominion University has developed a VR chain saw safety training system to assist in training chain saw operators. The system provides a comprehensive training solution including a web-based tutorial addressing chain saws and safety and a simulator that highlights key training objectives.

Trainees begin by reading background information on chain saws, safety issues surrounding chain saws, and best practices. Next, they are required to take and pass a quiz on the background material. Upon passing the quiz, they are then instructed how to use the VR chain saw simulator.

The present system addresses two key learning objectives. The first objective, concerns fulcrum points and the choice of where to make a cut in a log. In one scenario, the log is propped up on a pivot point near one end so that most of its weight lies to one side of the pivot point. Thus, a cut made to the opposite side of the pivot point results in a smaller piece of the log easily separating and falling from the larger piece. In a different scenario, the log to be cut is resting on two pivot points near each end. The terrain is open with a hole in the ground placed in the center of the log. The participant can cut the log from beneath before cutting the log on top to prevent binding the blade of the saw. However, if the user makes a cut in

the middle of the log without first making a bottom cut, the weight of each piece will collapse near the center and the trainee will experience the sensation of having saw become trapped within the log.

The second learning objective addresses kickback. In this scenario, when the trainee attempts to place the bar nose of the saw against the log, he/she will experience the sudden back and upward motion of the saw.

Architecture

The chain saw simulator is constructed from several software hardware components. Two important components are the visualization software; Virtools and haptic feedback device; Phantom (Sensable, Inc.). Virtools provide a centralized environment to visualize the simulator (see Figure 1). The modeled objects, such as the chain saw and the log are rendered by Virtools. On the other hand, Phantom device, which is a haptic robotic arm, enables us to simulate the force feedback properties of a chain saw in virtual computer space. This is achieved by position and orientation tracking of the Phantom and creating the forces that simulate tactile feedback of the chain saw.

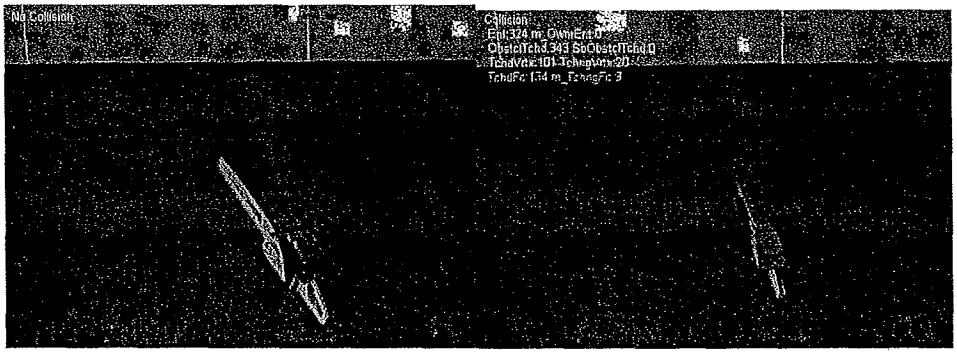


Figure 1. Two views of the virtual chain saw. Orienting the saw (on left) and cutting (on right).

The communication between the Phantom and the Virtools environment is handled by a custom building block (BB) that is specifically implemented for Virtools. The BB, is coded using Visual C++, is using both Virtools SDK and HDAPI (Haptic Device API). Thus, the custom BB can access to visualization environment and the Phantom device functions. The BB is also responsible for simulation flow and haptic calculations. Haptic calculations include collision detection, collision handling, and calculation of vibration and acting forces. In collision detection, the initial contact between the chain saw and the log is handled by the Virtools Collision manager. Since, it is not possible to use Virtools Collision Detection in every haptic frame, which is much frequent than Virtools' render frame, a simplified collision detection mechanism is implemented for post Virtools collision detection.

The chain saw VR safety trainer allows the user to note correct and incorrect chain saw positioning. The visual representation in present system reproduces movement in all three-dimensional positions (the x, y, and z axis). In terms of rotation, the user may control the pitch (rotation about the x axis); roll (rotation about the z axis) and yaw (rotation about the y axis). The haptic system, however, is limited to 3 degrees of freedom in the translational components of the x, y and z axes. Thus, the present system cannot faithfully reproduce the force feedback associated with cutting through a log and pinching.

The haptics system also reproduces chain saw vibration. The user is able to control the minimum and maximum vibration frequency, which includes the chain saw in idle mode and in full throttle mode. The duration of the chain saw vibration between idle and full throttle is about 600 milliseconds. Every 10

milliseconds, the frequency is increased by 5 Hertz. The idle frequency of the chain saw vibration is 200 Hertz and the full throttle frequency is 500 Hertz.

When the virtual chain is idling and positioned to rest on the log, the chain saw will not cut through the trunk. This feature has been implemented by constantly reading the state of the chain saw (idle or full throttle) at all times. The chain saw will only begin cutting if full throttle is applied.

CONCLUSION

VR systems provide users with training opportunities that more closely match the actual environment in which they must perform. One of the primary advantages of VR training is its applicability to hazardous contexts. Users can train in hazardous environments or with dangerous equipment without the risk of injury.

Chain saws represent one of the most dangerous tools commercially available. Anyone can purchase a chain saw and use it. There are no training requirements and numerous studies on warnings suggest that users may not read the safety information. Thus, the need for a safe, experience-based training system is paramount.

The potential for the VR chain saw training system is limitless. Because the simulated tool and environment are computer generated, all aspects of the training scenarios can be easily modified. Different models of saws can be incorporated. The training can address a single log placed under ideal cutting conditions, challenging conditions including unusual log configurations/orientations, or an entire wooded area in which trainees must make decisions about clearing and cutting all timber present.

A VR training system for chain saw operation was created to address several important needs of both users and instructors. First, there are no formal chain saw safety training systems available to the nonprofessional user. If classroom instruction is available, it may include hands-on training that puts novice users at risk. The VR chain saw safety trainer provides an opportunity for novices to learn how to operate and practice with a simulated chain saw that removes the risk of serious injury. Second, the VR system allows trainees to experience the sights, sounds, and haptic forces of operating a chain saw. As a result, trainees can get a "feel" for operating a chain saw. They can make decisions about where and how to cut timber, execute the cuts, and experience the repercussions of those decisions. Third, the VR chain saw training system shifts the emphasis from passive learning to active, engaged learning. Fourth, the VR chain saw training system can provide the trainee with immediate performance feedback. Data addressing trainee knowledge and skill acquisition and can be recorded and analyzed.

In sum, the VR chain saw training system provides an interactive and engaging, simulated environment for learning proper chain saw operating techniques. It allows trainees to practice experience using a chain saw without risk of injury and can provide an added degree of protection for chain saw users not presently available in any other training regimen.

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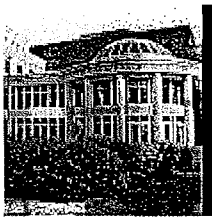

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EVMS/ODU license virtual stethoscope to Texas manufacturer

August 24, 2007

Rick McKenzie, associate professor of electrical and computer engineering at ODU, demonstrates a mock-up of the virtual stethoscope.

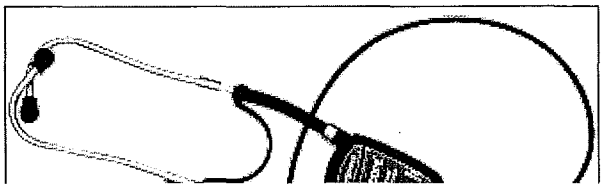
NORFOLK—A Virtual Pathology Stethoscope invented by a team of researchers from Eastern Virginia Medical School (EVMS) and Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC) has been licensed to a Texas-based company, Cardionics Inc., which manufactures medical diagnostic and teaching equipment.

The Virtual Pathology Stethoscope, or VPS, is a training device that can simulate the sounds of a human body's circulatory and respiratory systems. It will be an important addition to the products offered by Cardionics, according to Keith Johnson, president of the company. Cardionics specializes in technologies related to auscultation, which is the art of listening for sounds made by the body's internal organs. Its current products include an E-Scope Electronic Stethoscope and a Pocket Monitor Analysis System that have helped to revolutionize bedside diagnoses.

The invention is the first licensed product to emerge from the National Center for Collaboration in Medical Modeling and Simulation, which is a joint venture of EVMS and Old Dominion University.

Thomas W. Hubbard, M.D., professor of pediatrics and director of the EVMS Office of Professional Development, leads the team of inventors. His top collaborator at VMASC is Frederic McKenzie, an ODU associate professor of electrical and computer engineering.

The VPS is designed to be used in tandem with a standardized patient (SP). Medical schools increasingly train



The Virtual Pathology Stethoscope will look much like this current product of Texas manufacturer Cardionics.

doctors-to-be by using SPs, who are actors skilled at pretending to be sick. Working with SPs, medical students improve their interviewing skills and gain the medical judgment they need to diagnose ailments.

But when a medical student puts a conventional stethoscope to the body of the SP, the typically healthy sounds heard don't match the illness the SP is portraying. The VPS substitutes abnormal sounds for healthy sounds, so that when the student puts the augmented stethoscope to the SP's body, the sounds provide evidence that can support the diagnosis. The sounds the teaching stethoscope plays are recorded from actual patients who have a variety of diseases.

Members of the VPS development team took the device and a veteran EVMS standardized patient, Patrick Walker, to the 4th annual Advanced Initiatives in Medical Simulations (AIMS) Conference and Congressional Exhibition in May in Washington, D.C. The invention drew the attention of numerous conference goers, including Virginia 4th District Rep. Randy Forbes and Rep. Patrick Kennedy of Rhode Island, the son of Massachusetts Sen. Edward Kennedy and a champion of health care issues in Congress.

Both Kennedy and Forbes took time to test the stethoscope on Walker. When they listened at his neck, they heard the whooshing sound of plaque-restricted blood flow through the carotid artery. When they listened to his chest, they heard crackling sounds in the lungs, a sign of pneumonia or congestive heart failure.

ODU and EVMS joined forces in 2001 to form the National Center for Collaboration in Medical Modeling and Simulation, which has attracted funding from several sources across the nation, including the Stemmler Medical Research Fund of the National Board of Medicine, as well as national media attention.

"The VPS is one example of the potential of medical simulation to improve the training of medical and health professionals and, ultimately, to improve patient safety," said C. Donald Combs, Ph.D., who leads the medical modeling initiative at EVMS. Combs and Mark Scerbo, professor of human factors psychology at ODU, are co-directors of the National Center for Collaboration in Medical Modeling and Simulation.

An article late last year in *Mechanical Engineering* magazine focused on one of the products of the collaboration — a virtual operating room. This immensely complicated system, which can be used to train surgeons and other operating room personnel, utilizes ODU's Cave Automatic Virtual Environment (CAVE). Combs said these simulations and others under development are the early returns on the investments that the federal and state governments have made in the region's effort to expand simulation research and development beyond the military market into areas such as medical modeling and emergency response.

A primary mission of VMASC is to create modeling, simulation and visualization applications that are practical enough for commercial development. When representatives from the EVMS Theresa A. Thomas Center Professionals Skills Teaching and Assessment Center sought a way to enhance student training with SPs, they asked VMASC to create the VPS.

McKenzie, the VMASC researcher, said the team's original VPS is very high-tech, but too expensive for broad use. This first system is called "tracked VPS" because it includes a sensing component that tracks on the body where the stethoscope's head is placed so the appropriate sound recording can be cued. The team has a patent pending for the "tracked VPS," but then moved on to improve the system's practicality.

The more economical version, which is the one licensed to Cardionics, is "SP-triggered VPS," for which another patent is pending. This is the system that was demonstrated at the AIMS conference, and for it the SP uses hidden controls to track the stethoscope's head and to tell the system what sounds should be played. The second system is more economical because it does not have the automatic tracking component.

Preliminary tests with EVMS students have been promising. One series of tests reported in a paper written by McKenzie, Hubbard and other colleagues showed that the augmented standardized patient system is "a reliable and valid assessment tool."

The project team also includes John Ullian, Gayle Gliva-McConvey and Robert Alpino of EVMS, and Hector Garcia, Reynel Castelino and Bo Sun from ODU/VMASC.

Top

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Tuesday, September 11
Registration: 7:00am - 10:00am
8:30am - 10:00am Welcome & Plenary Session: Speaker - Gary Klein
8:30am - 6:30pm Exhibit Hall Open

Wednesday, September 12
7:15am - 8:15am Congressional brief & Q&A - Congressman Forbes
12:30pm - 1:15pm Lunch Speaker - Christopher Dede
6:00pm - 8:00pm Banquet & Awards Ceremony: Speaker - Douglas Dempster
8:30am - 6:00pm Exhibit Hall Open

Thursday, September 13
8:30am - 12:00pm Exhibit Hall Open
12:00pm Conference Adjurns

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Editor: Corie Forrest
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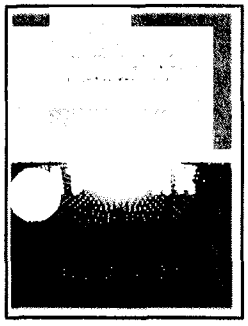
KEYNOTE SPEAKERS

Keynote Speaker
Plenary Session
Tuesday 8:30-10:00am

Gary Klein

Gary Klein, Ph.D., is Chief Scientist of Klein Associates Inc., a company he founded in 1978 to better understand how to improve decision making in individuals and teams. The company has 30 employees working on projects for both government and commercial clients. Dr. Klein is one of the founders of the field of naturalistic decision-making. His work on recognitional decision-making has been influential for the design of new systems and interfaces, and for the development of decision training programs. He has extended his work on decision-making to describe problem detection, option generation, sense making, and planning.



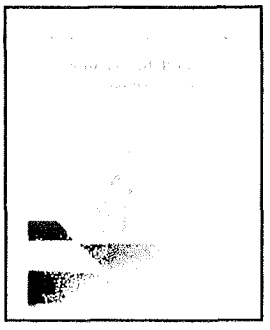
Gary Klein's journey began over 20 years ago when he began to carve a new path in the study of human decision-making. Dr. Klein and other researchers created Naturalistic Decision- Making, a paradigm that examines the interplay of context and cognition together. Sources of Power, a chronicle of Klein's work, is a rich information source that explores Naturalistic Decision Making in depth and illuminates the power of experience, a power that shapes how we interact with the world around us.

In over two decades of research, Gary Klein has found that the most critical decisions we make are based on intuition. Although sometimes difficult to explain, intuition is important in making decisions and is based on the ability to recognize patterns and interpret cues, i.e., it develops through experience. In Klein's new book Intuition at Work, specific practical steps are offered to improve your intuition to help you perform your job more confidently and successfully.

In order to perform research on decision-making in field settings, Dr. Klein and his colleagues have developed new methods of Cognitive Task Analysis. Klein Associates has used Cognitive Task Analysis methods to study decision making in more than 60 domains, including firefighting, command and control, software troubleshooting, healthcare, and consumer purchasing. Dr. Klein has presented workshops on Cognitive Task Analysis to more than 300 professionals in the U.S. and abroad, and has presented seminars on naturalistic decision making to a wide variety of groups such as the Smithsonian Associates program.

Cognitive Task Analysis

Klein will help you understand the decision strategies people actually use so that you can put the findings into action using Cognitive Task Analysis (CTA).



In order to understand how people act upon the world around them, it is necessary to understand what goes on inside their heads. Particularly when the tasks they are doing are complex, it is not enough to simply observe their behaviors. It is also important to find out how they think and what they know, how they organize and structure information, and what they seek to understand better. Cognitive Task Analysis (CTA) is a family of methods and tools for gaining access to the mental processes that organize and give meaning to observable behavior. CTA methods describe the cognitive processes that underlie performance of tasks and the cognitive skills needed to respond adeptly to complex situations.

CT n boost human performance by guiding the development of tools and programs that support the cogn itive processes required for a task. The results of CTA studies have been successfully applied to areas such as instruction and training, system development, human-computer interface design, organizational design, product design, and marketing. CTA typically consists of distinct phases of knowledge elicitation, analysis, and knowledge representation.

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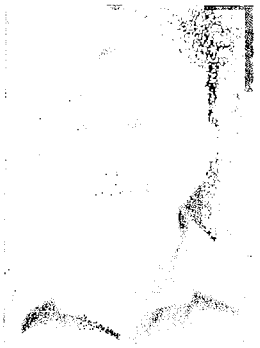

Chris Dede's fundamental interest is the expanded human capabilities for knowledge creation, sharing, and mastery that emerging technologies enable. His teaching models the use of information technology to distribute and orchestrate learning across space, time, and multiple interactive media. His research spans emerging technologies for learning, infusing technology into large-scale educational improvement initiatives, policy formulation and analysis, and leadership in educational innovation. He is currently conducting funded studies to develop and assess learning environments based on modeling and visualization, online teacher professional development, wireless mobile devices for ubiquitous computing, and multiuser virtual environments. Dede also is active in policy initiatives, including creating a widely used State Policy Framework for Assessing Educational Technology Implementation and studying the potential of developing a scalability index for educational innovations. From 2001 to 2004, he served as chair of the Learning & Teaching area at Harvard Graduate School of Education.

eynote Speaker
anquet
'ednesday 6:00-8:00pm

Mr. Doug Dempster (Maj.-Gen. Ret. CAAR) was appointed the NATO Assistant Secretary General for Executive Management on 6 October 2005 following international competition. He brings experience in leading large-scale transformation and resource realignment. He is an advocate of the new public management producing accountability, transparency and results.

He is a member of the Secretary General's policy board and has NATO-wide functional authority in the areas of governance, civilian personnel and financial management. As the executive manager he enables NATO Headquarters to perform its strategic politico-diplomatic role. He delivers services in the human resource, information system, infrastructure, language, finance and procurement domains.

Mr. Dempster had a 36-year military career, the last seven as a General Officer. The majority of his 36-year military career was spent as an Army Communications and Electronics officer where he was heavily involved in using chnological tools including modeling and simulation. He continues to use this experience in his current position. In July 2001, immediately ior to the 9/11 attacks, he was appointed Director General Strategic Planning within the integrated defense headquarters. In this dynamic ne he worked closely with the senior military and civilian leadership of the department, participated in inter-departmental coordination and orked with the central agencies of government. He led the national effort on capability modernization, allocated the defense budget, introuced corporate performance management and orchestrated four successive budget increases.

the deputy commander of Canada's army from 2000 to 2001, he steered the transformation process and improved internal communications. e managed army base infrastructure and human resources, both military and civilian.

om 1998 to 2000 he served as the departmental force planner and resource allocator where he facilitated the development of Defense rategy 2020 and synchronized the 2000 federal budget increase following a succession of cuts.

Schedule

Technical Chair: C. Donald Combs, Ph.D. combscd@evms.edu
Track Co-Chair: Mark W. Scerbo, Ph.D. mscerbo@odu.edu

Within the last 10 years, simulation technology has been implemented successfully in training across medical and health professions specialties including resuscitation, laparoscopic surgery, and vascular access. Almost all of the simulator systems currently available, however, target medical students and junior residents in the early years of their training.

There is a critical need for simulation systems aimed at more advanced residents and at practicing medical and health professionals who have mastered the fundamentals of specific procedures and now must learn the problem-solving and decision-making skills needed to become more effective clinicians and members of interdisciplinary teams. Moreover, learning to make decisions under stress is particularly important for those whose professional practice involves working in emergency or combat situations. Simulation is a standard component of officer training in the military, but does not yet exist for advanced medical professionals, whether civilian or military.

The goal of the medical track at MODSIM World is to assemble experts in simulation-based training for advanced cognitive skills and engage them in dialogue with leading medical and health educators about current needs and future directions for the pervasive incorporation of modeling and simulation systems into medical and health professions training.

Advanced residents and practicing medical and health professionals who have mastered the fundamentals of specific procedures must learn the problem-solving and decision-making skills needed to become more effective clinicians and members of interdisciplinary teams. Training in medical and health decision making is particularly important for those whose professional practice does or will involve working in emergency situations. This MODSIM track will convene leading experts in simulation-based training for advanced cognitive skills and contextual training and engage them in dialogue with leading medical and health educators.

Tuesday

10:30am - 12:00pm

Session 1:

Welcome And Medical Track Overview: Why Was This Conference Needed?

Speaker 1: The Emerging Imperative For Medical Simulation--C. Donald Combs, Ph.D., Eastern Virginia Medical School, Norfolk, VA

Speaker 2: Simulation And Graduate Medical Education: A 2007 Update--L.D. Britt, M.D., MPH, FACS, Eastern Virginia Medical School, Norfolk, VA

1:30pm - 3:00pm

Session 2:

Medical Simulation: Past, Present and Future

Speaker 1: The State-Of-The-Art In Medical Simulation--Steven L. Dawson, M.D., Center For The Integration of Medicine and Innovative Technology (CIMIT), Cambridge, MA

Speaker 2: The Future Of Medical Simulation: Where We've Come, Where We're Going - Curricula, Criteria, Proficiency, And The Paradigm Shift In Surgical Education--Richard M. Satava, M.D., FACS, University of Washington School of Medicine, Seattle, WA

3:30pm - 5:00pm

Session 3:

Surgical Training

Speaker 1: Proficiency-based Laparoscopic Simulator Training Leads To Improved Operating Room Skill That Is Resistant To Decay--Dimitrios Stefanidis, M.D., Ph.D., Carolinas Medical Center, Charlotte, NC

Speaker 2: Neuro-cognitively Designed Dynamic Simulations For Laparoscopic Surgical Skills--Kanav Kahol, Ph.D., Arizona State University, Tempe, AZ, and Banner Good Samaritan Medical Center, Phoenix, AZ

Speaker 3: Integrated Real-time Performance Feedback During Simulation-based Surgical Skill Training--Azhar Rafiq, M.D., M.B.A., Virginia Commonwealth University, Richmond, VA

Speaker 4: The Learning Curve On The KAIST-Ewha Colonoscopy Simulator II--Doo Yong Lee, Ph.D., Korea Advanced Institute Of Science And Technology (KAIST), Daejeon, Republic Of Korea

5:30-6:30pm Opening General Reception and Poster Session

Wednesday

8:30-10:00am

Session 4:

Simulation In The Military Workshop: Current Initiatives And A Framework For Future Directions--Alan Liu, Ph.D. And Gilbert M. Muniz, Ph.D., National Capital Area Medical Simulation Center, Uniformed Services University of the Health Sciences, Bethesda, MD, And Gerald R. Moses, Ph.D., Maryland Advanced Simulation, Training, Research and Innovation Center (MASTRI), University of Maryland Medical Center, Baltimore, MD

10:30-12:00pm

Session 5:

The Impact Of Medical Simulation On Patient Care And Safety

Speaker 1: Patrick C. Cregan, M.D., FRACS, University of Western Sydney, New South Wales, Australia

Speaker 2: Medical Errors And The Need For Simulation--Mark W. Scerbo, Ph.D., Old Dominion University, Norfolk, VA

1:30--3:00pm

Session 6:

New Developments From The Trenches

Speaker 1: Innovative Uses Of Simulation Technology In The Classroom Environment: Paving The Road For Sim-based Curricula--Carla M. Pugh M.D., Ph.D. FACS, Northwestern University Feinberg School of Medicine, Chicago, IL

Speaker 2: Paul E. Phrampus, M.D., FACEP, Peter M. Winter Institute for Simulation, Education and Research (WISER), University of Pittsburgh Medical Center, Pittsburgh, PA

Speaker 3: The MASTRI Center: Medical Simulation For Skill Acquisition--F. Jacob Seagull, Ph.D., The Maryland Advanced Simulation, Training, Research and Innovation Center (MASTRI), University Of Maryland Medical Center, Baltimore, MD

3:30-5:00pm

Session 7:

Virtual Reality Applications

Speaker 1: Virtual Reality In Gait Rehabilitation--Nigel W. Tierney, Old Dominion University, Norfolk, VA

Speaker 2: EMS and Virtual Reality Demonstration of Feasibility--Ernie Wheeler, A.A.S., NREMT-P, Hobbs Fire Department, Hobbs, NM

Speaker 3: Individual Personality Characteristics For Virtual Agents In A Virtual Operating Room--Amber T. Nalu, M.A., Old Dominion University Norfolk, VA

Speaker 4: Decoupled Agent Architecture For Virtual Operating Room Training Simulations--Emre Baydogan, M.S., Old Dominion University, Norfolk, VA

Thursday

8:30-10:00am

Session 8:

Can We All Learn To Play Together In The Same Sandbox?

Speaker 1: The SISO Perspective On Medical Simulation Interoperability--Richard J. Severinghaus, M.S., SISO, Inc., Orlando, FL

Speaker 2: Got Team? Now What?--Claudia L. Johnston, Ph.D., Texas A&M University - Corpus Christi, Corpus Christi, TX

Speaker 3: Health Care Return-On-Investment Needs a Systems Approach to Training and Treatment--J. Lance Acree, M.S. Eng., Aviation Training Consulting, LLC, Altus, OK

10:30-12:00pm

Session 9:
Models and Visualization
Speaker 1: A Fetal Heart Rate Monitor Simulator--Lee A. Belfore, II, Ph.D., Old Dominion University, Norfolk, VA
Speaker 2: Disease Interaction In Cognitive Simulations For Medical Training--Bruce E. Jarrell, M.D., FACS, University of Maryland School of Medicine, Baltimore, MD
Speaker 3: Design Of A Digital Cerebrovascular Simulation Model for Teaching and Research--W. Bosseau Murray, M.D., Pennsylvania State University College of Medicine, Hershey, PA
Speaker 4: Registration Of 3D CT Model Of The Pectus Excavatum Chest To Subject: Methodologies Utilizing 3D Laser Surface Scanning--Taryn T. Cuper, Old Dominion University, Norfolk, VA

Medical Track Poster Session

Stress And Workload Associated With Monitoring Simulated Maternal-Fetal Heart Rate Signals
Brittany L. Anderson, Old Dominion University, Norfolk, VA

Improving Residency Training In Ob-Gyn Emergencies Utilizing Simulated Team Drills
Adair R. Heyl, Ph.D., Eastern Virginia Medical School, Norfolk, VA and Elizabeth A. Schmidt-Panos, M.S., Old Dominion University, Norfolk, VA

Evaluation Of A Procedural Checklist For Anesthesia Pre-induction And Induction
Michael W. Jackson, CRNA, M.S.N.A., Old Dominion University, and
Alison Kelly, CRNA, M.S., J.D., ; Michael Jackson; Elizabeth, T. Newlin & Mark W. Scerbo, Old Dominion University (all)

OntoVOR: The Design Of A Knowledge-base For A Virtual Operating Room
Saurav Mazumdar, M.S. CpE, Old Dominion University, Norfolk, VA

Procedural Modeling Of Wound Textures
Ramu Pedada, Old Dominion University, Norfolk, VA

An Approach To Identifying The Biomechanical Differences Between Intercostal Cartilage In Subjects With Pectus Excavatum And Normals In Vivo: Reconstruction And CT Registration
Zhenzhen Yan, Old Dominion University, Norfolk, VA

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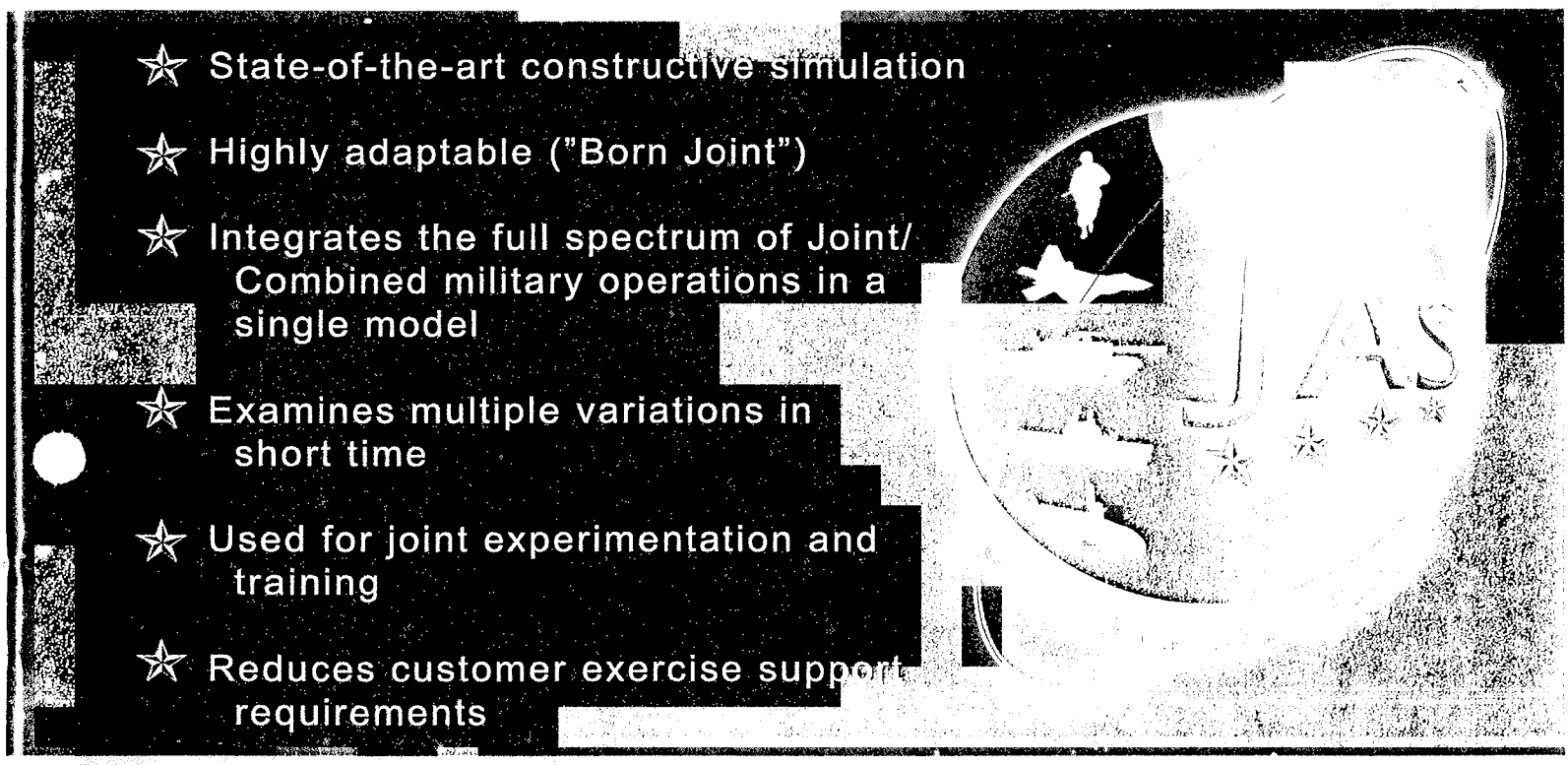

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TRANSPORTATION

Schedule

Technical Chair: Jeremiah Creedon, Ph.D., Director of Transportation Research, ODU jcreedon@odu.edu
Program Organizers: Sharon Welch sharon.s.welch@nasa.gov & Ben Francisco rfrancisco@alionscience.com

Modeling and simulation (M&S) tools and visualization technologies enable improved designs and operations for land, air and sea transportation systems. Analytical tools support predictions of complex transportation system performance. When combined with advanced information displays, and decision support tools, these M&S technologies can be used to test and improve the safety of transportation systems operations and provide aid to decision makers in business development, local and state planning activities, and emergency management and homeland defense.

For example, from M&S studies, the nation's Next Generation Air Transportation System (NGATS) is emerging. The goal is to increase flexibility in scheduling travel and shipments, increase security, increase access to flights and reduce time and cost spent traveling to and from airports. Sophisticated ground-based simulations provide realistic environments that allow multiple human pilots and air traffic controllers to engage under a variety of conditions to test new technologies and NGATS operations strategies. These simulations greatly reduce the cost and risk of testing and, because they enable a large number of scenarios to be evaluated, increase the reliability and safety of the final system design. Transportation systems models may also be coupled to enable the security and cost of multimodal transportation operations to be assessed. In addition, derivative simulations may be used for other applications including training and decision support for business development, local and state planning for ports, roads, and airports, and emergency response.

Tuesday

10:30am - 12:00pm

Session 1:

Panel Discussion - Designing the Next Generation Air Transportation System (NGATS) –

Session Chair – David Hinton, Program Manager, Aeronautics Directorate, National Aeronautics and Space Administration, Langley Research Center, Hampton, VA

Speaker 1: Session Keynote - Sherry Borener NASA/JPDO, Program Manager for Simulation-Based Next Generation Air Transportation System Architecture, Washington, D.C.

Speaker 2: Mike Lewis, Boeing ATM, Virginia

Speaker 3: Mark Ballin, NASA Langley Research Center, Virginia

Speaker 4: Robert Windhorst, NASA Ames Research Center, California

1:30pm - 3:00pm

Session 2:

Paper Presentations: Complex Air Space Modeling (NGATS)

Session Chair - Dr. Nicolas Suarez, Head of Simulation and Architecture Department, Ingenieria de Sistemas, Madrid, Spain

Paper 1: Evolution of air space modeling tools - exemplary for automation in Air Traffic Control, Dr. Matthias Poppe, Thomas Hellbach DFS Deutsche Flugsicherung GmbH

Paper 2: Hybrid Simulation Of Air Navigation Systems, by José Miguel De Pablo, Division Chief, AENA (Spain)

Paper 3: Using Serious Gaming and Macromodels to Validate the Future ATM System, by Nicolás Suarez, Department Head, Isdef Madrid, Spain; Amaya Prieto, Simulation Group, Isdefe, Madrid, Spain; Marta Sánchez; Lucas Lacasa; Modeling Group, Isdefe, Madrid, Spain

3:30pm - 5:00pm

Session 3:

Panel Discussion: Integrating New Air Transportation Systems and Operations into the National Air Space

Session Chair - Dr. Peter Lattimore, Chief Scientist, Rhinocorp Albuquerque, NM

Speaker 1: Paul Hamilton, Orion International, A Simulation and Integration Framework for Aviation System Safety Analysis

Speaker 2: Leon Stinson - CDO Technology, GA

Speaker 3: Dr. Eric Weisel, Warner-Anderson (Gloucester, VA) OT&E, VV&A

MODSIM World Conference '07

Schedule

Wednesday

8:30am - 10:00am

Session 4:

Maritime Transportation Modeling and Simulation (Ports & Cargo Terminal Ops)

Session Chair - Wayne K. Talley, Executive Director, International Maritime, Ports and Logistics Management Institute, ODU

Paper 1: Continuous and Dynamic Berth Allocation with Simultaneous Quay Crane Scheduling, Maria Boile, Sotirios Theofanis, M. Golias, Rutgers University

Paper 2: Integrating System Simulation and Traffic Micro Simulation Tools to Evaluate Benefits from a Virtual Container Yard Application, Dr. Sotirios Theofanis and Dr. Maria Boile, Rutgers University

Paper 3: Comparison and Evaluation of Two Automated Guided Vehicle Systems in the Transhipment of Containers at a Container Terminal, Dr. Lawrence Henesey, Dr. Paul Davidsson and Dr. Jan A. Persson, Blekinge Institute of Technology, Karlshamn, Sweden

10:30am - 12:00pm

Session 5:

Intermodal Freight Panel Discussion (a systems engineering and TQL approach to Intermodal Trade)

Session Chair - Luke Ritter, Trident-Global Partners

Speaker 1:- M. Nuns Jain, Director, MARAD South Atlantic Region

Speaker 2:- Joe DiRenzo, Deputy, Operations Plans Branch, USCG Atlantic Area Command

Speaker 3:- Mr. Chris Matson, Associate, TranSystems Corp

1:30pm - 3:00pm

Session 6:

Modeling and Simulation in Transportation Systems Planning

Session Chair - Eric Weisel, WernerAnderson (Gloucester, VA)

Paper 1: Overview of the Transportation Analysis Simulation System (TRANSIMS), Antoine Hobeika, Professor, VA Tech

Paper 2: An Agent-Based Modeling Tool for Transportation System Planning, Peter Lattimore, Rhinocorp, Albuquerque, New Mexico

Paper 3: Extraction of Road Network Topology from Shapefiles for Transportation and GIS Applications, Srinivas Karthik Jakkula and Yuzhong Shen, Electrical Engineering Department, Old Dominion University, Norfolk Virginia; John Sokolowski, Director of Research, VMASC, Old Dominion University

3:30pm - 5:00pm

Session 7:

Panel Discussion – A Comparison of U.S. and European Approaches to Multimodal Passenger Transportation Planning & Design

Session Chair - Lee Beach, Hampton Roads Research Partnership, VA

Speaker 1: Michael Laubrock, Eurocontrol, Program Manager, Centre de Bois des Bordes, France

Speaker 2: David Ekern, Commissioner, Virginia Department of Transportation, Virginia

Speaker 3: Antoine Hobeika, Professor, Department of Civil and Environmental Engineering, Virginia Tech, Virginia

Thursday

8:30am - 10:00am

Session 8:

Student Modeling and Simulation Competitions for Transportation System Design Joint Session with Education Track (see Education Track Schedule for details)

10:30am - 12:00pm

Session 9:

The Way Forward (wrap up) - Panel Discussion - Session Chair - Charles Massey

Track Co-Chairs Jeremiah Creedon and Vice Admiral James Hull, USCG (Ret)

HOMELAND SECURITY/DEFENSE

Schedule

Technical Chair: David Ozolek, JFCOM
Deputy Co-Chair: Wayne Buck, NATO/ACT buck@act.nato.int

Analytical tools enable decision-makers to identify and address gaps in current plans and processes. Significant detail and complexity can be built into a model database to explore the effects of strategic decisions at the local level. This MODSIM track will address how application of command and management processes will more effectively coordinate resources and address catastrophic events, including natural disasters and acts of terrorism.

Tuesday

10:30am - 12:00pm
Session 1:
Panel Discussion – M&S as a Planning Tool
Facilitator: Robert Anderson, USJFCOM
Chairman: Robert Crouch, Special Assistant to Virginia Governor for Commonwealth Preparedness
Panel Member: Col. Stan Vanderwerf, Chief, Analysis Division, U.S. Northern Command
Panel Member: Andrew Vallerand, Ph.D., Director Of the Canadian Public Security Technical Program
Panel Member: Andreas Tolk, Ph.D., Associate Professor, Engineering Management & Systems Engineering, Old Dominion University

1:30pm-3:00pm
Session 2:
Speakers Session
Facilitator: Mr. Wayne Buck, ACT/NATO
Speaker: Andrew Vallerand, Ph.D., Director Of the Canadian Public Security Technical Program
Speaker: Peter Verga, Acting Assistant Secretary of Defense for Homeland Defense

3:30pm-5:00pm
Session 3:
Panel Discussion – Industry M&S Support to HLS/D
Facilitator: Robert Anderson, USJFCOM
Panel Chair: RADM Lindell Rutherford (Ret.) Northrop Grumman CVN 21 Program Director
Panel Member: Rob Lisle, Northrup Grumman, Modeling, Simulation & Analysis Manager
Panel Member: Josh Jackson - SAIC
Panel Member: Jean-Pierre Faye, Thales-Raytheon
Panel Member: Franz-Josef Schulz, IABG

Wednesday

8:30am - 10:00am
Session 4:
Speakers Session
Facilitator: Wayne Buck, ACT/NATO
Speaker: Angel San Jose Martin, Former Deputy Head of the NATO M&S Coordination Office
Speaker: Jim Blank, US Joint Forces Command, Joint Innovation & Experimentation Directorate, Chief of M&S

10:30pm-12:00pm
Session 5:
A Strategy for Validation of Homeland Security Simulation Systems: Eugene Nielsen, Tara Elzie, Don Anderson, Rick Pabst, DDL OMNI Engineering, LLC.
Distributing Integration & Test for Homeland Security – William H. Crain, Gestalt LLC

1:30pm-3:00pm
Session 6:
Panel Discussion: M&S Training and Experimentation
Facilitator: Randy Sickmier, VMASC
Chairman: Tim Baker, Deputy Joint Force Trainer/Business & Technical Manager
Panel Member: Brian Witherden, NATO Consultation Command and Control Agency
Panel Member: John A. Sokolowski, Ph.D., Director of Research, Virginia Modeling, Analysis and Simulation Center

3:30pm - 5:00pm
Session 7:
Speakers Session
Facilitator: Tom Frost, JFCOM
Tony Cerri, U.S. Joint Forces Command, Joint Innovation & Experimentation Directorate, and Experiment Engineering Support Lead
Col. Michael Armstrong, Joint Warfighting Center, JFCOM
Michael R. Sorokach, NASA

Thursday

8:30am - 10:00am
Session 8:
Using M&S To Improve Military Infectious Disease Response: Kristy Bryan & Darren Kwock, Alion Science and Technology
Integrated PMESII Planning & Experimentation for Wargaming; Jason Shreve, Booz/Allen/Hamilton

10:30pm
Session 9:
Emergency Management Conceptual Model: Heather Warren Noell, Analyst Evidence Based Research, Inc.

11:00pm
Synthetic Environments for Analysis and Simulation: Dan Snyder and Wayne Buck

11:30pm
Final Remarks
David Ozolek, SES, Member of the Department of Defense M&S Board of Directors

EDUCATION

Schedule

Technical Chair: Thomas Pinelli, Ph.D. t.e.pinelli@larc.nasa.gov
Deputy Co-Chair: Alicia Sanchez, Ph.D., Defense Acquisition University aliciadsanchez@hotmail.com

Computer modeling and simulation (M&S) can accelerate learning and problem solving. Scientists and engineers develop complex models and simulations to enable more rapid understanding of physical phenomenon and to predict and test performance of new technologies and systems. Simulations are also used to decrease the time required to train people to operate equipment and systems and to learn how to respond to man-made and natural disasters. Similarly, M&S technologies applied to the K-16 classroom can accelerate learning.

Virtual laboratories, worlds, and other highly immersive game-based environments can provide opportunities for students to learn through trial and error. This more experiential learning has been demonstrated to increase students' self efficacy over video or lecture formats alone and may provide an advantage in teaching science, technology, engineering, and math (STEM) subjects to students who struggle with the symbolic learning of the classic text and lecture formats. In addition, video games are familiar to students and the interface is well suited to introduce concepts of modeling and simulation early on.

Tuesday

10:30am - 12:00pm

Session 1:

Invited Speaker – Simulated Students and Classroom Use of Model-Based Intelligent Tutoring
Dr. Kenneth R Koedinger, Carnegie Mellon University
Discussant: Dr. Michael Evans, Virginia Tech

1:30pm - 3:00pm

Session 2:

Panel Session – How Learning Theory Supports Using Modeling, Simulation and Game-Based Learning to Teach Science, Technology, Engineering and Mathematics
Bruce Milligan, Federation of American Scientists, Moderator
Panel Member 1: Christopher Clark, Moves Institute, Naval Post Graduate School
Panel Member 2: Dr. Daniel Laughlin, NASA Goddard, University of Maryland
Panel Member 3: Dr. Michael Darby, Curtin University of Technology, Australia
Panel Member 4: Mary Meuders, Reseacher, IPN Foundation Talent Development & Research

3:30pm - 5:00pm

Session 3:

Panel Session – Integrating Modeling, Simulation, and Game-Based Learning into Science, Technology, Engineering and Mathematics
Catherine Wyman, DeVry University, Moderator
Panel Member 1: Tyler Bangert, Alchesay High School, Whiteriver, AZ
Panel Member 2: John Jamison, DeVry University
Panel Member 3: David Weaver, Chandler-Gilbert Community College

Wednesday

8:30am - 10:00am

Session 4:

Invited Speaker –Play and Learn: Potentials of Game-Based Learning
Dr. Maja Pivec, University of Applied Sciences, FH Joanneum, Austria
Discussant: Paul Kearney, UNITEC New Zealand

10:30am - 12:00pm

Session 5:

Panel Session –Scientific and Mathematical Knowledge Acquisition: Professional Development in Interactive

Learning Environments
Dr. Len Annetta, North Carolina State University, Moderator
Panel Member 1: Dr. Bethany Hudnutt, SHODOR Educational Foundation
Panel Member 2: Dr. James Minogue, North Carolina State University

12:30pm - 1:15pm
Lunch Speaker:
Immersive Collaboration Simulations: Multi-User Virtual Environments and Augmented Realities
Invited Speaker - Dr. Chistopher Dede, Harvard University

1:30pm - 3:00pm
Session 6:
Panel Session –Tools, Techniques and Applications: Innovative Uses of Game-Based Learning
Paul Kearney, UNITEC New Zealand, Moderator
Panel Member 1: Dr. Karin Orvis, Old Dominion University
Panel Member 2: Dr. Rasha Morsi, Norfolk State University
Panel Member 3: Graeme Duncan, Caspian Learning, UK

3:30pm - 5:00pm
Session 7:
Panel Session – From Infrastructure to Integration: Modeling, Simulation, and Game-based Learning in the 21st Century Classroom
Linda Holt, Virginia Department of Education, Moderator
Panel Member 1: Dr. Matt Dunleavy, Graduate School of Education, Harvard University
Panel Member 2: Dr. Tammy McGraw, Virginia Department of Education
Panel Member 3: Dr. Manorama (Mano) Talaiver, Longwood University
Panel Member 4: Dr. Michael Evans, Virginia Tech

5:30pm - 6:30 pm
Reception and Poster Session-- Dr. Alicia Sanchez, Defense Acquisition University

Thursday

8:30am - 10:00am
Session 8:
Panel Session – An Overview of Student Modeling and Simulation Competitions for Transportation Systems Design
Susan Baker, Northern Virginia Technology Council, Moderator
Panel Member 1: Dr. Mary Sandy, Virginia Space Grant Consortium
Panel Member 2: Dr. Elizabeth "Liz" B. Ward, Christopher Newport University
Panel Member 3: Ms. Susan Baker, Project Director, Virginia Economic Bridge
Panel Member 4: Dr. Catherine Banks, Director of Academic Affairs, VMASC, Old Dominion University

10:30am - 12:00pm
Session 9:
Panel Session – Preparing a World Class MODSIM Workforce for Virginia: The Community College Connection
Dr. Deborah G. Wright, Thomas Nelson Community College, Moderator
Panel Member 1: Dr. Michael Summers, Tidewater Community College
Panel Member 2: Patricia "Pat" P. Taylor, Thomas Nelson Community College
Panel Member 3: Dan Brookman, Apprentice School, Northrop Grumman Newport News

EDUCATION

Schedule

Education Poster Session

CAB: A Tool for Interoperation Among Cognitive Modeling Architectures
Donald Benton, Wayne Zachary, Jean-Christophe LeMentec
CHI Systems

Applications of Visualization Software for Mathematics Education
Sarah Daugherty; Yuzhong Shen, Ph.D.
Virginia Modeling, Analysis, and Simulation Center, ODU
Department of Electrical and Computer Engineering, ODU

Playing Mind Games: Applying Augmented Cognition to Serious Games
Dr. Julie Drexler, Peter Smith, Lee Sciarini, and Dr. Denise Nicholson
Institute for Simulation and Training, University of Central Florida

Fidelity Versus Cost And It's Effect On Modeling & Simulation
Jeff Duncan
Evidence Based Research

Simulation And Leadership Competencies
David O. Hassell
Imedia.it Inc

Simulation and Visualization Enhanced Engineering Education: The Stiffness Matrix Method Module for Structural Analysis Course
Ahmed Mohammed, Duc T.Nguyen and Sushil K. Chaturvedi
Old Dominion University

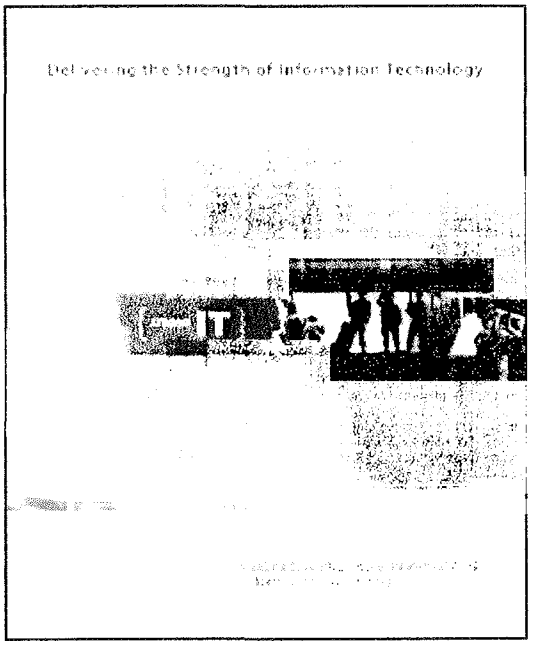
Design and Development of Educational MMOG's
Peter Smith, Tim Holt, Dr. Clint Bowers, Dr. Jan Cannon-Bowers and Rachel Joyce
Institute for Simulation and Training, University of Central Florida

Emergency Response Virtual Environment for Safe Schools
Ayman Wasfy; Teresa Walker
Hampton University

Technical Chair: Pete Schrider, pschrider@breakawayltd.com
Program Organizer: Alicia Sanchez, Ph.D., Defense Acquisition University aliciadsanchez@hotmail.com

Serious-Games

Game based technology enables the rapid development and deployment of solutions to real world problems. This cross cutting segment will examine how this technology is currently being used to discover solutions within issues ranging from training the next generation of health care professionals to planning for social change and managing incident response. We will also explore the direction that this technology is shaping our future. It has been said "...games have the power to change the world"-Doug Whatley, CEO, BreakAway, Ltd., and serious games are doing just that.



Wednesday

8:30am – 10:00am
Session 4:
Serious Games
Moderator: Doug Whatley, CEO, BreakAway Ltd.
Catherine Wyman, DeVry

Interoperability

If our inability to communicate effectively limits our ability to be successful, then it must be true that interoperability is a key element of success. The issues which range from disjointed multi-jurisdictional processes to a lack of common databases and network protocols highlight the need to manage our tasks effectively and efficiently. This cross cutting segment will explore the ways that modeling and simulation will help us see problems in new ways and enable exciting new solutions.

Thursday

10:30am – 12:00pm
Session 9:
Interoperability
Speaker: TBA

Speaker Bios

L.D. Britt

Session 1

Brickhouse Professor and Chairman of the Department of Surgery at Eastern Virginia Medical School

L. D. Britt, M.D., M.P.H., FACS, is a graduate of the Harvard Medical School and the Harvard School of Public Health, and serves as the Brickhouse Professor and Chairman of the Department of Surgery at Eastern Virginia Medical School. He is the author of over 160 scientific publications. He serves on numerous editorial boards in addition to being a reviewer for the New England Journal of Medicine. Dr. Britt, a member of Alpha Omega Alpha (AOA), is the recipient of the nation's highest teaching award in medicine – the Robert J. Glaser Distinguished Teaching Award, which is given by the Association of American Medical Colleges in conjunction with AOA. He was recently honored by the Association of Surgical Education with its lifetime achievement award the Distinguished Educator Award – given annually to the one person considered by their peers to be a true master. Dr. Britt is a member of the Executive Committee of the Board of Regents of the American College of Surgeons. He is the past President of the Society of Surgical Chairs. Also, Dr. Britt is the Chairman of the ACGME Residency Review Committee for Surgery, President of the Southeastern Surgical Congress, Vice-President of the Halsted Society, and Vice-Chairman of the Board of Regents of the American College of Surgeons. He was recently elected Director of the American Board of Surgery and appointed to the Robert Wood Johnson Clinical Scholar Program National Advisory Committee. The NIH National Library of Medicine, in collaboration with the Reginald F. Lewis Museum of Maryland African American History and Culture, recently featured Dr. Britt for his contributions to academic surgery. An active community leader, Dr. Britt has received numerous awards for public service contributions.

C. Donald Combs

Session 1

Professor of Health Professions
Associate Dean for Planning and Health Professions
Eastern Virginia Medical School

C. Donald Combs, Ph.D., serves as Professor of Health Professions, Professor of Family and Community Medicine, and as Associate Dean for Planning and Health Professions of the Eastern Virginia Medical School (EVMS). His responsibilities include strategic planning, oversight of medical modeling and simulation, program development, governmental and community relations, and directing educational outreach programs. He has long-standing research interests in health and human services management, emergency response, health services research, health professions regulation, organizational development, strategic planning, and medical modeling and simulation. These interests are reflected in his professional publications and conference presentations, many consultancies with federal, state and local agencies, non-profit services organizations and businesses, and $110 million in external funding. Dr. Combs is active in the Association of Academic Health Centers (AHC) and in national policy discussions addressing health workforce planning, emergency medical response to WMD, applied information systems and medical modeling and simulation. In the international arena, Dr. Combs has worked with colleagues at the Naval Postgraduate School to develop and implement the International Health Resource Management executive education program that has served some 20 nations, including Moldova, Bulgaria, Macedonia, Nepal, Botswana and El Salvador. He holds degrees received with distinction from South Plains College, Texas Tech University and the University of North Carolina - Chapel Hill.

Patrick C. Cregan

Session 5

Associate Professor of Surgery
University of Western Sydney

Patrick C. Cregan, M.D., FRACS, currently serves as an Associate Professor of Surgery at the University of Western Sydney in Penrith, New South Wales (NSW), Australia, where he has a clinical practice and special interest in general, endocrine and laparoscopic surgery. In addition, Dr. Cregan serves as the Clinical Program Director of Surgery for the Sydney West Area Health Service and as Chair of the Surgical Services Taskforce of the NSW Dept of Health. Dr. Cregan holds the title of Visiting Surgeon at Nepean Hospital, Nepean Private Hospital, and Springwood Hospital.

Dr. Cregan's current research interests include surgical robotics, high-performance computing and surgery, hapto-visual environments, the Internet and ultra-broadband internet applications for clinical practice.

Dr. Cregan serves as Chair of the Virtual Critical Care Unit (ViCCU) Project, as a member of the Board of Directors of the NSW Cancer Institute and as the Medical Director of Medic Vision, Ltd., the entity that served as the designer/builder of the technology setup and backbone of the three current Australian simulation skills centers together with centers in China, Hong Kong, India, the UK, etc., responsible for researching, developing and manufacturing surgical and anesthetic simulators, and as a reseller of surgical simulators from multiple manufacturers.

In addition, Dr. Cregan is a member of the Board of Directors of the NSW Institute of Medical Education and Training (IMET), is the Found- Director of the Australian Society for Simulation in Health Care H), served as the convener of the first three Australian Simulation Industry Association-Healthcare meetings, and currently serves on the Program Committee of the Medicine Meets Virtual Reality annual conference.

Steven L. Dawson

Session 2

Associate Professor, Harvard Medical School

Dr. Steve Dawson graduated magna cum laude, Phi Beta Kappa, from the State University of New York at Buffalo in 1974. He received his medical degree from Tufts University in 1978 and completed his radiology residency and a two year post-doctoral fellowship in Interventional Radiology at the Massachusetts General Hospital in Boston. In 1993, he was a co-founder of CIMIT, a successful incubation laboratory of several Boston academic and clinical institutions.

In December 2000, the journal Catheterization and Cardiovascular Interventions published a report of a simulator for interventional cardiology training, which Dr. Dawson and colleagues from MGH and the Mitsubishi Research Laboratories developed. The system (VIST-Mentice AB, Gothenburg, Sweden), has trained over 15,000 physicians in sites throughout Europe, Asia and North America. An editorial accompanying the article called the work "an astonishing breakthrough of potentially revolutionary importance."

In addition to his research work, Dr. Dawson is an active clinical interventional radiologist at MGH. He is an Associate Professor at Harvard M al School and from 1998-2002 was also Visiting Scientist at th Massachusetts Institute of Technology. He is on simulation and education committees and subcommittees of the Radiological Society of North America, the American College of Radiology, the Society of Interventional Radiology, and the Cardiovascular and Interventional Radiology Society of Europe. He is the Chair of the Advanced Initiatives in Medical Simulation, a section 501c 6 non-profit corporation, as well as a member of the Board of Trustees of the Society for Simulation in Healthcare.

Paul E. Phrampus

Session 6

Director, Peter M. Winter Center for Simulation, Education & Research
University of Pittsburgh Medical Center

Dr. Paul Phrampus is the Director of the Peter M. Winter Center for Simulation, Education and Research (WISER) at the University of Pittsburgh Medical Center (UPMC). In 2005, WISER conducted more than 10,000 simulation-based training sessions with physicians, fellows, residents, medical students, nursing students, nurses, emergency medical personnel and other health care professionals.

He received a B.S. degree in Biology from Old Dominion University and an M.D. degree from Eastern Virginia Medical School in Norfolk, Virginia. He is a board certified Emergency Medicine physician who completed residency training at the University of Pittsburgh where he now holds an appointment as Assistant Professor in the Departments of Emergency Medicine and Anesthesiology.

Dr. Phrampus has been active in patient safety efforts in airway management in the practice of emergency medicine. He has developed a simulation-based difficult airway management course that has been completed by the entire academic faculty staff of the Department of Emergency Medicine. Currently it is being deployed across the emergency departments of UPMC's 19 hospital system.

Dr. Phrampus has an extensive background in Emergency Medical Services and serves as an active EMS medical director. He has deployed simulation technology for both testing as well as competency assessment measures in EMS services in Southwestern Pennsylvania. He co-authored a simulation course for flight crew training for Stat Medevac. He has been involved with WISER since working with local paramedic airway training efforts dating back to 1998.

Dr. Phrampus has been active in education for many years and was recently awarded the faculty excellence award by the University of Pittsburgh Emergency Medicine Residency, and he has created and deployed simulation-based education exercises for the residency.

Carla M. Pugh

Session 6

Assistant Professor of Surgery
Northwestern University

Dr. Carla Pugh is currently Assistant Professor of Surgery and Associate Director of the Center for Advanced Surgical Education at Northwestern University. She also holds an appointment in the School of Education at Northwestern. Dr. Pugh obtained her undergraduate degree at U.C. Berkeley in Neurobiology and her medical degree at Howard University School of Medicine. Upon completion of her surgical training at Howard University Hospital, she attended Stanford University and obtained a PhD in Education. Her thesis project was, "Evaluating Simulators for Medical Training: The Case of the Pelvic Exam Simulator". Dr. Pugh holds a patent on the method of simulation used to design the Pelvic exam simulator and is currently engaged in the design of other simulators using similar technology. Since the completion of her doctoral studies, Dr. Pugh has developed breast and prostate exam

simulators.

Dr. Pugh has a broad interest in the use of technology for medical and surgical education, and is especially interested in how medical professionals learn. Her simulators are currently being used to train and assess medical students at several universities. She is also working with the National Board of Medical Examiners (NBME) to support their interest in using her simulators as assessment tools on the United States Medical Licensing Examination™. In addition to her appointments at Northwestern, Dr. Pugh also holds an appointment at the Telemedicine and Advanced Technology Research Center (TATRC), which is under the U.S. Army's Medical Research and Materiel Command, as Special Assistant to the Director. At TATRC, Dr. Pugh serves as a subject matter expert on simulation.

ichard M. Satava

Session 2

Professor of Surgery
University of Washington Medical Center

Richard M. Satava, M.D., FACS, is Professor of Surgery at the University of Washington Medical Center and Special Assistant in Advanced Surgical Technologies at the US Army Medical Research and Materiel Command in Ft. Detrick, MD.

Prior positions include Professor of Surgery at Yale University and a military appointment as Professor of Surgery (USUHS) in the Army Medical Corps assigned to General Surgery at Walter Reed Army Medical Center and Program Manager of Advanced Biomedical Technology at the Defense Advanced Research Projects Agency (DARPA).

His undergraduate training was at Johns Hopkins University, medical school at Hahnemann University of Philadelphia, internship at the Cleveland Clinic, surgical residency at the Mayo Clinic, and a fellowship with a Master of Surgical Research at Mayo Clinic.

He is currently a member of the Emerging Technologies and Resident Education and Informatics committees of the American College of Surgeons (ACS), is past president of the Society of American Gastrointestinal Endoscopic Surgeons (SAGES), past president of the Society of Laparoendoscopic Surgeons (SLS), and is on the Board of Governors of the National Board of Medical Examiners (NBME). He is on the editorial board of numerous surgical and scientific journalsand active in numerous surgical and engineering societies.

He is credited with more than 200 publications and book chapters in diverse areas of advanced surgical technology.

During his 23 years of military surgery he has been an active flight surgeon, an Army astronaut candidate, MASH surgeon for the Grenada invasion, and a hospital commander during Desert Storm, all the while continuing clinical surgical practice and aggressively pursuing the leading edge of advanced technologies to formulate the architecture for the next generation of medicine.

Mark W. Scerbo

Session 5

Professor of Human Factors Psychology
Old Dominion University

Mark W. Scerbo, Ph.D., is Professor of Human Factors Psychology at Old Dominion University and leads a team of researchers and developers who are studying user interaction with medical simulation technology, developing new medical simulation models and technology, and investigating methods to integrate

simulation into medical school curricula. He received his Ph.D. from th 'niversity of Cincinnati in 1987 and managed the AT&T Systems E ıtion Center in New Jersey from 1987 to 1990. Dr. Scerbo has autnored over 120 scientific publications and is co-editor of Automation Technology and Human Performance, published in 1999 by Erlbaum. He is a Fellow of the Human Factors and Ergonomics Society and received his Modeling and Simulation Professional Certification in 2002. He has served on the editorial board of Human Factors since 2000 and was a development editor for Ergonomics in Design for five years. He has been an ad hoc reviewer for numerous other journals including Simulation in Healthcare. He also serves as a member of the Society for Interventional Radiology Simulation Task Force. Dr. Scerbo has over 25 years of experience researching and designing systems and displays that improve user performance in academic, military, and industrial work environments. His research interests include human memory; attention; perception in real and virtual environments; advanced automation; and adaptive interfaces. His expertise in human factors and medical simulation has landed him invitations to speak at the National Academy of Sciences Committee on Human Factors, the Advanced Initiatives in Medical Simulation Meeting, the Annual Safar Symposium at the University of Pittsburgh, the Human Factors in Healthcare Course at the Mayo Clinic, and the Forum on Research in Science and Technology Education: Accelerating U.S. Competitiveness.

Richard J. Severinghaus

Session 8

Senior Staff
Dynamic Animation Systems, Inc.

Richard J. Severinghaus, M.S., is a member of senior staff at Dynamic ation Systems, Inc., in Fairfax, Virginia, where he serves as the Hu- Systems & Technology Performance Integration lead for the Naval Submarine Medical Research Center, Groton, CT. His work involves research and analysis of operational problems and development of integrated human systems and technology solutions. During the past ten years, he has been involved in advanced distributed simulation systems design integration work, in development of 3D immersive PC-based simulations, and in analysis of simulation systems requirements. He is active in the Simulation Interoperability Standards Organization, Inc., (SISO) as a member of the SISO Board of Directors. He currently serves as the Chairman of the Executive Committee and is additionally a member of the Executive Committee of SimSummit, an international roundtable on M&S issues. A retired submarine officer, he has extensive experience in submarine operations, including command of a nuclear powered submarine. He served on 5 submarines, on a Fleet staff, as a staff engineer at the Department of Energy, Division of Naval Reactors, and as Director, Combat Systems and Tactics, Naval Submarine School. Mr. Severinghaus holds an M.S. in Systems Management from the University of Southern California, the equivalent of an M.S. in Nuclear Engineering from the U.S Navy, and a B.S in Economics from the U. S. Naval Academy. He also spent a year studying computer science at the Rensselaer Polytechnic Institute.

TRANSPORTATION BIOGRAPHIES

Mark G. Ballin

Session 1

Bachelor of Science, Aerospace Engineering: University of Virginia, 1979
Master of Science, Aerospace Engineering: Pennsylvania State University, 1982
Postgraduate course work, Aerospace and Electrical Engineering: Stanford University 1984-88

Mark G. Ballin has twenty-six years of experience as an engineer, researcher, software developer, and manager. He worked at Rockwell International before joining NASA in 1983. His experiences include Space Shuttle dynamics analysis supporting payload integration, han-

Speaker Bios

dling qualities research using flight simulation and flight testing, and the development and validation of real-time models of rigid-body airframe, engine, and blade-element rotor systems for helicopters. He also developed a methodology for the development and assessment of new technology for space life support system hardware, based on Bayesian decision theory. He entered the air traffic management research area in 1994 as a researcher and developer of the Center/TRACON Automation System. Mr. Ballin led a team at NASA Langley Research Center that develops flight deck decision support automation and performs research in support of future distributed air/ground traffic management concepts. He is chief designer of the NASA Airspace and Traffic Operations Simulation, a high-fidelity networked air traffic simulation developed for study of future airspace operations, and the NASA Autonomous Operations Planner flight crew decision aiding system.

Mr. Ballin is an Associate Fellow of the American Institute of Aeronautics and Astronautics. He is an active member of the Institute of Electrical and Electronics Engineers and the Society of Automotive Engineers. He is a recognized world expert in concepts for distributed air/ground traffic management and their enabling technologies. He has been invited to speak numerous times at international symposiums in the United States and Europe, focusing on avionics and air traffic control modernization.

H. Lee Beach, Jr.

Session 7

Director
Hampton Roads Research Partnership

Dr. Beach is Executive Director of the Hampton Roads Research Partnership (HRRP), a consortium of seven universities, two National Laboratories, and a Research Institute focused on technology based economic development. Previously, he was a university professor and culminated a long NASA career as Deputy Director and Chief Operating Officer of the Langley Research Center. At NASA, he was responsible for 4,500 research and support personnel and technology programs with an annual budget of over $800 million. Dr. Beach is an internationally recognized authority in the field of hypersonic propulsion and has played a lead role in developing the technology for hypersonic aircraft; he has more than 40 publications documenting this work. He served on advisory boards at five universities and has been ve in professional societies and civic endeavors at local and national levels. He has B.S., M.S., and Ph.D. degrees from N.C. State University and has been honored with numerous awards, including: Fellow, American Institute of Aeronautics and Astronautics, Presidential Ranks of Distinguished and Meritorious Executive in the federal Senior Executive Service, NASA Distinguished Service and Outstanding Leadership Medals. He currently serves on the Boards of Directors of the Virginia Peninsula Chamber of Commerce, the Hampton Roads Technology Council and Technology Incubator, and the Virginia Air and Space Center.

Sherry Borener

Session 1

Director, Systems and Engineering Analysis Division
Joint Planning and Development Office (JPDO)

Dr. Sherry Borener is assigned to the JPDO from NASA Headquarters - Aeronautics Research Mission Directorate. Dr. Borener directs a team of researchers and analysts in the development and application of high-level models of aviation system performance to evaluate the impacts of Next Generation Air Transportation System (NGATS) plan. Her experience has been in the collection and analysis of data to support program investment, risk assessment, and management system evaluations, including regulations and economic incentive programs. Dr. Borener is a senior researcher in system performance modeling, having led many system performance and risk analysis studies for the Department of Transportation as well as other government agencies. Prior to joining JPDO, Dr. Borener conducted program investment and risk analyses for the National Highway Traffic Safety Administration, the Office of Pipeline Safety, the Federal Railroad Administration, Nuclear Regulatory Commission and the Department of Energy. Most recently, she has conducted major national policy research activity with NASA. She has developed advanced modeling and simulation assessment tool kits, including detailed analytical simulation and models of the U.S. and international aviation system, models of the U.S. economic and impacts of Economics Policy, aviation safety and risk models, aviation security and airport infrastructure models, and models of human and aircraft performance. Dr. Borener received her Masters of Public Policy and Ph.D. in Planning Degrees from the University of Michigan, Ann Arbor.

Jeremiah F. Creedon

Session 9

Professor, Aerospace Engineering Department
Old Dominion University

Dr. Creedon is a Professor in the Aerospace Engineering Department at Old Dominion University (ODU) in Norfolk, VA. He has been at ODU since July 2003 and is teaching in Engineering Management and pursuing research in transportation systems including Magnetic Levitation Systems and the National Airspace System.

Br[illegible]e joining ODU Dr. Creedon was employed by NASA for forty y[illegible] in a variety of research and management positions. He worked at NASA Langley Research Center (LaRC) becoming the Center Director in 1998.

In 2002, Dr. Creedon became the NASA Associate Administrator for Aerospace Technology where he was responsible for NASA efforts in Aeronautics, Space Transportation Technology development, technology to enable space science, and in Technology Commercialization (spinoff).

Dr. Creedon has B.S, M.S, and Ph.D. degrees from the University of Rhode Island and a Masters in Management Science (Sloan Program) from Stanford. He is a Fellow of the AIAA.

José Miguel De Pablo — Session 2

Division Chief
Air Navigation Systems Development (AENA–Spain)

José Miguel de Pablo holds a degree in Aeronautical Engineering. He worked as project manager responsible for INDRA (formerly INISEL). After he joined AENA, he worked as a project manager, first in the international projects area for the Automation Division and later (up to the present time) as head of the simulation and Research and Development activities in the Air Navigation Directorate. Since 2002, José Miguel de Pablo is the Leonardo Project Leader. He represents Aena in the R&D related groups of international bodies.

[illegible]id S. Ekern — Session 7

Co[illegible]missioner
Virginia Department of Transportation

David S. Ekern, P.E., was appointed commissioner by Gov. Timthy Kaine in September 2006. He had been director of the Idaho Transportation Department since July 2003. Before that, he served 33 years with the Minnisota Department of Transportation as assistant commissioner, assistant chief engineer, and as a district engineer. He also held positions in Environmental Policy, Project Development, Planning, and Operations.

From 2001-2003 he was on assignment to the American Association of State Highway and Transportation Officials (AASHTO). In that role, he focused on initiatives and policy development that are changing the face of our nation's transportation agencies.

He is a member of numerous professional associations and societies and has earned the standing of Fellow in the American Society of Civil Engineers. Ekern received his Bachelor of Science degree in Civil Engineering from the University of Minnesota and his Maters in Business Administration from the University of St. Thomas.

David A. Hinton — Session 1

Principal Investigator, NASA
NGATS ATM – Airportal Project

Mr. Hinton has been with NASA since 1979, beginning as a researcher studying crew issues (workload, controls, displays, and automation) associated with general aviation aircraft operations. Later project activities included quantifying transport aircraft performance in the context of encountering low-altitude wind shear, developing recovery options for wind shear encounters and associated requirements for forward-looking airborne wind shear sensors, and leading the fundamental research and system level integration to develop and test models and technologies for a ground-based Aircraft VOrtex Spacing System (AVOSS) to safely reduce aircraft wake-vortex spacing restrictions in appropriate meteorological conditions. Mr. Hinton has since served as the Associate Director of the Airborne Systems Competency at Langley Research Center, completed a System Design and Management Fellowship at the Massachusetts Institute of Technology, aided the development of an Integrated National Plan for the Next Generation Air Transportation System (NGATS) while serving as staff to the interagency Joint Planning and Development Office for the NGATS, and served as the Associate Director of the Aeronautics Research Directorate at Langley Research Center. In his current assignment he is responsible for the planning and execution of the NGATS ATM – Airportal Project, within NASA's Airspace Systems Program, to support the capacity, efficiency, and environmental goals of the NGATS.

Mr. Hinton has a BS in Applied Science from the University of Louisville (1979), a MS in Flight Sciences from the George Washington University (1988), and a MS in Engineering and Management from MIT (2003).

Antoine Hobeika — Session 6 & 7

Associate Professor of Civil and Environmental Engineering,
Virginia Polytechnic & State University

Areas of Interest :

* Air transportation, simulation and modeling, airport engineering, systems engineering, infrastructure systems

Education :

* B.S. in Aeronautical Engineering, Embry-Riddle Aeronautical University (1984)
* M.S. in Systems Engineering, Virginia Polytechnic Institute and

State University (1986)
* Ph.D. in Transportation Engineering, Virginia Polytechnic Institute and State University (1988)
Selected Research Projects :
* Aviation Demand Modeling of the Next Generation Air Transportation System (NGATS) Sponsor: NASA Langley Research Center
* National Center of Excellence in Aviation Operations Research. Sponsor: Federal Aviation Administration (FAA)
* Runway Exit Design for Capacity Improvements. Sponsor: Federal Aviation Administration (FAA)
* An Integrated Simulation Model to Enhance the Ground Simulation Capabilities of SIMMOD - An Airspace and Airfield Simulation Model. Sponsor: Federal Aviation Administration (FAA)
* Integrated Multimedia Courseware Repository. Sponsor: 'onal Science Foundation
:light Simulations of High-Speed Runway Exits. Sponsor: Federal Aviation Administration (FAA)

VADM James D. Hull, USCG Retired

Session 9

Vice Admiral James D. Hull assumed command of Coast Guard Atlantic Area on May 14, 2002 in the wake of 9-11. He was the operational commander for all Coast Guard activities in an area of responsibility spanning five Coast Guard Districts, over 14 million square miles, involving 33,248 military and civilian employees. He served concurrently as Commander U.S. Maritime Defense Zone Atlantic. As the senior field commander in the Coast Guard, Vice Admiral Hull's immediate focus included protecting the vital ports, waterways and borders of the United States, supporting all military preparations required by the Department of Defense, and he was an integral member of the newly formed Department of Homeland Security.

Vice Admiral Hull's previous assignments included: Director of Operations Policy at Coast Guard Headquarters, Chief of Staff for the Seventh Coast Guard District, Chief of the Budget Execution and Analysis Branch, Chief of Congressional and Governmental Affairs and Executive Director for the U.S. Interdiction Coordinator.

Vice Admiral Hull earned a BS at the USCG Academy; a Masters 'ee in Operations Research and Statistics from Rensselaer , technic Institute; a Masters of Business Administration from the University of New Haven, CT; and is a graduate of the National War College.

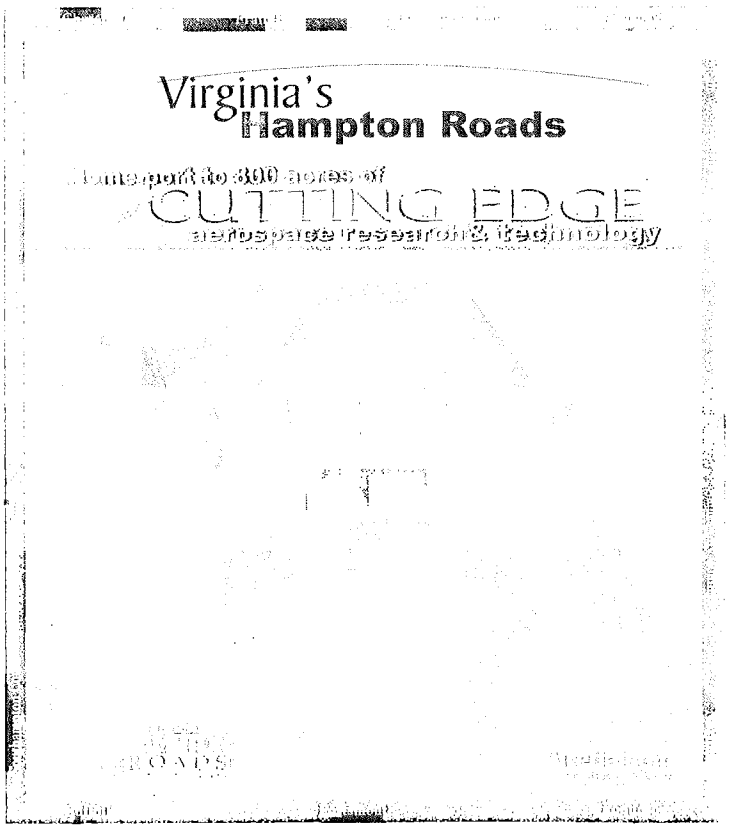
Mike Lewis

Session 1

Director Business Development
Boeing – Advanced Air Traffic Management

Mike Lewis is the Director of Programs and Business Development for Boeing Advanced Air Traffic Management, responsible for programs management, business development strategy, and business capture aimed at the mission of transforming the global air traffic management system. Mike is a member of the Boeing ATM Leadership Team.

Prior to joining Boeing in December 2002, Mike was a Senior Executive at NASA and directed numerous leading edge aviation development programs for nearly 18 years. His leadership roles have ranged from helicopter flight control system research to the development and flight test of wind shear detection systems now standard on all commercial aircraft to managing the design of a supersonic transport flight deck. In 1998, he was named the first director of NASA's highly successful $500M Aviation Safety



Program, an initiative that created an impressive number of aircraft and aviation system technology advances.

In 2001, Mike was selected as the technology staff leader for the Presidential Commission on the Future of the U.S. Aerospace Industry. His responsibilities included collaborating with industry and government leaders to assess national aerospace policy recommendations and drafting Commission reports on the need for dramatic improvements to the domestic air transport system.

Charles D. Massey

Session 9

Technical Advisor
Department of Energy

Dr. Charles Massey is an internationally recognized expert in the fields of transportation safety, vulnerability analysis, nuclear waste management, and nonproliferation.

Dr. Massey has managed programs ranging from supply chain security analysis to safety of nuclear facilities, and from detect, deter, and interdict illicit trafficking in nuclear materials to the design and implementation of risk prioritization and risk assessment models and tools.

Dr. Massey served as the Technical Advisor to the Department of Energy and was a key contributor to the development and implementation of a major nonproliferation program involving the return of highly enriched uranium reactor fuel to the U.S. and the conversion of reactors to low enriched (non-weapons grade) fuel.

Matthias Poppe

Session 2

Project Manager
ATM Research Projects

He received the Diploma and Ph.D. degree in electrical engineering and telecommunications from the Technical University of Braunschweig, Germany. He joined DFS Deutsche Flugsicherung GmbH, Research and Development in 1995. Currently he is a project manager for ATM research projects. His principal areas of activities include Operational Concept development and validation in the European context. He is also strongly involved in the Single European Sky ATM Research (SESAR) activities.

Before joining DFS, Matthias Poppe worked on research for the Aeronautical Telecommunication Network (ATN), Data Link and on Mode S avionics.

Luke Ritter

Session 5

CEO and Founder, Trident Global Partners
Author, Securing Global Transportation Networks

Luke Ritter is the founder and CEO of Trident Global Partners, a transportation consulting firm based in Annapolis, MD. He has spent his entire professional career in commercial and military transportation, operations and logistics work and specializes in intermodal transportation and security technology issues. After graduating from the U.S. Naval Academy, he served in various transportation and logistics assignments and earned a military transportation management specialist designation while on active duty. His commercial transportation experience includes work as the intermodal manager for Tropical Shipping, a container line based in South Florida, where he was responsible for all trucking and railroad operations. He also has several years of defense contractor experience, having worked for SPARTA, Inc. and Science Application International Corporation (SAIC), providing transportation and security technology solutions to government and commercial clients. Mr. Ritter holds an M.B.A., with a concentration in maritime and logistics management, from Old Dominion University. He is a Certified Transportation & Logistics Professional by the American Society of Transportation & Logistics and holds a seat on the Transportation Council of the American Society for Industrial Security. He also serves as a member of the Trade Security Working Group at the Heritage Foundation, the Maryland Critical Infrastructure Protection Working Group. Mr. Ritter was selected by the Maryland Department of Business and Economic Development to represent Maryland homeland security issues in a meeting with the U.S. Secretary of Homeland Security and has been appointed to the Maryland Transit Administration Advisory Council. He is currently listed as a transportation subject matter expert in Global Register's Who's Who in Executives and Professionals and is co-author of *Securing Global Transportation Networks: A Total Security Management Approach* published by McGraw-Hill.

Leon Stinson

Session 3

Director of Aviation Solutions
CDO Technologies

Leon Stinson is a recognized Air Traffic Control professional with over 30 years of supervisory & management experience. He started his career in the Air Force in 1972, trained and then served as an Air Traffic Controller managing tower operations at Keesler and Maxwell Air Bases.

Leon joined the FAA just prior to the strike in 1981 and rapidly completed training. He rose through the ranks from an Air Traffic Specialist

to Air Traffic Supervisor at the Fort Worth Air Route Traffic Control Center (ARTCC) in 1990.

After serving as an FAA Systems evaluator, Leon then transferred to Atlanta ARTCC where he was ultimately promoted to Assistant Air Traffic Manager. This responsibility entailed managing all facets of daily operations of the Atlanta ARTCC with over 450 employees. After retiring from the FAA, Leon "volunteered" to assist in the creation of the new Air Traffic Control system in Afghanistan. Currently, Leon is the Director of Aviation Solutions at CDO Technologies where he applies his depth of experience helping develop solutions for today's challenges in air transportation management.

Nicolás Suárez — Session 2

d of Simulation and Architecture Department
enieria de Sistemas, Madrid, Spain

Nicolas Suarez holds a BS in Aerospace Engineering from the Kansas University. He has worked since 1990 in Isdefe in different technical areas related to Air Traffic Management (ATM); currently he is the Project Manager for the Architecture and Simulation department in Isdefe's Civil System Division. Within the different ATM areas he has a strong expertise in the area of ATM system assessment and modeling. His experience also includes the elaboration of capacity and operation models of an airport including elements such as the control tower, the apron or the taxiway. He also has a strong background in the development of Operational Concepts for the operation of an ATM system. He is a member of the AIAA (American Institute of Aeronautics and Astronautics), and the ACM (Association for Computer Machinery).

Robert D. Windhorst — Session 1

Dr. Robert D. Windhorst received his BS in Mechanical Engineering from the University of California at Davis in 1993. After graduation, he spent 3 years with Space Systems/Loral working on satellite thermal control. While at Loral, he entered the graduate program at Santa Clara University. In 1996 he left Loral to pursue full time graduate research in aerospace vehicle guidance and control sponsored by NASA Ames Research Center. He completed his MS degree in 1997 and PhD in 1999. Then, NASA Ames d him as an Aerospace Engineer. Currently, he serves as chief o the Aerospace Operations Modeling Branch, a position he has held for one year. From this position, he directs research focused on modeling and simulation of the national air transportation system and air traffic management concepts.

HOMELAND SECURITY/DEFENSE BIOGRAPHIES

Wayne Buck — Session 4

Modeling and Simulation
Headquarters Supreme Allied
Command Transformation

Born in Saint John, New Brunswick, Canada, Wayne Buck always wanted to be in the Army. He joined the Canadian Armed Forces as soon as he could as a reservist in 1976, joining the regular forces a short time later. Grateful that the government paid for his degree at a civilian university, Wayne completed his basic signal officer training in 1984 and was assigned to his first operational unit.

Throughout his military career, Mr. Buck has had the privilege and pleasure of working with and commanding troops at many levels within Canada, the United States and on UN missions. He has also worked as a staff officer in several headquarters and training establishments.

In 2001, Wayne was sent to Headquarters Supreme Allied Commander Atlantic and took a position in the fledgling Concept Development and Experimentation section. He stayed with that

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We never forget who we're working for

section and guided its growth within the new Allied Command Transformation to become the Joint Experimentation, Exercises, and Analysis sub-division. As the deputy Branch Head for Operational Experimentation, then LCol Buck built the Experimentation Program into a substantial Program of Work worth some $29M within NATO.

Looking for new challenges, Mr. Buck was offered and accepted a NATO civilian position in the Future Capabilities Research and Technology (FCRT) sub-division. He is a Modeling and Simulation Research Analyst working primarily in the analytical domain. His primary responsibility is to work with Nations and coordinate their efforts with NATO.

Wayne is married to Carol (nee Myers) and they have two sons, A nder and Matthew. Alexander is in university in Canada a Matthew expects to be there soon.

Bud Hay

Director, Experimentation Group
Joint Experimentation

Orville E."Bud" Hay is often referred to as the "Dean of War Gaming". For over twenty five years he has been a major force in stretching the boundaries of the art of war gaming. A pioneer in research gaming he has created gaming formats that range from thousands of participants at distributed sites to small teams working at engineering levels of detail. From games at the White House, Pentagon, the four Services, the Combatant Commanders, the Civil Agencies and the Intelligence Community he has handcrafted games that focus on the issues that are most relevant to that specific community. Professor Hay was one of the founders of the Navy's Global War Game and was the Game Director throughout its two decade evolution. In this capacity he was a charter member of the Title X series of war games. Prof. Hay was the Chair of War Gaming and Research at the Naval War College. He has designed, directed and analyzed hundreds of games, studies and workshops over the last quarter century. Mr. Hay introduced economics into the general art of war gaming including work for the National Economic Council. He pioneered Space play and ISR capabilities into war games and was the spearhead in integrating Information Technology into operational war g s.

Currently Bud Hay is leading the Experimentation Group, focused on operations through the next two decades at U. S. Joint Forces Command, J9. He is responsible for delivering actionable recommendations, refined concepts, and innovative capabilities for transformation.

Josh Jackson

Session 3

SAIC

Mr. Jackson, a certified Project Management Professional, has more than 11 years of systems engineering, operations research and modeling & simulation experience supporting a wide cross-section of customers within the Department of Defense. Mr. Jackson earned a bachelor's degree in Mathematics and Mechanical Engineering from Virginia Tech and a MBA from William and Mary. While at The John Hopkins University Applied Physics Laboratory, Mr. Jackson supported the Standard Missile Program with engineering modeling and analysis of single crystal sapphire domes used in the guidance system. He has managed large engineering development, design, experimentation efforts to include novel shock and acoustic isolation mounts for the VIRGINIA Class Submarine. Mr. Jackson has supported the United States Joint Forces Command and Office of Force Transformation with operations research and wargaming enabling technology and capability assessments. Mr. Jackson is currently the Chief Technology Officer in SAIC's Joint Mission Support Operation and oversees a wide variety of research and development efforts. His current research interests are the integration and application of disparate analytical, modeling, and simulation tools to solve complex warfighting issues.

David J. Ozolek

Session 9

Senior Executive Service
Executive Director
Joint Innovation & Experimentation

David J. Ozolek is the Executive Director of the Joint Futures Laboratory, and the Joint Innovation & Experimentation Directorate (J9), US Joint Forces Command. He provides executive oversight of the Command's concept development and experimentation on capabilities and concepts required for the next decade and prototyping of capabilities for the joint warfighter. He also serves as the Executive Director of the Defense Joint Urban Operations Office, with responsibility for the integration of all activity supporting development of joint urban operations concepts and capabilities across the Department of Defense. He is a member of the Department of the Navy's Senior Executive Service and a retired Army officer.

Mr. Ozolek was commissioned in the Regular Army in 1970 as a distinguished military graduate of the ROTC program at John

Carroll University. During his 30 years of active service as an infantry offi- he commanded units from platoon through brigade level.

His joint and combined assignments included tours with the Military Assistance Command, Vietnam as an advisor to the Korean Tiger Division; Supreme Headquarters Allied Powers Europe as an operations analyst; US European Command as commander of the joint and combined Military Liaison Team, Hungary; and US Atlantic Command as the first director of the Joint Battle Lab.

He received bachelor degrees in psychology and philosophy, and a master's degree in literature from John Carroll University in Ohio. His military education includes the Infantry Basic and Advanced Courses, the Armed Forces Staff College, and the Army War College.

He was an Assistant Professor of English, United States Military Academy, and has authored a dozen articles published in leading U.S. and international professional military journals.

Andreas Tolk

Session 1

Associate Professor, Dept. of Engineering Management
Old Dominion University

Dr. Tolk is an Associate Professor in the Department of Engineering Management and Systems Engineering at the Old Dominion University (ODU). He is a member of the Modeling, Simulation, and Visualization faculty and affiliated with the Virginia Modeling Analysis and Simulation Center (VMASC) as a Senior Research Scientist. He received his Ph.D. in Computer Science (1995) and his M.S. in Computer Science (1988) from the University of the Federal Armed Forces, Munich, Germany. His emphasis was Applied Systems Science and Military Operations Research. Before coming to the United States in 2002, Dr. Tolk was Vice President for Land Weapon Systems and project manager for decision support systems and integration of M&S into Command and Control systems with leading German Consulting Organizations. He served as an officer in the German Army from 1985 to 1995 (and in the Army Reserve until 2002).

Dr. Tolk supported writing the NATO M&S Master Plan as a national expert. He is co-author of NATO's Code of Best Practice for Command and Control Assessment and has been the Technical Evaluator for the annual M&S Conference of NATO between 2003 and 2006. He is member of the Executive Committee of the Simulation Interoperability Standards Organization (SISO) and active member in the Society for Modeling & Simulation (SCS). He chaired various tracks and session on international conferences and gave keynote presentations and workshops on decision support and interoperability. He published over 100 journal papers and conference contributions and received more than 25 outstanding paper awards in the domain of simulation interoperability. His research interests include model-based data engineering for system of systems, agent-mediated integration of complex systems in knowledge-based environment, and military applications of M&S.

Colonel Stan L. VanderWerf

Session 1

Chief, Analysis Division of J84, North American Aerospace Defense Command & United States Northern Command
United States Air Force

Colonel VanderWerf is the Chief, Analysis Division of J84, North American Aerospace Defense Command and United States Northern Command at Peterson Air Force Base, Colo. Colonel VanderWerf, a native of Glen Rock, New Jersey, graduated from Purdue University in 1983 as a distinguished ROTC graduate earning an Industrial Engineering Degree. Since then, he obtained a Master of Arts in International Relations from the University of Dayton and a Master of Science in National Resource Strategy from the Industrial College of the Armed

Forces. He is a graduate of Airborne School, Squadron Officer's School, Air Command and Staff College, Air War College, the Advanced Program Management Course at Defense Systems Management College, Ft. Belvoir, and the Joint and Combined Staff Officer School, Norfolk Naval Base, VA. Colonel VanderWerf is a certified acquisition professional and member of the acquisition corps.

Colonel VanderWerf has held several intelligence and acquisition assignments in space and aviation fields. He served as a Joint Staff Officer at Headquarters, United States Special Operations Command, MacDill AFB, Florida as Executive Officer to SOCOM's Acquisition Executive and as System Acquisition Manager for the CV-22 tilt rotor. In June 2001, Col. VanderWerf was assigned as Chief of the C-130 Readiness Division, Robins AFB, Georgia. He r served as the Korea Commander for the Defense Contract i agement Agency (DCMA).

Session 2

The Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs

The Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs is the principal assistant and advisor to the Assistant Secretary of Defense on matters related to the overall supervision of the homeland defense activities of the Department of Defense and regional security matters for the countries of the Western Hemisphere. In addition he is responsible for the day-to-day management of the Department of Defense participation in interagency activities concerning homeland security and Department of Defense relations with the Department of Homeland Security. He is a member of the Federal Emergency Management Agency National Advisory Council. Prior to his current assignment Mr. Verga served as the Special Assistant for Homeland Security and Director of the Department of Defense Homeland Security Task Force. Born in Winston-Salem, North Carolina in 1947, Mr. Verga holds a Bachelor of Science degree in Public Administration from the University of La Verne, La Verne California, and a Master, of Science degree in Public Administration from Troy State University, Troy, Alabama. A graduate of the United States Army Command and General Staff College, he is a visiting professor at the Naval Postgradu- a :hool in Monterey, CA. He is a career member of the Senior E. utive Service, appointed to this position in March, 2003.

Mr. Verga served on the White House staff as Special Assistant to the Assistant to the President for Management and Administration, advising on a variety of matters including issues associated with continuity of the office of the Presidency, continuity of government and classified, sensitive emergency plans and programs in direct support of the President. This followed duty as Deputy Director of the Office of Emergency Operations of the White House Military Office and in the Operations Directorate of the Joint Chiefs of Staff.

Bria :rden Session 6

NATO Consultation
Command & Control Agency

Brian Witherden was appointed Resource Centre Manager of the Operational Analysis & Exercise Support Resource Centre in the Operations Research Division of the NATO C3 Agency in The Hague, The Netherlands in April 2006. He was previously both the IPT Leader and Resource Manger in the Modeling & Simulation and Training Applications areas since 2000.

Born in 1951 in Swansea, Wales, he was educated at Doncaster Grammar School, and Merton College, Oxford University where he obtained a first class honours degree in Mathematics and a Master of Science. Following research at the Rheinisch Westphälische Technische Hochschule in Aachen, Germany he joined NATO as an analyst-programmer at HQ AFCENT in 1977. He joined the then SHAPE Technical Centre in 1981 as a Senior Scientist in the Operations Research Division.

During the following years he was heavily involved with modeling aspects of wargaming and exercises, and in particular the simulation of theatre level air operations. After his promotion to Principal Scientist in 1987, he was responsible for a series of wargames with senior officers which constituted the main input to the NATO Forces at Parity Study in 1990. This study, during its lifetime, continually formed the basis for the NATO position at arms negotiation talks in Vienna following the collapse of the old Warsaw Pact.
Since then he has been involved in the initial IFOR deployment to Bosnia with analytic support to the movements cell at SHAPE and with movement analysis for the Joint Analysis team. He also contributed to a SHAPE study of Operation Deliberate Force, and has been instrumental in providing Operational Analysis (OA) support to many major exercises. The success of this effort was a factor in the establishment of OA cells in many NATO Headquarters. He has also been responsible for the holding of NATO HILEX events at STC/NC3A since they started in 1995.

EDUCATION BIOGRAPHIES

Len Annetta

Session 5

Assistant Professor, Science Education
North Carolina State University

Dr. Len Annetta is an assistant professor of Science Education at North Carolina State University. His research has focused on distance learning and the effect of instructional technology on science learning of teachers and students in rural and underserved populations. His research has cascaded from his dissertation on comparing three different distance delivery strategies on science teacher professional development to his current focus on evaluating video games as a teaching and learning tool and as a vehicle for synchronous online instruction. Understanding the popularity of online, multiuser videogame play, Dr. Annetta began to use his past programming knowledge to build a virtual environment that became the platform for his current research. Through two separate internally funded grants, he designed and created a synchronous, online 3D virtual environment for distance learning courses offered at North Carolina State. His most recent endeavor, HI FIVES (Highly Interactive Fun Virtual Environments in Science-ESI-0525115), has been funded by the National Science Foundation to investigate the viability of video games as a supplement to science instruction in grade 5-9. This project seeks to teach both teachers and students to design and build multiplayer games that align with state and national science and mathematics standards. HI FIVES seeks to answer such questions as can students learn STEM content through playing and/or designing videogames. He is also exploring the interaction dynamics of multiple students in a 3D online environment as a function of increased engagement and achievement. Further, he seeks to explore how teachers use the games as a teaching tool and if the common student experiences can be used for inquiry instruction.

Tyler R. Bangert

Session 3

Science Teacher
Alchesay High School, Whiteriver, AZ

Tyler Bangert received his Bachelor's degree in Engineering from Saint Louis University in 1983. He worked in the engineering field for a short time, and then he began teaching high school in 1986. Tyler has been in education ever since with twelve of these years in the Republic of Palau and the Northern Marianas Islands.

Tyler has completed graduate work in Education, Educational Psychology, Astronomy and Administration, and he earned a Master's degree in both Community Leadership and School Administration. Of his time in education, six of those years have been as Principal.

Currently, Tyler is a certified teacher in Physics and Mathematics at Alchesay High School in Whiteriver, Arizona. This summer he began graduate work in Physics and Chemistry with the Modeling method at Arizona State University, and believes that this method is excellent, especially for the population of students work with – Native Americans.

Bethany Hudnutt

Session 5

Interactivate Project Manager

Bethany Hudnutt is the project manager for Interactivate, Shodor's interactive online K12 mathematics courseware. As project manager, Bethany focuses on developing interface designs for the use of modeling and visualization tools in the teaching and learning of mathematics and also develops curricular materials for the integration of such tools into the curriculum. Bethany has been with Shodor for seven years and has a master's degree in mathematics education from the North Carolina State University.

Through her work at Shodor, Bethany provides professional development for teachers and faculty, develops curriculum and leads workshops for middle and high school students, and also mentors high school and undergraduate students involved in Shodor's internship and apprenticeship programs. Bethany's background experience includes teaching high school mathematics and research and development within the standardized testing industry.

John Jamison

Session 3

Program Director
DeVry University

John Jamison is National Program Director for the Game and Simulation Programming Program at DeVry University, as well as Chief Creatologist of imagiLearning, Inc., a company focused on creating the future of learning through blending the game-culture with traditional education to create something very strange, but very good for learning. He is currently totally lost in his dissertation research using Second Life (SL) to introduce traditional educators to the digital culture and its impact on adult learning theory, sitting back and quietly giggling as they all move from initial panic to full-blown SL addiction. John brings 20 years experience in education and educational technologies focusing primarily on learning centered instruction and faculty development, and in rare moments also speaks of his prior 20+ years past-life as a pastor and pastoral psychologist. Currently

playing with his three personal sims in SL, he manages the new sim for the DeVry program, along with consulting with schools both in and yet outside of SL. John is a frequent presenter at carbon-based and virtual conferences.

Kenneth R. Koedinger

Session 1

Carnegie Mellon University

Dr. Kenneth Koedinger has a BS in Mathematics, an MS in Computer Science, a PhD in Cognitive Psychology, and experience teaching in an urban high school. This multi-disciplinary preparation has been critical to his research goal of creating educational technologies that dramatically increase student achievement. Toward this goal, he creates "cognitive models", computer simulations of student thinking and learning, that are used to guide design of educational materials, practices and technologies. These cognitive models provide the basis for an approach to educational technology called "Cognitive Tutors" in which rich problem-solving environments are created for students to work in and provide just-in-time learning assistance much like a good human tutor does.

Kenneth has developed Cognitive Tutors for mathematics and science and has tested them in the laboratory and classroom. In a whole-year classroom study with our Algebra Cognitive Tutor, He has shown that students in the experimental classrooms outperformed students in control classes by 50-100% on targeted real world problem-solving skills and by 10-25% on standardized tests. My research has contributed new principles and techniques for the design of educational software and has produced basic cognitive science research results on the nature of mathematical thinking and learning. Kenneth has authored 67 peer-reviewed publications, 6 book chapters, and 42 other papers and has been a Project Investigator on 16 major grants. He is the co-founder and board member of Carnegie Learning, Inc. and the CMU director of the Pittsburgh Science of Learning Center (PSLC). The PSLC is a $25 million National Science Foundation center that will provide researchers with the "LearnLab", an international resource for creating, running, and analyzing realistic and rigorous experiments on human and machine learning.

nes Mi...ogue

Session 5

...ssistant Professor, Elementary Education
North Carolina State University

James Minogue received his Ph.D. in Science Education from North Carolina State University (NCSU) in 2005 where he is currently an Assistant Professor in the Elementary Education Department. Prior to joining NCSU he was an Assistant Professor in the Department of Elementary and Early Childhood Education at The College of New Jersey in Ewing, New Jersey for two years. Armed with eight years of experience teaching middle school science, Dr. Minogue's research efforts center on science teacher education, haptic (sense of touch) perception and cognition within the context of teaching and learning, and the efficacy of haptically augmented virtual environments. His current projects involve the development and testing of "haptically rich" multimodal computer-based instructional programs for the teaching of school science concepts. The aim of such work is to enhance students' interest in and understandings of science, as well as to systematically link the knowledge flows of fundamental learning about haptic perception and cognition with that of haptics as an intervention for change.

Maja Pivec

Session 4

Professor of Game-Based Learning
University of Applied Sciences

Maja Pivec received her PhD at the Graz University of Technology and is now professor of Game-based Learning and Learning with Multimedia at the University of Applied Sciences in Graz, Austria. During 1993 – 2004 she received numerous international grants and awards for her research in the field of innovative computer-based learning approaches and knowledge based systems, including the 2001 Herta Firnberg Award (Austria) in the field of computer science.

She was scientific leader of the UniGame EC Minerva founded project (www.unigame.net, finished 2004). She is project co-ordinator of SIG-GLUE EC eLearning project (www.sig-glue.net), and of Austrian national project AdeLE (http://adele.fh-joanneum.at). She is editor and co-editor of two book publications in the area of innovative learning approaches.

- Pivec M (Ed.) Affective and emotional aspects of human-computer interaction; Game-Based and Innovative Learning Approaches. Vol.1: The Future of Learning (IOS Press, 2006), ISBN 1-58603-572-x
- Pivec M., Koubek A., Dondi C. (Eds.): "Guidelines on Game-Based Learning". Pabst Vrlg. 2004, ISBN: 3899671937

She was also the guest editor of the May 2007 issue of the British Journal of Educational Technology's (BJET), special issue on learning from games and has published and presented at more than 70 international conferences and publications. Dr. Pivec is

an international advisory board member of the Malaysian Journal of Educational Technology (MJET); the Program Committee member e GAMEON conference and DIGITEL 2007 workshop; and is a reviewer for the European Science Foundation and for BJET.

David Weaver Session 3
Physics Faculty
Chandler-Gilbert Community College

David Weaver was hired to design and implement a new Electronics/ Microprocessor Technology program at Scottsdale Community College in 1982. He then moved to Chandler-Gilbert Community College in '87 to teach physics and do staff development and has been at the Williams Campus of C-GCC for the last dozen years. He's taught all levels of community college physics, 16 different electronics courses, as well as capstone, student success, and computer art courses. He has served as faculty association president, division chair, occupational dean, instructional council chair, president of the state physics teachers organization, Ocotillo (district technology leadership) chair, and co-PI of and participant in numerous grants focused on helping K-12 teachers improve their content and pedagogical knowledge.

Catherine Wyman Session 3
Associate Program Director
DeVry University

Catherine Wyman is Associate Program Director at DeVry University. She began her career with DeVry in 1991 as an Associate Professor in Computer Information Systems. An avid gamer, her work in the classroom has employed active learning strategies with gaming to engage students and make learning fun. In 2005 she was promoted to Online Program Dean for Game and Simulation Programming (GSP). In 2006 she was again promoted to Curriculum Manager and in 2007 to Associate Program Director for GSP. She has written C, C++, Java and Visual Basic textbook ancillaries, reviews, and papers on learning models and eLearning tools.

MEDICAL

Abstracts

MEDICAL ABSTRACTS

Health Care Return-On-Investment Needs a Systems Approach to Training and Treatment

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Uniformed Services University
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Abstract. This paper examines the intuitive results of applying a Systems Approach to Training and Treatment to managing clini- l resources. We begin by examining the successes achieved in imilar high reliability activity, aviation, when it adopted model- ing and simulation within a systems approach. The problem we now face is that we are expending an ever-greater fraction of our wealth upon healthcare but no longer gaining proportional increases in health. Today's approaches to treatment, and to training those learning to provide treatment, are based on ad hoc models now over a century old. A system-wide, high-level change in operating model is required to restore financial health to large-scale clinical resource management while retaining our current high quality of small-scale care.

We propose a new operating model: a Systems Approach to Training and Treatment. This approach starts with applying the Systems Approach to Training (SAT), a well-characterized and proven process that has greatly reduced losses of time, money and lives in mature, high-risk activities such as aviation. Using such an SAT approach, the whole healthcare training and delivery system can be systematically designed to minimize cost and risk while ensuring performance quality.

Stress and Workload Associated with Monitoring Simulated Maternal-Fetal Heart Rate Signals

Brittany L. Anderson Mark W. Scerbo Lee A. Belfore, II
Old Dominion University

'ostract. Numerous studies show that individuals have difficulty onitoring displays for critical signals over extended periods of time and that the activity is considered challenging and stressful. An example of one such task occurs in Labor and Delivery units where nurses and physicians must often examine signals generated by maternal-fetal heart rate (MFHR) monitoring equipment over the prolonged course of a woman's labor. The goal of this study was to determine the levels of stress and workload associated with monitoring MFHR signals. Participants monitored simulated MFHR signals for critical signals (late decelerations) of either moderate or low magnitude over the course of a 48-mintute vigil. They reported their perceived levels of stress on the SSSQ (Helton, 2004) and workload on the NASA-TLX (Hart & Staveland, 1988), before and after performing the monitoring task. The results showed that participants reported significantly higher levels of distress and lower levels of task engagement after completing the vigil. With respect to workload, participants reported significantly higher levels of frustration and poorer levels of performance, but lower temporal demand after the vigil. The magnitude of the critical signal had no effect; thus, signals that were easier to detect did not reduce the stress or frustration. The results for stress are consistent with those of other vigilance studies; however, the workload scores were lower than those typically reported by other researchers. It is possible that monitoring continuous signals like those associated with the MFHR task may be less demanding than the discrete signals often studied in other experiments.

Decoupled Agent Architecture for Virtual Operating Room Training Simulations

Emre Baydogan; Lee A Belfore, II; Saurav Mazumdar
Department of Electrical and Computer Engineering
Old Dominion University

Abstract. The Virtual Operating Room (VOR) is an operating room training environment capable of supporting team training for surgical procedures. One of the challenges of creating such training environments is assembling a suitable team of participants for a training session. In the VOR, simulated agents are substituted for actual participants enabling the ability to conduct training sessions with a few and even one participant. Agent behavior is defined by two components: 1) agent behavior in the context of the specific task context, and 2) the agent personality. Agent behavior is defined by an automaton that incorporates these behaviors. Furthermore, each agent is an independently acting automaton, facilitating the integration of different behaviors and characteristics without affecting other aspects of the environment implementation. The agent automaton interacts with others in the environment through the specific inputs and outputs. The inputs take the form of inputs from the voice recognition, environment sensors, equipment simulators, and other similarly enabled training equipment. Medical procedures that form the baseline activities for the training session form the

context and setting for the training procedure. Sequencing and structured interchanges among the participants for a successful procedure is the main contribution to agent automaton behavior. In addition, branching caused by injected complications, interruptions, and other external stimulus is layered upon the baseline procedure. In order to compose, manage, and maintain training scenarios, the exercise and agent automatons are represented in an XML format. Furthermore, a simple authoring environment is integrated to allow the creation of scenarios without having to do additional application development. Finally, the simulation architecture was created to decouple the various major components of the system including voice recognition and rendering to provide for modular development and also to support other technology platforms.

A Fetal Heart Rate Monitor Simulator

Lee A. Belfore II Mark W. Scerbo Brittany Anderson
Old Dominion University

Abstract. A fetal heart rate monitor records fetal heart rate variations and uterine contractions. The fetal heart rate monitor is an important piece of medical equipment used to monitor the well being of the fetus during labor and delivery. The monitor provides a time recording of the contraction pressures in mm Hg and the fetal heart rate. The simulator software architecture provides several important functions including tracings of the fetal heart rate and contraction profiles as a function of time. In addition, the simulator has the ability to model several situations including both normal and pathological conditions. The fetal heart rate monitor simulator can be used in proficiency training for actual fetal heart rate monitors and psychological testing for identifying pathological situations in continuous time environments.

The Emerging Imperative for Medical Simulation

C. Donald Combs, PhD; Robert J. Alpino, MIA
Eastern Virginia Medical School

Abstract. Medical simulation has now become an accepted methodology for both educating future medical practitioners and for providing ongoing training and assessment for current practitioners. What have been the driving factors behind this acceptance? After all, many studies have described the centuries-old persistence of the apprenticeship model of medical education. This paper focuses on key trends in medical education, in health care delivery and in medical ethics that have resulted in this acceptance and identifies trends that may further influence the utilization of simulation methodology in the future.

Registration of 3D CT model of the Pectus Excavatum Chest to Subject: Methodologies Utilizing 3D Laser Surface Scanning

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Department of Modeling and Simulation, Old Dominion University
Virginia Modeling, Analysis, and Simulation Center

Abstract. We describe a project in which ultimate goal is to ensure accurate acquisition of force deflection measurements taken from the pectus excavatum chest. Segmentation and reconstruction of the rib cage and costal cartilage will provide us with a 3D CT model of the subject's chest area. The crucial step in this process is the registration between the 3D CT model and the subject himself. This enables data collection points to be taken from the subject by an experienced clinician with tracking and force-deflection measurement devices. The results are then validated through comparison with the 3D CT model and a 3D surface scan of the subject. In this paper, we discuss the primary method of obtaining these measurements using a FARO robot arm. We also elaborate other proposed methods of enhancing the data collection ability while reducing the errors involved in obtaining such measurements. The additional proposed methods include better guides using additional virtual and physical 3D models as well as employing a stylus compatible with the laser surface scanner instead of the FARO arm robot. Each of these methodologies will be tested and the one yielding the least amount of error will be used to ensure accurate data collection.

Improving Residency Training in Ob-Gyn Emergencies Utilizing Simulated Team Drills

Adair R. Heyl, Ph.D. Elizabeth A. Schmidt-Panos
Eastern Virginia Medical School

Abstract. Simulated team drills were conducted for obstetrical emergencies to assess team training, coordination, and adherence to accepted standards of emergency obstetrical care. Obstetrical team drills offer an alternative educational experience for obstetrics and gynecology (ob-gyn) residents and nurses by simulating urgent events that occur on Labor and Delivery in a hospital setting. Our team conducted real-time unannounced umbilical cord prolapse emergency drills at Sentara Norfolk General Hospital. A full-size female mannequin, NOELLE™, with fetus served as the obstetrical emergency patient. Other members of the ob-gyn staff provided vocal patient interaction with the Labor and Delivery nurses and residents. All Labor and Delivery personnel were instructed to treat each team drill as if they were interacting with a genuine patient. After each drill con-

cluded, all participants completed individual and team assessment surveys and checklists that were used to assess adherence to obstetrical emergency protocol. The data presented in this paper represents the initial phase of the study for the obstetrical emergency of cord prolapse leading to cesarean section. Our survey results suggest that most Labor and Delivery team drill participants rate their leadership and skill level relatively high. However, a faculty attending educator rated the residents' skill levels and management of the obstetrical team drill less favorably. Thus, while the majority of nurses and residents reported that their obstetrical emergency management skills are above average, the attending's ratings did not concur.

Got Team? Now What?

ıdia L. Johnston, Ph.D., Associate Vice President for Special ects
Texas A&M University-Corpus Christi
CDR. James R. Dunne, M.D., U.S.N., Chief of Trauma/Surgical Critical Care
National Naval Medical Center, Bethesda, Md.

Abstract. The collaboration of medical education research and serious-game development plots a tricky course through unknown territory for both. Their interests coalesce around producing a medical learning platform, but both streams of interest are driven by undercurrents of clashing assumptions about the nature of the work. It is essential from the outset of any collaboration of this kind – higher education research with private industry – that these assumptions become matters of consensus lest they become factors in failure. Pulse!! The Virtual Clinical Learning Lab, a research project at Texas A&M University-Corpus Christi, has successfully navigated some uncharted waters in bringing the beta version of its three-dimensional virtual learning platform to test beds at three major medical institutions. The project is a collaboration of the university with BreakAway Ltd., an industry leader in modeling and simulation software used for developing computer games, military/government training applications and advanced data visualization tools; however, the web of collaboration extends well beyond the work BreakAway has been hired to do with the university. It includes an international team of experts in medical treatment and education, ·tronic modeling and simulation and learning in virtual space. conversation is extensive and not without flash points, as scholars and game developers come to terms in theory and practice. The Pulse!! collaboration is unique in medical education – research grounded in demonstrable theory structured to produce valid, reliable data in response to a hunch that high-level clinical medical learning and skills can be acquired through video game technologies pushed to the highest levels of experiential fidelity. If the project's animating theory proves true, the payoff for medical education will be an innovative means of acquiring clinical skills based on critical thinking and iterative training in virtual space: and for business, a well-deserved piece of the pie.

Evaluation of a Procedural Checklist for Anesthesia Pre-induction and Induction

Alison Kelly; Michael Jackson; Elizabeth T. Newlin; & Mark W. Scerbo
Old Dominion University

Abstract. Traditionally, nurse anesthesia students begin clinical training without previous exposure to the operating room (OR). Anesthesia simulation training would improve students' proficiency at performing procedures prior to their clinical rotations. The purpose of the present research was to develop and evaluate a procedural checklist. The checklist addresses the students' proficiency at performing pre induction, induction and basic procedures and consists of essential items such as "administers induction agent," each with a point value. The training itself addresses the roles of OR personnel, sterile technique, patient monitoring, anesthesia ventilators, the anesthesia machine, patient monitoring systems specific to the OR, airway management, intubation techniques, anesthetic instruments and pharmacologic agents.

The checklist was evaluated by comparing trainee effectiveness on pre induction and induction procedures before and after simulation training. Twenty-three nurse anesthetist Old Dominion University graduate students were trained and videotaped in a simulated environment using the Laerdal, Inc. SimMan simulated patient. Students were allowed two attempts to intubate the patient.

Several repeated measures ANOVAs were used to determine differences between pretraining and posttraining using each student's best score obtained from the two posttraining assessments. Results indicated that simulation training improved student performance. There were significant increases from pretest to posttest on the overall checklist scores, pre-induction scores, induction scores, and procedural rating scores (all tests $p < .001$). The findings show that simulation training is effective for improving procedural performance of patient monitoring, airway management and intubation techniques. The procedural checklist was shown to be sensitive; it clearly distinguished

between levels of training. The improvement in performance should help relieve stress for the student and preceptor, thus reducing human error and ultimately improve patient safety and health outcomes. Future research is aimed at examining sensitivity among experienced anesthetists and other medical scenarios.

Neuro-cognitively Designed Dynamic Simulations For Laparoscopic Surgical Skills

Kanav Kahol, PhD.; Marshall L Smith, MD, PhD
Department of Biomedical Informatics, School of Computing and Informatics, Fulton School of Engineering, Arizona State University
Simulation and Training Center, Banner Good Samaritan Medical Center

Abstract. Human-in-the-loop simulations are increasingly driven by real time measures of a trainee's performance which often include neural measurements such as electroencephalogram (EEG). In this paper, we present a system and its initial usability evaluations that employ EEG measurements of a user to (a) gauge the current attentional and fatigue levels of a user when performing simulations designed to hone surgical skills and (b) dynamically alter the simulations based on current performance levels of the user. EEG ratings were acquired using a 6 channel Bluetooth EEG Cap. The B-Alert® software was analyzed to reveal ratings of alertness/drowsiness, engagement, mental workload and distraction. These ratings showed statistically significant differences between groups divided on experience level (1st year residents versus 2nd year residents and 3rd year residents $p<0.05$). Residents performed a specially designed ring transfer task in haptic simulation. Residents were tasked with grasping a series of "virtual" rings and placing each on randomly highlighted pegs on a board. In order to dynamically vary the complexity of the task, the orientation of the peg board and the ring position were chosen as the parameters for variation. The orientation and ring position changed to offer a degree of difficulty or simplicity depending on the neuro-cognitive analysis of the users performance determined through the EEG analysis. The results showed that the overall proficiency and skill of the users with this system was significantly better than a control group of residents trained with conventional training system and suggest that neuro-cognitively driven simulations may provide an effective basis for surgical training.

Medical Simulation in the Military: Current initiatives, and a framework for future directions

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Abstract. Simulation has become an accepted form of training within the medical community. The majority of US medical schools have integrated simulation into its curriculum to varying degrees. Recent regulatory action has reaffirmed the value of simulation.

The US military healthcare system is among the largest trainer and employer of medical personnel in the nation. Simulation plays an increasingly central role in their education. The adoption of simulation has occurred in many institutions within the military in a decentralized fashion. While this has encouraged a diversity of valid approaches, a potential for duplication of effort exists. In this workshop, we examine the accomplishments and implications of medical simulation use in the military. The session will begin with a survey of medical simulation initiatives for each branch of the military. Common goals and present limitations will be highlighted. This workshop will also propose a unified framework for structuring medical simulation initiatives within the military. The intent is to suggest guidelines for coordinating effort, enhance the effectiveness of individual programs, and make the process of bringing simulation to the military more efficient. Implications for research directions and technical developments will also be discussed. The workshop will conclude with a forum for discussion.

OntoVOR: The Design of a Knowledge-base for a Virtual Operating Room

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Abstract. The design of OntoVOR: knowledge-base for a Virtual Operating Room is presented. A Virtual Operating Room (VOR) is an immersive training environment wherein a medical team can be trained to perform a variety of surgical procedures. A trainee may work in tandem with a real or virtual medical team in the VOR. The VOR software architecture is agent-based, decoupled, and its interfaces allow for extensibility with respect to surgical procedures and simulation models. An explicit specification of VOR concepts for an operating

room, surgical procedures, and simulation models, support the open VOR software architecture and can provide several benefits. Ontologies in OntoVOR can assist in dynamic generation of the simulation controller classes. The level of detail involved in a particular surgical process can be explicitly defined. The generation of training scenarios may be semi-automated. OntoVOR can assist in improving word sense disambiguation and keyword expansion for improved speech recognition and stimulus to the controller. The ontologies in OntoVOR are committed in supporting the VOR software architecture. Minimum commitment may be obtained by the reuse of existing biomedical networks. The ontologies are being constructed in OWL-DL and are under active development. Description of key components of OntoVOR and strategies to use these components to achieve the above mentioned goals is discussed.

Disease Interaction in Cognitive Simulations for Medical Training

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Abstract. Maryland Virtual Patient (MVP) is a simulation and tutoring system for training medical personnel in cognitive decision making skills. It is implemented as an agent network using an ontological knowledge substrate. This paper focuses on disease interaction in the MVP environment including how diseases and/or their treatments can automatically give rise to other diseases, and how disease manifestation can be altered by another concurrent disease.

The MASTRI Center: Medical Simulation for Skill Acquisition

Gerald R. Moses, PhD, Director MASTRI Center; F. Jacob Seagull, PhD, Director, Education Research; Ivan M. George, Advanced Technology Specialist; Adrian E. Park, MD, Chair, Department of General Surgery
University of Maryland Medical Center

Abstract. The Maryland Advanced Simulation, Training, Research and Innovation (MASTRI) Center was established by the University of Maryland to provide cutting-edge simulation and training to surgeons, nurses, anesthesiologists, and allied healthcare professionals. The center employs both low-and high-fidelity simulators for surgery, anesthesia, and trauma procedures. This paper will discuss strategies to maximize efficacy in the use of high- and low-fidelity in medical simulation in Minimally Invasive Surgery (MIS). MIS is particularly well suited for simulation, as the "natural" method of viewing surgery is via a video monitor, and surgical instruments isolate the surgical field from the surgeon's hands. Surgeons developing MIS skills face two challenges: First, they must develop a unique set of manual skills associated with the MIS environment; second, they also must develop the appropriate cognitive skills associated with judgment and decision making. To address the first challenge, low-fidelity simulators are used to develop fundamental skills. Using realistic instrumentation and displays and low-fidelity "mock-up" tasks, surgeons can learn to manipulate objects effectively. In traditional surgical training, decision making and judgment are still acquired primarily through supervised experience in the operating room. However, virtual reality simulation of surgical procedures can provide an alternative to training on real patients. Virtual reality can provide the means to present appropriate challenges to the learner, within an error-tolerant environment. Virtual environments afford easy acquisition of objective measures of performance that are not readily available through either low-fidelity simulation or operating room performance. This presentation will discuss the MASTRI Center's strategies for developing and deploying both low- and high-fidelity simulation, and the challenges/obstacles faced in the application of educational theory to real-world training of surgeons.

Design of a Digital Cerebrovascular Simulation Model for Teaching and Research

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Abstract. We developed a comprehensive cerebral blood flow and intracranial pressure model to simulate and study the complex alterations in cerebrovascular dynamics caused by multiple simultaneous alterations, including normal and abnormal functional states of the auto-regulation of the brain.

Equations (derived from animal and human studies) were implemented into a simulation program (Berkeley Madonna, version 8.0.1, 1997-2000 Robert I. Macey & George F. Oster). Included in the normal physiological modelling was: cerebral blood flow

(one single path), blood pressure, and carbon dioxide (CO2) partial pressure. We also added external and pathological perturbations, such as intracranial hemorrhage and head up position.

The model was stable when tested for extremes of input parameters. The main manoeuvres simulated include changes of basic physiological inputs (e.g. blood pressure, central venous pressure, CO2 tension, head up position, and respiratory effects on vascular pressures) as well as acute intracranial bleeding, and obstruction of cerebro-spinal outflow. The model performed clinically realistically given inputs of published traumatized patients and cases encountered by clinicians. The pulsatile nature of the output graphics was easy for clinicians to interpret.

Based on the results, we believe the model would be useful to teach complex relationships of brain hemodynamics and study clinical research questions such as the optimal head-up position, the effects of intracranial hemorrhage on cerebral hemodynamics as well as the best CO2 concentration to reach the optimal compromise between ICP and perfusion.

With the ability to vary the model's complexity, we believe it would be useful for both beginners and advanced learners. The model could also be used by practicing clinicians to model individual patients (entering the effects of needed clinical manipulations, and then running the model to test for optimal combinations of therapeutic manoeuvres).

Individual Personality Characteristics for Virtual Agents in a Virtual Operating Room

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Abstract. The Virtual Operating Room (VOR) is a fully immersive virtual environment representing a standard OR that incorporates real and virtual equipment as well as other medical simulators. Trainees can interact with a surgical team comprised of real and/or virtual team members. The VOR allows residents, medical students, and nurses to learn technical skills as well as social skills within a changeable, digital environment. Virtual agents representing different members of the surgical team have been created and have unique knowledge structures and personalities. The personalities were developed using the Big Five Model as well as the ACL-FF and AB5C models. The Big Five model represents personality with five factors: Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness. The ACL-FF and AB5C models provide more detail about the nature of personalities and their relationship to the five factors. Personality is reflected in the virtual agents primarily through scripted statements and variations in the pitch, volume and rate of speech produced by the text-to-speech engines. The VOR environment provides a forum for surgical team members to sharpen their interpersonal skills with less social inhibition than they might have when interacting with one another in more typical role-playing scenarios.

Procedural Modeling of Wound Textures

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Abstract. Surgical simulation is a valuable addition to traditional teaching methods in the field of medical education. Virtual reality based training systems have been developed for various surgical fields. Realistic simulation of scenes with anatomically correct organ models and textures is the main objective of such systems. The surgical wound debridement simulator was developed to provide training of surgical wound debridement in a virtual environment. In the wound debridement simulator, wound cleanliness is modeled by a series of texture images, simulating a variety of debris around the contaminated wound. Previously the wound texture images were created by artists manually with considerable efforts. In this paper, we propose an algorithm to automatically generate the wound texture images used in the wound debridement simulator. The proposed method is a two-pass procedure. In the first pass, noise is generated based on spectral synthesis to simulate the dirt and debris on the wound. In the second pass, the noise locations are computed based on elliptical shape composition. By automatically generating the wound textures, each execution of the wound debridement simulation produces new a set of wound conditions, greatly enhancing the range of scenarios that the trainee can experience and hence improving the training outcome.

Innovative Uses of Simulation Technology in the Classroom Environment: Paving the Road for Sim-Based Curricula

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Abstract. The purpose of this paper is to introduce two innovative uses of simulation technology in the classroom room environment:

Abstracts

I) Use of simulation to introduce students to a clinical skill, and II) Use of simulation as a POP-QUIZ during a classroom-based lecture series. Our experience using and evaluating these new approaches have been positive and lend support to further research investigating the various ways in which simulation technology may benefit the learner by changing the classroom.

Proficiency-Based Laparoscopic Simulator Training Leads to Improved Operating Room Skill that is Resistant to Decay

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stract. Proficiency-based laparoscopic simulator curricula have proved effective in improving operating room performance of trainees; however, little is known about the retention of acquired skills. The purpose of this study was to assess skill retention in the operating room following completion of a validated laparoscopic skills curriculum. Novices (n=15 students) with no previous surgical or simulator experience were enrolled in an IRB-approved protocol. Participants were randomized in a 3:1 fashion to training and control groups, respectively. Training group participants (n=11) practiced in laparoscopic suturing and knot tying on the Fundamentals of Laparoscopic Surgery suturing model until previously reported proficiency levels were achieved. The suturing performance of both groups was assessed on the simulator and on a live porcine laparoscopic Nissen fundoplication model at training completion (post-test) and 5 months later (retention-test). Performance was measured with objective scores based on time and errors. No further training or operative exposure occurred between testing sessions. Analysis was by paired and unpaired t-test ($p<0.05$ considered significant). Results are reported as mean ± sd. All participants completed the study. Training to proficiency required 4.7 ± 1.2 hours and 41 ± 10 repetitions. The performance of the control group did not change between testing sessions. Trained participants outperformed controls during both sessions ($p<0.001$). While the simulator performance of trained participants deteriorated slightly between the post- and retention tests (505 ± 22 vs. 462 + 50, respectively; $p<0.05$), their operative room performance
nained stable (263 ± 138 vs. 279 ± 88, respectively; p=n.s).
roficiency-based simulator training results in durable improvement in operative skill of trainees even in the absence of practice for up to 5 months. Minute skill decay on the simulator does not appear to affect operating room performance. These findings provide further support for the incorporation of proficiency-based simulator curricula in surgical training.

Integrated real time performance feedback during simulation based surgical skill training

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Virtual Reality in Gait Rehabilitation

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2 Virginia Modeling Analysis and Simulation Center, Old Dominion University, Virginia USA
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Abstract. This paper describes an innovative approach to gait rehabilitation via a system that combines the use of traditional and advanced rehabilitation techniques with a virtual reality (VR) training environment. The VR-Gait system that has been developed consists of VR software that generates and displays a dynamic urban environment on a large high definition television mounted in front of a treadmill. The treadmill is paired with an overhead suspension device that can provide a patient with partial weight support. Inertial tracking is used to actively monitor a patient's posture during a training session and prompt auditory cues that encourage a patient to maintain correct walking posture. This project aims to demonstrate that improved gait rehabilitation can be accomplished using a VR environment composed of widely available, relatively inexpensive, and unobtrusive hardware components. This project will also have the capability to improve medical decision-making by providing objective guidelines for patient progress and projected functional outcome. A validation study with stroke patients is currently ongoing.

An Approach to Identifying the Biomechanical Differences Between Intercostal Cartilage in Subjects With Pectus Excavatum and Normals in vivo: Reconstruction and CT Registration

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Abstract. Pectus excavatum (PE), also called sunken or funnel chest, is a congenital chest wall deformity affecting the ribs and sternum and exhibiting a concave appearance in the anterior chest wall. In this paper, we describe a study to investigate in vivo differences in the pectus excavatum rib cage and outline initial steps using Visible Human data in developing models and methods to be used in carrying out the study. We propose methods to develop reconstructed models in order to enable proper registration between locations on the 3D rib cage model reconstructed from CT data and measurements taken from PE patients. A 3D laser scan of the patient will be used for validation purposes. A Polhemus Fastscan 3D laser scanner is used to produce a non-invasive way of quantifying the surface of the subject's chest, which can then be compared with the 3D reconstructed CT model to estimate the errors with these procedures.

EMS And Virtual Reality Demonstration Of Feasibility

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stract. Objectives: Recent research suggests that entering an immersive virtual reality (VR) environment can serve as an adjunct for management of painful conditions. Advances in the portability of VR equipment now make this technology accessible to austere clinical environments such as EMS. We sought to demonstrate that VR could be utilized in an EMS environment. Methods: Sixty healthy volunteer subjects, serving as simulated patients, were randomized for evaluation under three conditions for 20 minutes each: A) No VR, in moving ambulance (baseline), B) VR in stationary ambulance, and C) VR in moving ambulance. The VR system included a head mounted video display unit, audio headphones, and the SnowWorld VR software. After each condition, subjects evaluated their nausea with a 10 cm visual analog scale (VAS). After each VR condition, subjects evaluated their nausea using the Kennedy Simulator Sickness Questionnaire (KSSQ) with a score range of 0 to 300. They also rated their sense of presence in the VR world, the ease of use, and comfort of the VR equipment on a 10 cm VAS. Statistical analysis was performed with non-parametric tests for paired groups and repeated measures. Results: VAS ratings for nausea were low under all conditions and slightly increased under VR conditions: A (0.08 cm, 95% confidence interval (CI): 0, 0.16), B (0.17 cm, CI 0.02, 0.33), and C (0.59 cm, CI 0.25, 0.94), P = 0.002. The KSSQ scores were not statistically different: B (12.6, CI 7.1, 18.1), C (24.5, CI 12.6, 36.4), P = 0.26. There was a moderately strong sense of presence in the VR world that remained unchanged between the VR conditions B (6.7 cm, CI 5.9, 7.3), C (6.4 cm, CI 5.7, 7.1), P = 0.79. The VR equipment was rated as very easy to use (9.2 cm, CI 9.0, 9.4) and comfortable (8.3 cm, CI 7.9, 8.6). Conclusion: VR was proven feasible in an EMS environment in a group of simulated patients. There was a low rate of nausea, use in a moving ambulance did not appear to increase simulator sickness, and the equipment was rated as comfortable and easy to use.

TRANSPORTATION ABSTRACTS

A Simulation And Integration Framework For Aviation System Safety Analysis

Paul Lawrence Hamilton
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Abstract. The Umbra simulation and integration framework, a tool originally developed as a test bed for robotics and unmanned aerial systems, has been used with success to integrate experimental hardware and software with legacy flight simulators and test software to evaluate new concepts for the National Airspace System (NAS). Self separation exercises were successfully simulated according to the NASA Higher Volume of Traffic Concept. Simulation results show that the concept merited further attention and the simulation was used to prepare for subsequent successful flight tests. The three key features of easy incorporation of systems, rapid prototyping and synoptic data collection make this framework particularly attractive for independent safety analysis as they facilitate early simulation and more effective evaluation of results.

Comparison and Evaluation of Two Automated Guided Vehicle Systems in the Transshipment of Containers at a Container Terminal

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Abstract. Due to globalization and the growth of international trade, many container terminals are trying to improve performance in order to keep up with demand. One technology that has been proposed is the use of Automated Guided Vehicles (AGVs) in the handling of containers within terminals. Recently, a new generation of AGVs, called C-AGVs, has been developed which makes use of cassettes that can be detached from the AGV. We have developed an agent-based simulator for evaluating the cassette-based system and comparing it to a traditional system. In addition, a number of different scenarios of container terminal equipment, e.g., number of AGVs and cassettes, have been studied in order to find the most efficient configuration. The simulation results suggest that there are configurations which the cassette-based system is more cost efficient than a traditional AGV system.

Extraction of Road Network Topology from Shapefiles for Transportation and GIS Applications

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Abstract. Geographic information systems (GIS) are widely used for data analysis and representation in industry, transportation, scientific investigations, urban planning, etc. GIS represents real world data with digital data using different file formats. Shapefile is the one of the most widely used file format because of its simple file structure and compatibility with many software packages. As their name indicates, most shapefiles store only the geometry (shape) information of features, but contains no topology information of the features. However, topology is important in many applications, such as routing in transportation analysis, modeling, and simulation. Topology contains information about spatial relationships between adjacent or neighboring features. This paper proposes an algorithm to extract road network topology from shapefiles that contain polylines. The output contains two shapefiles. The first output file is a modified version of the input shapefile, but has attributes containing information of nodes connected to links. The second output file is a new file and contains nodes, with attributes of number of links connected to each node and the specific links connected to each node. The proposed algorithm can be used to extract network topology for transportation and GIS applications. It is also a very useful tool to find polyline intersections and merge polylines to reduce the number of polylines (complexity) in shapefiles.

Hybrid Simulation Of Air Navigation Systems

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Abstract. The air transportation system continually tackles prob-

lems that arise from new necessities and its evolution as a system. To resolve these problems, the design of system components (airports, space, or parts of these and their relation with other modes of transportation) and the selection of the best alternatives for their evolution or modification employ diverse analysis techniques. Among these, fast-time simulation or model based simulation stand out. On the other hand, the final test of a system's behaviour, validation of a concept, or final adjustment of a design and its automated component parameters generally use real-time simulation or human-in-the-loop simulation.

In this paper, a description of an innovative concept in the area of Air Navigation System analysis will be presented: the Hybrid Simulation. The Hybrid Simulation merges two worlds into one exercise that, until now, were totally separate: real-time and fast-time simulation. The principal objective is to give a general idea of how this analysis technique works, the tools and means utilized, the associated methodology, and its applicability in Air Transportation. In addition, the benefits and advantages that this technique provides - once fully developed - will be analyzed. To complete the paper, specific development projects of hybrid simulation components and prototypes conducted by Aena will be briefly presented.

Notes on a complex Airspace Simulation

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Abstract. This paper describes the framework and approach of a complex airspace simulation in Air Traffic Management (ATM). It shows in the context of the Single European Sky ATM Research (SESAR) program how current airspace organisation can be optimized in order to cope with the increasing traffic numbers. The example addresses two major problem areas in German airspace and shows how solutions for the Upper Airspace support the operations in the Lower Airspace and vice versa.

Using Serious Gaming and Macromodels to Validate the Future ATM System

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Abstract. As a result of the Single European Sky initiative (SES) and the Strategic Research Agenda discussed in the context of ACARE, over the next 10-15 years an extensive process of validation for new ATM Operational Concepts and system components must be performed. To support the Validation needs of SESAR new validation tools are needed. These validation tools must provide the insight needed to ensure the fitness for purpose of the proposed Operational Concept. Specifically, the validation tools must address the impact of the new proposed Operational Concept on the environment as well as the interactions of the different identified performance areas. The envisioned games and Macromodels will be based on a common logical structure that ensures the usability and understandability of the results produced by both types of simulations. Games will be usec to obtain insight in the area of team performance and to assess and refine the required operational procedures that ensue from the SESAR Operational Concept. The macromodel will support the definition of a performance framework that will be used to define the performance envelope of the envisioned Operational Concept and also to understand the interactions between the different performance areas.

Continuous and dynamic berth allocation with simultaneous quay crane scheduling

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Abstract. The berth allocation problem deals with the optimal scheduling and assignment of vessels to berths along a quay. The vessel service time for a vessel assigned to a specific berth is greatly dependent upon the number of quay cranes assigned to the vessel for loading/unloading operations. This paper presents a formulation for the simultaneous berth and quay crane scheduling. The objective is the minimization of costs endured by the port operator by failing to meet agreed cargo handling performance and tardiness of completion of service of the vessels. A genetic algorithm based heuristic with a two-dimensional chromosome representation is proposed as a solution approach.

HOMELAND SECURITY/DEFENSE ABSTRACTS

Using M&S To Improve Military Infectious Disease Response

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Abstract. According to the Centers for Disease Control and Prevention, three major influenza pandemics occurred in the last :ury, affecting up to forty percent of the world population. The Avian Flu threat at the turn of this century indicates another pandemic is imminent. Every facet of society must prepare for the potentially devastating effects, including our nation's military forces. The U.S. Pacific Command (USPACOM) has the critical mission of protecting its warfighters and providing defense support to civil agencies and allied nations in the Asia-Pacific region, predicted to experience an early outbreak. Currently, USPACOM and its Components do not possess tools or methods to accurately predict the spread and impact of infectious diseases on its forces. Alion Science and Technology and the Office of Naval Research have teamed to develop the Toolkit for Operational Medical Modeling (TOMM). The primary system objectives, as defined by USPACOM, include:

- Accurately predicting the spread of an infectious disease outbreak from a selected location in the Area of Operational Responsibility, based on all relevant factors;
- Providing recommendations for resources required versus resources available to implement the desired infectious disease response plan;
- Incorporating effects of all relevant intervention techniques;
- Providing insight on the secondary and tertiary effects of capability and readiness of military forces and missions as a result of the disease spread;
- Providing insight into the effect on civilian agencies and organizations;
- Rapidly updating disease parameters and run analyses that supports course-of-action comparisons and decisions; and
- Interoperating with relevant real-world and exercise networks, systems, and architectures.

TOMM will be a web-based, course-of-action analysis system capable of simulating and predicting the effects of infectious diseases on military forces and resources. This paper will provide a project overview, required capabilities, development plan, architectural overview, assessment strategy, and future implications.

Distributing Integration & Test for Homeland Security

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Abstract. The importance of simulation to the Department of Defense (DoD) and Home Land Security (HLS) increases each day as the need to experience, evaluate, and employ mission responsibilities in increasingly diverse, complex scenarios is confronted by a constantly over-burdened and dwindling supply of money, manpower, and time. Simulations boasting state-of-the-art technology are rare, and funding to upgrade or replace legacy simulations is even harder to come by.

Legacy software systems, some with lineage going back decades, are often monolithic applications closely coupled to their host operating system. Interaction between simulations is via network interface protocol; very few interact directly. Capabilities and benefits of today's enterprise computing technologies are lost here as these systems liken back to the day of a single application executing on a single computer for the purpose of a single user. To make matters worse these systems, best classified as engineering systems due to their scant documentation and steep operation learning curves, are maintained by software engineers cloistered in small caches with defense contractors and academia.

All in all there are few professionals that have the experience and know-how to maintain and operate these systems. Once more,

ulation centers that host simulation events are engaged at full capacity. The addition of a few more computers, a bit more network dwidth, or a few more people is hardly noticed. To do more requires more computers, larger network bandwidth, and more personnel with the requisite skill set to make it all come together. Time and resources to support integration and test requirements just don't exist. This paper illustrates how simulation software modifications at remote locations can correct serious deficiencies and add vital new enhancements while benefiting from essential system integration and test using existing network infrastructure and remote computer assets, enabling capability where none exists today.

Integrating PMESII Planning & Experimentation for Wargaming

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Jason Shreve; Daniel Snyder; Paul Everson
Booz Allen Hamilton

ract. Experimenting with effects based operations involves integ ng planning across diverse domains and spanning local to global sc es. Providing a comprehensive planning framework requires a sh from the traditional, single-scope, military strategy experiments actics simulations. An integrated planning environment is a -sided approach that allows a user to plan the actions of any y in the environment and design a media campaign at any scope, n as a national government, military force at a given echelon, key er, or organization.

By providing an integrated planning and experimentation environment, plans are developed at various levels of granularity, composed into playbooks, stored in a database, chosen as part of a course of action (COA), used to instantiate an experiment, analyzed with respect to other courses of action, and then further refined based on the analysis. Other players can merge or mix playbooks stored within the database, allowing for the rapid creation of new COAs and facilitating the experimentation and learning of effects based concepts.
This paper describes an Integrated Planning and Experimentation framework composed of core simulation technology consisting of the Synthetic Environments for Analysis and Simulation and the Integrated Gaming System, and integration technology following a Society of Systems (SoS) that integrates simulations executing across the Internet into a single experimentation environment. This framework supported COA development and subsequent wargaming in order to study campaign planning investigating complex security challenges configured for a specific regional context.

A Strategy for Validation of Homeland Security Simulation Systems

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DDL OMNI Engineering, LLC

Abstract. While under contract to the Virginia Modeling, Analysis and Simulation Center (VMASC) in 2004, DDL OMNI Engineering developed a strategy for validation of Homeland Security simulation systems. This paper addresses how the strategy was developed, the writing of the validation plan and validation test cases to support that strategy, and the execution of results validation. The uniqueness of this effort was that the evaluation was done on existing mature simulation systems originally focused on warfighting but repackaged and refined for civil emergency response activities. This uniqueness and the relatively short timeframe allotted for validation necessitated using a flexible approach while developing the validation strategy.

Emergency Management Conceptual Model

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Evidence Based Research, Inc.

Abstract. Emergency responders have the difficult task of comprehending and integrating disparate information sources, new protocols, and complex relationships between agencies, which can impede their ability to respond to a disaster. The Emergency Management Conceptual Model (EMCM) enables greater usability and understanding of the complex relationships, states, and behaviors represented in the National Response Plan. Additional information was gathered through exercise observation, interviews, and the study of other local and state emergency response plans. The EMCM details specific behaviors for each entity present in an emergency response. The model is constantly evolving in that as protocol changes and resources shift, the model must also be updated to represent reality. Currently, the model is being expanded to include specific resources, response time, mobility assets, and location for those entities in the Hampton Roads area of Virginia; however, similar adaptations could be made to incorporate any area of the country. The conceptual model serves as the blueprint for the development of a fully functional simulation of emergency response, which could be used by Federal, State, and Local emergency responders for training and analysis, resulting in greater effectiveness, increased efficiency, enhanced comprehension, and improved coordination. Possible uses include a simulation for tabletop exercises, a training aid, a simulation of virtual exercise players, or an analysis tool.

EDUCATION

Abstracts

EDUCATION ABSTRACTS

CAB: A Tool for Interoperation Among Cognitive Modeling Architectures

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CHI Systems

Abstract. The rapid technology development for modeling and simulating human behavior and cognition has resulted in broad incompatibilities among underlying architectures and specific models. At the same time, there is growing application of cognitive models in defense/aerospace, healthcare, and training systems. Such practical uses, however, require greater ability to reuse existing cognitive models and model components, and to compose new and complex applications more cost-effectively from existing ones wherever possible. In other software domains, analogous problems have been solved through standards and/or introduction of "middleware." The Cognitive Architecture Bridge (CAB) represents a new 'middleware' approach to providing multiple levels of interoperability and composibility between and among cognitive architectures and model-components of specific cognitive models. CAB allows capabilities from heterogeneous models and modeling architectures to be integrated into a single "virtual" cognitive model, through a set of standardized interaction declarations and a common run-time infrastructure. Importantly, existing cognitive agent engines and architectures can be made CAB-compliant through a one-time adaptation to support the CAB application program interfaces (APIs). Initial implementation of CAB has led to practical applications, including a software agent for high-level data fusion.

Applications of Visualization Software for Mathematics Education

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Virginia Modeling, Analysis, and Simulation Center, Old Dominion University
Department of Electrical and Computer Engineering, Old Dominion University

Abstract. Graphical representations such as figures, illustrations, and diagrams play a critical role in mathematics, and they are equally important in mathematics education. However, graphical representations in mathematics textbooks are static, i.e., they are used to illustrate only a specific example or a limited set of examples. By using computer software to visualize mathematical principles, virtually there is no limit to the number of specific cases and examples that can be demonstrated. However, we have not seen widespread adoption of visualization software in mathematics education. There are currently a number of software packages that provide visualization of mathematics for research and also software packages specifically developed for mathematics education. In this study, we first conducted a survey of mathematics visualization software packages, summarized their features and user bases, and analyzed their limitations. We focused on evaluating the software packages for their use with mathematical subjects adopted by institutions of secondary education in the United States (middle schools and high schools), including algebra, geometry, trigonometry, and calculus. We found that cost, complexity, and lack of flexibility are the major factors that hinder the widespread use of mathematics visualization software in education. Second, we determined topics in mathematics, suitable for visualization, which will provide the most effective educational experience for users. Also, we discussed some issues that must be addressed in mathematics visualization software user interface design. Methods of receiving user inputs and parsing user inputs are the main challenges faced in user interface design.

Playing Mind Games: Applying Augmented Cognition to Serious Games

Dr. Julie Drexler, Peter Smith, Lee Sciarini, and Dr. Denise Nicholson
Institute for Simulation and Training, University of Central Florida

Abstract. Recently, AugCog science and technology (S&T) has begun to emerge in the entertainment industry. Videogame companies appear to have realized the potential ability to increase the level interaction and immersion through the use of innovative interfaces that leverage computational methods and state-of-the-art non-invasive neurophysiological sensing techniques such as electroencephalographic (EEG) signals, electromyography (EMG), and eye tracking. Although many of the new entertainment ideas are still in their infancy, AugCog techniques are being employed to explore development of videogames.

To date, AugCog S&T has shown the greatest influence in the area of videogame design, although, some game systems are employing AugCog sensor devices directly. Relatedly, Games for Health, a division of the Serious Games Initiative, has conducted an investigation on the potential use of videogames for providing cognitive exercise and Nintendo has even developed a product line of "brain training" games that have proven to be

widely popular.

advances are made in the AugCog field, new opportunities for the insertion of AugCog S&T into the into the multi-billion dollar videogame industry are inevitable. Accordingly, this work will discuss the current uses of AugCog S&T in the videogame field, the capabilities of sensing technologies for entertainment applications, and the future direction of AugCog for videogame applications.

Fidelity Versus Cost And It's Effect On Modeling & Simulation

Joe Duncan
Evidence Based Research

Abstract. Fidelity and cost are intertwined in any model or simulation, but how does one affect the other? As with most simulations, human factors are present from development through acquisition to the end users perception of the simulation fidelity. This paper begins to examine the relationship between cost and fidelity and how the human perception affects the two. In addition to fidelity and the cost thereof, the author begins the exploration of the concept of a theoretical 100% fidelity and its relationship to the perceived fidelity of the end user.

Simulation And Leadership Competencies

David O. Hassell
Immedia.it Inc

Abstract. The US military remains very interested in producing the best leaders. To accomplish this goal, leaders are systematically trained and educated to build experienced service men and women who can then make decisions and perform actions based on prior knowledge and understanding of the current situation as it relates to previous experiences. Which areas on which to focus that training and education have led to modeling and descriptions of what competencies are needed for leaders. How the leaders then acquire those identified competencies and further, when and how they provide the training/education of those competencies are then issues resolved with pedagogy program choices. Advances in technology and methods, particularly with respect to simulations, are allowing stake holders to create experienced leaders with very large experience bases obtained in scenario based game-like role playing simulation.

Simulation and Visualization Enhanced Engineering Education: The Stiffness Matrix Method Module for Structural Analysis Course

Ahmed Mohammed, Duc T.Nguyen and Sushil K. Chaturvedi
Old Dominion University

Abstract. Existing macromedia FLASH software, which has extensive and exciting simulation and visualization capabilities, are utilized to develop the "Stiffness Matrix Method" (SMM) module, which is one of the topics covered in a Structural Analysis I course, offered at the junior level at Old Dominion University. The developed software (under FLASH environment), including tutorials to explain all necessary theoretical background, formulas, step-by-step computerized procedures, and numerical examples, is presented in a simple user-friendly, visual, and interactive environment to enhance students' learning. Due to numerous graphical visualization and simulation examples embedded in the module, it is expected that the developed software package will be a valuable tool for both students and instructors. Furthermore, as a byproduct, the developed software package can also be used as a "research tool" in addition to its intended application to engineering education.

Design and Development of Educational MMOG's

Peter Smith, Tim Holt, Dr. Clint Bowers, Dr. Jan Cannon-Bowers and Rachel Joyce
Institute for Simulation and Training, University of Central Florida

Abstract. Starting with the idea that an engaging multiplayer game can serve as an effective adjunct to traditional teaching methods, resulting in improved learning of targeted materials and enhanced motivation to remain in science and engineering, a designed methodology for educational Massively Multiplayer Online Games (MMOGs) has been developed.

One of the biggest challenges was how to quickly and cheaply integrate educational content into the proposed MMO game. Designs based on deep integration of educational content and concepts proved to be difficult to design and create, and often "broke" the game design creating gameplay that didn't make sense or have much entertainment value. The main challenges were to not let the game content compromise the educational content nor the educational content compromise the game content.

This challenge led to the development of the hybrid game concept where the educational content is separated from the MMO game content. This separation is accomplished by placing it in an external Web 2.0 environment. With this approach, the educational content is kept rooted in traditional pedagogical methods, while allowing easy integration into the game with some creative story telling. Develop-

ment of the game (MMO) and educational (Web 2.0) content then becomes a set of almost parallel tasks which accelerates development plus greatly simplifies the task of integration.

Emergency Response Virtual Environment for Safe Schools

Ayman Wasfy; Teresa Walker
Hampton University

Abstract. An intelligent emergency response virtual environment (ERVE) that provides emergency first-responders, response planners, and managers with situational awareness as well as training and support for safe schools is presented. ERVE incorporates an intelligent agent facility for guiding and assisting the user in the context of the emergency response operations. Response information folders capture key information about the school. The system enables interactive 3D visualization of schools and academic campuses, including the terrain and the buildings exteriors and interiors in an easy to use Web-based interface. ERVE incorporates live camera and sensors feeds and can be integrated with other simulations such as chemical plume simulation. The system is integrated with a Geographical Information System (GIS) to enable situational awareness of emergency events and assessment of their effect on schools in a geographic area. ERVE can also be integrated with emergency text messaging notification systems. Using ERVE, it is now possible to address safe schools' emergency management needs with a scaleable, seamlessly integrated and fully interactive intelligent and visually compelling solution.

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NASA's booth features elements from two of the conference tracks: Transportation and Education. The agency uses modeling and simulation tools to design, test, and refine many of its mission components. One of the tools used to model and simulate real air space systems, the Air Traffic Operations Laboratory, will be represented at the booth. To help achieve the goal of inspiring the next generation of explorers, NASA and its partners have developed interactive computer programs that enable new ways of learning. Several of these computer-based learning tools will be on display and information about how to access them will be available. NASA personnel will staff the booth during all regularly scheduled exhibit hours.

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gaming system, National Training Center - Objective Instrumentation System, United Kingdom Combined Arms Tactical Trainer, Close Combat Tactical Trainer (CCTT), CCTT Reconfigurable Vehicle Simulation, and Virtual Combat Convoy Trainer. Logistics and test equipment programs include F-35 Autonomic Logistics Information System, and the U.K. Ministry of Defence Joint Asset Management and Engineering System. With more than 2,600 employees, STS is headquartered in Orlando, with locations in Fort Worth, Texas; Huntsville, Ala.; Little Rock AFB, Ark.; Tyndall AFB, Fairborn, Ohio; Hulburt Field, Fla.; Albuquerque, N.M.; Washington, D.C. and the U.K.

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Our staff and associates have contributed to USJFCOM Industry Days 07, AUSA Annual Meeting, The Navy League Sea Air Space Show, and The Millennium Challenge Exhibition. We have created specialized marketing materials for General Dynamics, ACT/NATO, The Naval Media Center, COMOPTEVFOR, USAREC, and many others. Private sector slients include leading national advertising agencies, Canon, Stihl, Norfolk Southern, Home Depot and many others!

Eastern Virginia Medical School

Eastern Virginia Medical School (www.evms.edu) is an academic health center based in Norfolk. Its mission includes educating 1,000 medical and health professions students and 325 residents, providing patient care throughout the Hampton Roads region and conducting over $30 million annually in sponsored research.

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The Hampton Roads Economic Development Alliance (HREDA) is the region's lead economic marketing organization in the promotion of Virginia's Hampton Roads as a nationally and internationally recognized center of innovation in the Modeling & Simulation (M&S) industry. For regional answers affecting tomorrow's industry, contact HREDA today!

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The Hampton Roads Research Partnership is a regional consortium of universities, federal labs and a research institute dedicated to promoting collaborative research as a means for technology based economic development.

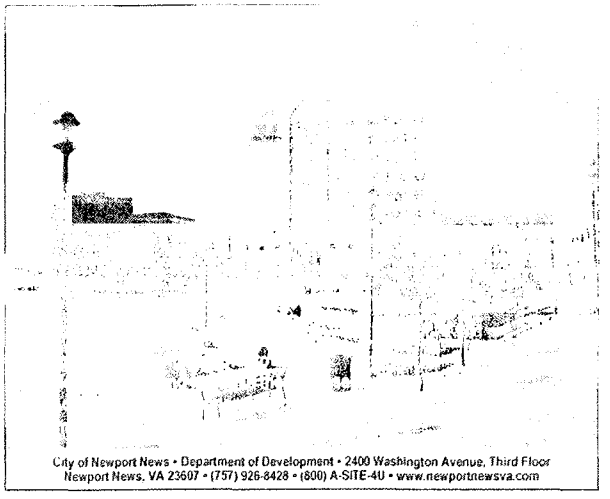
The Hampton Roads Technology Council (HRTC)

The Hampton Roads Technology Council (HRTC) is the technology nerve center for the southeastern region of Virginia named Hampton Roads. HRTC is a member-driven non-profit organization that provides educational programs, networking opportunities and industry information to the region's high-tech companies. By linking Hampton Roads' technology businesses with investors, legislators, educators, support organizations, and other critical resources, HRTC hopes to reach its mission of accelerating the transformation the region and its technology companies into world-recognized technology leaders.

MS&T

MS&T Magazine

MS&T is the simulation industries first dedicated publication, in print since 1985. It has pioneered and promoted the use of simulation as a major defense game changer since the earliest days of force on force laser based and flight simulation to today's networked, multi player, joint operations scenarios. Produced by people who have 'been there and done it,' both in the military and in industry, it continues to lead the simulation discussion amongst today's community. MS&T is proud to support this first MODSIM World and we wish all participants an enjoyable and valuable event.



The City of Newport News

Newport News, Virginia offers a business environment of exceptional quality, plus a highly competent technical and professional workforce, in Hampton Roads, a nationwide leader in modeling and simulation. Newport News companies currently engaged in sophisticated M&S include Alion Science and Technology, C-squared Technologies, Jefferson Lab and Northrop Grumman Newport News.

VIRGINIA

City of Portsmouth

Portsmouth, one of the oldest cities in Virginia, is experiencing unprecedented revitalization. With its new high-tech office park neighboring United States Joint Forces Command, the heartbeat of the modeling and simulation industry in Hampton Roads, Portsmouth offers a strategic location that connects businesses with the world.

SUFFOLK
VIRGINIA
It's a good time to be in Suffolk

Suffolk's Technology Corridor

The Harbour View submarket of Northern Suffolk is emerging as a regional center of excellence for modeling and simulation technology. The U.S. Joint Forces Command and many innovative high tech firms design, test, and implement advanced computer simulations for both the military and private sector applications.

VMASC

Virginia Modeling, Analysis, and Simulation Center

The Virginia Modeling, Analysis, and Simulation Center

The Virginia Modeling, Analysis, and Simulation Center (VMASC) is a multi-disciplinary modeling, simulation and visualization collaborative research center managed through the Office of Research at Old Dominion University. VMASC supports the University's Modeling and Simulation (M&S) graduate degree programs, offering multi-disciplinary M&S Masters and Ph.D. degrees to students across the Colleges of Engineering and Technology, Sciences, Education, and Business. With more than one hundred industry, government, and academic members, VMASC furthers the development and application of modeling, simulation, and visualization as an enterprise decision-making tool that promotes economic development.

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Hampton, a waterfront city in southeastern Virginia, is home to a successful and growing modeling and simulation industry. Over 60 M&S companies employing over 1,100 contribute to the success of this industry in Hampton. Combine Hampton's location and top-notch business parks, and it is easy to see why Hampton is a great location for M&S businesses.

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Norfolk's development-friendly urban attitude is energized by collaborative ingenuity and unique assets. World-class cruise center; sparkling residential projects; new research centers; mixed-use towers; logistically-smart office parks; and business programs. Refreshing lifestyle with recreational waterfront; glamorous performance venues plus Virginia's premier art companies, the region's hip restaurant & visual arts scene.

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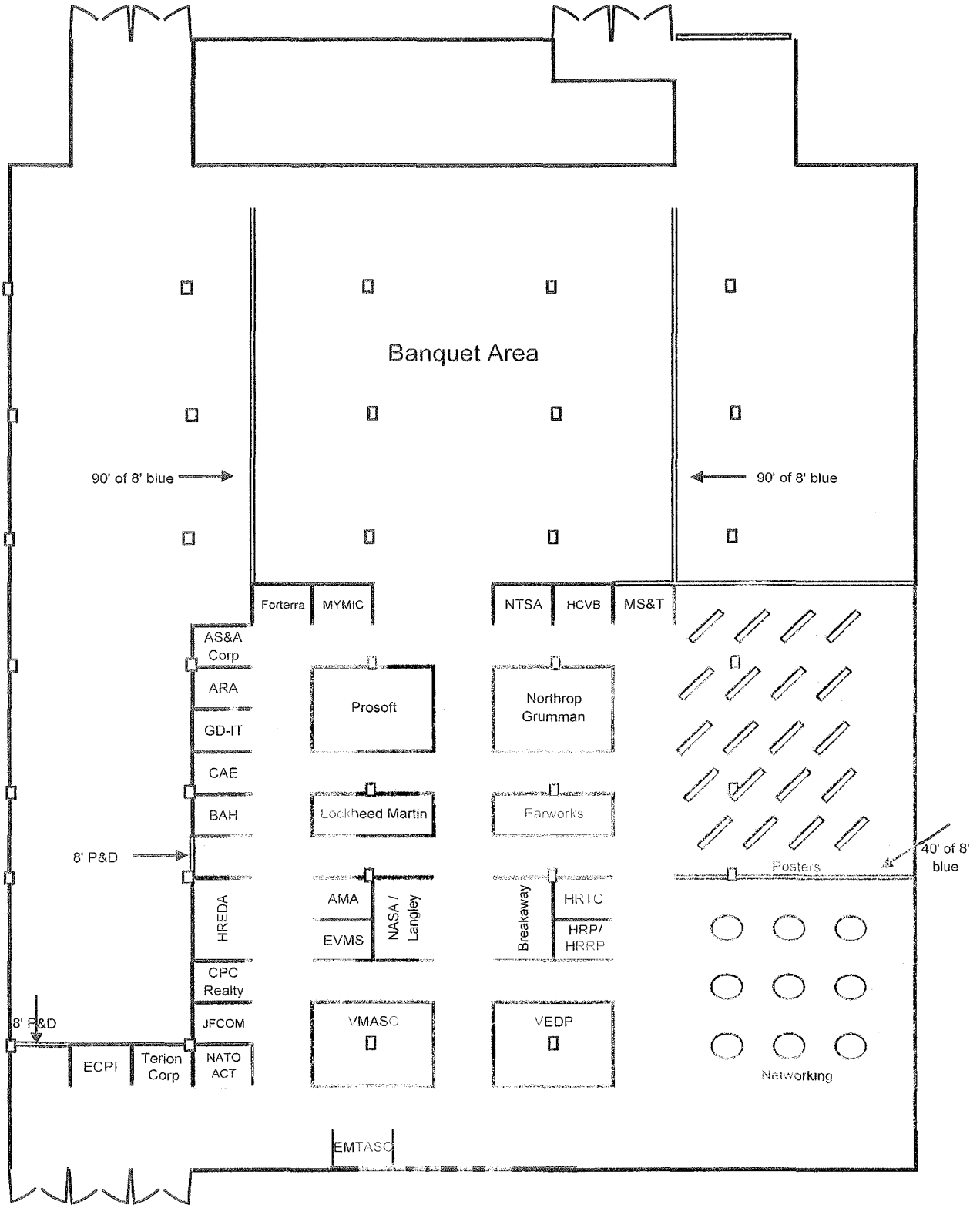

MODSIM 2007

VBCC - Exhibit Hall A

Acknowledgements

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Current members of CP3 include:

Michael Adolphi

Mr. Adolphi is a co-founder and the Executive Vice-President of Professional Software Engineering, Inc. (PROSOFT). He serves as co-chair for this year's MODSIM World conference.

Bill Younger

Mr. Younger is a co-founder and the Vice-President/Chief Operating Officer of MYMIC LLC. He serves as co-chair for this year's MODSIM World conference.

Mike McGinnis

Dr. McGinnis is the Executive Director of the Virginia Modeling, Analysis, and Simulation Center (VMASC) and the Program Chair for MODSIM World 2007.

Dana Dickens

Ms. Dickens is the President and Chief Executive Officer of the Hampton Roads Partnership, a charter participant of MODSIM World.

Paul Fosdick

Mr. Fosdick is the Technical Director for Northrop Grumman Mission Systems. He is the Deputy Program Chair for MODSIM World 2007.

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Business - Hampton
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INSIDER NEWS

EVMS-ODU team licenses first invention

Virtual stethoscope heads to Texas company

ERICK SORICELLI
Monday August 27, 2007

A team of medical modeling and simulation researchers from Eastern Virginia Medical School and Old Dominion University announced last week that they had licensed their first invention, a virtual stethoscope, to Cardionics Inc., a Webster, Texas, medical manufacturer.

The Virtual Pathology Stethoscope, or VPS, is an invention from the National Center for Collaboration in Medical Modeling and Simulation, a joint venture of EVMS and ODU. The VPS is a training device used to simulate the sounds of a human body's circulatory and respiratory systems. The device joins others in Cardionics' product line used for auscultation, or listening to the sounds made by the body's internal organs.

Cardionics president Keith Johnson said the company expects to start selling the VPS by next year.

The device's ideal use is on standardized patients, or actors who pretend to be sick. Medical school students work with the actors to learn interviewing and patient diagnostic skills.

EVMS uses SPs through its Professional Skills Teaching and Assessment Center. Staff from that center approached researchers at ODU three years ago about enhancing student training, which is how the VPS was first conceived.

"This program uses trained actors to simulate 600-650 different conditions," said Donald Combs, EVMS' associate dean for planning and health professions, and a co-director of the National Center. "We've started with some fairly common medical conditions. Any sort of heart or lung disease that could be picked up by sound can be simulated."

The VPS licensed to Cardionics allows an SP to use hidden controls to track the stethoscope's head and tell the system what sounds should be played. This allows a perfectly healthy person, acting as an SP, to simulate a heart or lung condition.

The "SP-triggered VPS" is a variation of the original invention, which was deemed too expensive for commercial use. The original, a "tracked VPS," had a sensor that tracked on the body where a stethoscope head was placed, in order for the right sound to play.

Cardionics has a number of electronic stethoscopes in its product line. It also sells instructional CD-ROMs, medical manikins and other sound simulators.

The company's stethoscopes sell in the hundreds of dollars, but Johnson, of Cardionics, said the VPS will likely sell for more than that. A price hasn't been determined.

"This differs a little bit from anything else we have," Johnson said.

The National Center was established in 2001. Its primary focus is on creating medical mod-sim products that are suitable for commercial use. The center is one of several partnerships between EVMS and ODU.

Earlier this month, EVMS and ODU signed an agreement that establishes a four-person executive committee to oversee existing partnerships and develop new ones. EVMS provost Gerald Pepe and ODU provost Thomas Isenhour are on the committee. Pepe and Isenhour will choose the remaining two members from each school.

OLD DOMINION UNIVERSITY NEWS

RESEARCHERS FROM ODU AND EVMS SHOWCASE NEW MEDICAL TOOL

A team of modeling and simulation researchers from Old Dominion University and Eastern Virginia Medical School made a big impression with a simple concept at the 4th annual Advanced Initiatives in Medical Simulations (AIMS) Conference and Congressional Exhibition May 8-9 in Washington, D.C.

The new tool that the team exhibited is a stethoscope, but a very smart "virtual pathology stethoscope" the researchers call the VPS. It can simulate sounds of the circulatory and respiratory systems to help medical students recognize the telltale sounds of sickness.

"Our demonstration was definitely the hit of the various displays," said Rick McKenzie, associate professor of electrical and computer engineering and a researcher at ODU's Virginia Modeling, Analysis and Simulation Center (VMASC). McKenzie is heading up the "augmented reality" stethoscope project together with Dr. Thomas Hubbard of EVMS's Theresa A. Thomas Professional Skills Teaching and Assessment Center.

Rep. Patrick Kennedy of Rhode Island, the son of Massachusetts Sen. Edward Kennedy and a champion of health care issues in Congress, spent an extra measure of time at the VMASC-EVMS demonstration and had good words for the project when he addressed the full AIMS conference, according to McKenzie.

"There were several people who wanted to buy the technology immediately," added Mark Scerbo, professor of human factors psychology at ODU and a collaborator in medical modeling with researchers at VMASC.

Medical schools for decades have trained doctors-to-be by using what is known as a standardized patient (SP). This is an actor skilled at pretending to be sick. The SP is able to report symptoms of a particular ailment. In working with SPs, medical students improve their interviewing skills and gain the medical judgment they need to diagnose ailments.

"Trouble is, when you put the stethoscope to the standardized patient, you find that he is healthy," Scerbo said. "Our augmented stethoscope simply substitutes pathological sounds for healthy sounds."

In other words, the SP reports and portrays symptoms of a particular ailment and when the medical student puts the augmented stethoscope to the SP's body, the

sounds that the student hears provide evidence that can support the diagnosis. The audio menu includes pathological sounds recorded from actual patients.

The ODU-EVMS team took an SP from Hampton Roads, Patrick Walker, with them to the AIMS conference and was able to demonstrate exactly how the process works. "We had the only exhibit that used a genuine SP and we had a very successful showing," Scerbo reported.

"Many displays at the conference were very graphic and visually focused, but ours was personable and interactive," MacKenzie said.

Both Kennedy and Virginia 4th District Rep. Randy Forbes took time to test the stethoscope on Walker. When they listened at his neck, they heard the cyclic whooshing sound of plaque-restricted blood flow through the carotid artery. When they listened to his chest, they heard crackling sounds in the lungs, a sign of pneumonia or congestive heart failure.

Forbes, the chair of the Congressional Modeling and Simulation Caucus, expressed interest in learning more about medical modeling and simulation work going on in his 4th District, which includes Suffolk, where VMASC is headquartered.

ODU and EVMS have joined forces to form the National Center for Collaboration in Medical Modeling and Simulation, which has attracted national funding and national media attention. An article late last year in Mechanical Engineering magazine focused on one of the products of the collaboration—a virtual operating room. This immensely complicated system, which can be used to train surgeons and other operating room personnel, utilizes ODU's Cave Automatic Virtual Environment (CAVE).

A primary mission of VMASC is to create modeling, simulation and visualization applications that are practical enough for commercial development, and this is where the virtual pathology stethoscope shines.

McKenzie said the team's original VPS is very high-tech, but too expensive for broad use. This first system is called "tracked VPS" because it includes a sensing component that tracks on the body where the stethoscope's head is placed so the appropriate sound recording can be cued. The team received a patent for the "tracked VPS," but then moved on to improve the system's practicality.

The economical version is "SP-triggered VPS," for which another patent has been obtained. This is the system that was demonstrated at the AIMS conference, and for it the SP uses hidden controls to track the stethoscope's head and tell the system what sounds should be played. The second system is more economical because it does not have the automatic tracking component.

Preliminary tests with students at EVMS have been promising, McKenzie said. One series of tests reported in a paper written by McKenzie, Hubbard and other colleagues showed that the augmented standardized patient system is "statistically significant in providing a valid assessment tool."

The project team also includes John Ullian and Gayle Gliva-McConvey of EVMS and Hector Garcia, visualization lab manager for VMASC.

AIMS is a coalition of individuals and organizations committed to promoting medical simulation as a way to improve patient safety, reduce medical errors and lower health care costs.

This article was posted on: May 14, 2007

Return to News of the Week

ModSim expo's turnout exceeds expectations

By JON W. GLASS, The Virginian-Pilot
© September 12, 2007
Last updated: 9:46 PM

VIRGINIA BEACH

Industry members looked to make contacts and land business deals. Academics and government officials came to share the latest in research and practice in computer modeling and simulation.

In all, more than 500 people showed up Tuesday for the region's first ModSim World Conference and Expo, with last-minute sign-ups causing a line that delayed the start by 20 minutes.

It was a problem that brought smiles to local organizers. They hope the three-day event - meant to showcase how modeling and simulation are being used in medicine, transportation, education, homeland security and defense - will help brand Hampton Roads as an international hub for the technology.

The turnout at the Virginia Beach Convention Center

exceeded expectations. Organizers would have considered 300 participants a success. Speakers for panel discussions came from across the nation as well as such countries as Sweden, Spain, the United Kingdom, Australia and South Korea.

"To have in excess of 500 for a brand-new conference is a big deal," said Mike Robinson, director of programs advancement for the Virginia Modeling, Analysis and Simulation Center, or VMASC, an Old Dominion University research center and a conference organizer. "It's very exciting to know we can draw that many people."

Paid admissions and industry and government sponsorships are expected to raise around $220,000 - enough to cover expenses and leave seed money to plan next year's conference, Robinson said.

At a time when mid week business has started to slack off for Beach hotels, attendees booked nearly a quarter of the neighboring DoubleTree Hotel's 292 rooms, said general manager Christine Geist.

"It's been great business for us," she said.

Mike McGinnis, VMASC's executive director, said ModSim World - combined with three conferences earlier this year on modeling and simulation in Norfolk, Chesapeake and Hampton - should pump about $2.5 million into the economy for such things as hotel rooms, restaurant meals and rental cars.

"It's only going to get bigger and better," McGinnis said.

In Hampton Roads, modeling and simulation has grown into a $400 million-plus industry. Defense and aerospace contractors working with the military's Joint Forces Command in northern Suffolk and with NASA Langley Research Center in Hampton comprise a large part of the market.

But other uses are emerging, including simulations to train medical students, help emergency responders prepare for disasters and assist transportation planners in moving traffic and freight.

Most of the approximately 30 exhibits at ModSim World still leaned heavily toward defense and homeland security. Such heavy hitters as defense contractors Lockheed Martin, Northrop Grumman and General Dynamics had displays.

"If our competitors are going to be here, we've got to be here - we can't afford not to be," said Mark Gerasch, senior director of business development, training and engineering for General Dynamics Information Technology.

"All of the main players in the industry are here, which is why we needed to be here," said Mark Espenant, manager of new product development for CAE, a Canada-based company. His firm, which is considering setting up an office in Hampton Roads, displayed a simulation that included a terrorist-caused train derailment, developed to help Vancouver officials plan for hosting the 2010 Winter Olympics.

Jon W. Glass, (757) 446-2318, jon.glass@pilotonline.com

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Business - Hampton
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INSIDER NEWS

Inaugural conference touts emerging technology

Modeling and simulation gets its own world expo in Virginia Beach next month

Michael Schwartz
Monday August 27, 2007

Organizers of the inaugural MODSIM World Conference and Expo aren't worried about having a huge turnout.

For the first year of a conference focusing on a technology that the average person has never heard of, quantity is not really the point.

The conference, which will take place Sept. 11-13 at the Virginia Beach Convention Center, will bring together modeling and simulation experts from various disciplines and countries to better understand how the emerging technological field can be used in decision-making and problem-solving in more than just the U.S. Department of Defense. At the same time, organizers hope MODSIM World will further buoy efforts at labeling Hampton Roads the nation's, if not the world's, center for modeling and simulation.

The conference theme is "Enable decision-making in a rapidly changing world" and it will focus on four industry tracks – medicine, transportation, homeland security/defense and education/training.

A fifth so-called cross-cutting track will be game-based technology or serious gaming and how it leads to interoperability between the four prime tracks.

The three-day event will feature exhibits from more than a dozen groups. And the keynote speaker will be Gary Klein, a founder of naturalistic decision-making, a discipline that closely analyzes how humans make decisions.

MODSIM World is the brainchild of Bill Younger and Mike Adolphi who were prompted by an M&S academic impact study to conceive such a conference.

Younger is co-chair of the conference and vice president, COO and co-owner of Mymic, a Portsmouth-based M&S firm.

Adolphi is the other co-chair, and co-owner, executive vice president of

Prosoft, a Virginia Beach-based M&S and systems engineering firm.

The vision they have for M&S in Hampton Roads is to break the industry out of its traditional DoD roots and into other fields.

For example, the medical community has dreams of using M&S to someday simulate virtually any situation to train medical students and professionals.

Eastern Virginia Medical School and Old Dominion University have been developing the roots of such capabilities and will showcase some at MODSIM World. The long-term goal of that local research, according to Don Combs, professor of health professions and associate dean for planning and health professions at EVMS, is to create what Combs calls a "tactile hologram," which can portray the look and feel of any medical circumstance.

Combs, also a co-chair of the conference's medical track, hopes the event will bring visibility to Hampton Roads and EVMS as forces in the medical M&S industry, which he said generates about $300 million nationwide annually.

Not only will the conference give visibility to what's going on in Hampton Roads, it will give those in the region exposure to current and future M&S capabilities outside the region.

"We still firmly believe that the private sector in time will start adopting this technology and seeing its benefit," Younger said. "Our region is well positioned to take advantage of this."

Another challenge the conference hopes to tackle is showing industries that may be slow to adopt an emerging technology how M&S can improve capabilities and perhaps cut costs.

Combs said he started looking at M&S as it pertains to medicine in the 1990s. He then had to wait on the evolution of computer technology.

But today, at least in medical societies, many are beginning to recognize the value of M&S, Combs said.

"I don't see resistance to this new technology," he said. "The momentum is clearly there."

Bob Sharak, director of special projects at the Hampton Roads Partnership and sponsor relations director for MODSIM World, said M&S is catching on in other industries. But it's not yet a household term.

"It depends on who you ask," Sharak said. "If you went down on a street corner in one of our localities, unless you are in north Suffolk, you might get a lot of blank stares."

MODSIM World does have some competition. An M&S conference takes place annually in Orlando, attracting up to 15,000 attendees, Sharak said.

Younger and Combs said they expect around 300 people to attend the conference.

In terms of how much money it costs to put on such a show, Sharak said when it's all said and done the bill will be in the neighborhood of $200,000.

With the help of plenty of volunteers, both Sharak and Younger are confident they'll break even and are optimistic to make enough from this first year to get the ball rolling on the second annual MODSIM World.

"My goal is to max out the largest convention center in Hampton Roads every year," Sharak said.

According to its latest sponsor list on the MODSIM World Web site, the conference has gathered a total of $165,000 from sponsors.

Registration for the conference is available at www.modsimworld.com and attendees can register at the door.

Medical Modeling and Simulation Database
a joint project of
Eastern Virginia Medical School and
the
American College of Surgeons
medicalmodsim.com

MMSD
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To foster awareness of the magnitude and breadth of activity and to foster collaboration among researches, Eastern Virginia Medical School in partnership with the American College of Surgeons has created the Medical Modeling and Simulation Database.

The MMSD consist of web-based searchable compilations: the Research Database, that contains bibliographic information on published articles and abstracts (where available), and Browse features for collections of, Articles/Publications, Companies, Products, Conferences and Meetings, contact information for Medical Simulation Centers, Simulation Sites of Interest and twenty-five most recent articles by Surgical Specialty.

EVMS is developing the MMSD to increase awareness of the breadth of the medical modeling domain and to provide a means for fostering collaboration by bringing like-minded organizations and researchers into more frequent contact with each other, thus speeding advancement of the medical modeling and simulation domain.

Funding for this project was provided, in part, by the Naval Health Research Center Through NAVAIR Orlando TSD under contract N61339-03-C-0157, entitled "The National Center for Collaboration in Medical Modeling and Simulation" and the Commonwealth of Virginia. The ideas and opinions presented represent the views of the authors and do not necessarily represent the views of the department of Defense.

Selected Medical Modeling and Simulation Scholarly Activities

Eastern Virginia Medical School

and

Old Dominion University
Virginia Modeling, Analysis and Simulation Center

Through September 30, 2007

Patents Pending

- "Subject Activated System & Method for Simulating Normal & Abnormal Conditions". Non-Provisional Patent Application No. 11/589,912 filed October 31, 2006. EVMS Inventors: Thomas W. Hubbard, M.D., J.D., Gayle A. Gliva-McConvey, and John A. Ullian, Ph.D. ODU Inventors: Bo Sun, M.S., Hector M. Garcia, M. Arch., and Frederic D. McKenzie, Ph.D.

- "System, Device, and Methods for Simulating Surgical Wound Debridements". Provisional Patent Application No. 60/706,414 filed August 8, 2005. Patent Cooperation Treaty Patent Application PCT/US2006/031063 filed August 8, 2006. EVMS Inventor: Leonard J. Weireter, M.D. ODU Inventors: Lee A. Belfore, II, Ph.D., Jennifer Seevinck, M.Phil., Frederic D. McKenzie, Ph.D., Mark W. Scerbo, Ph.D., Hector M. Garcia, M. Arch., Sylva Girtelschmid, M.S., Emre Baydogan, M.S., Wesley Adam Taggart, R. Bowen Loftin, Ph.D., Jessica R. Crouch, Ph.D., and Yuzhong Shen, Ph.D.

- "System, Method and Medium for Simulating Normal and Abnormal Medical Conditions". Provisional Patent Application No. 60/621,084 filed October 25, 2004. Patent Cooperation Treaty Patent Application PCT/US2005/038150 filed October 25, 2005. EVMS Inventors: Thomas W. Hubbard, M.D., J.D., John A. Ullian, Ph.D., Gayle A. Gliva-McConvey, and Robert J. Alpino, M.I.A. ODU Inventors: Frederic D. McKenzie, Ph.D., Hector M. Garcia, M. Arch., and Reynel J. Castelino, M.S.

Licensing Agreements

- Eastern Virginia Medical School and Old Dominion University's Virginia Modeling, Analysis and Simulation Center completed a Licensing Agreement with Cardionics, Inc., located in Webster, Texas, for a Virtual Pathology Stethoscope developed by the EVMS/ODU team to aid in training medical personnel to properly diagnose pathology in otherwise healthy standardized (simulated) patients during the medical education process.

SELECTED PUBLICATIONS

Journal Articles

Schellhammer, P.F., Diaz, J.I., Fabrizio, M.D., Davis, J.W., Given, R.W., Main, B., Chaganty, N.R., Hussein, R. & McKenzie, F.D. (in press). Computer Modeling Technology to Assess Extra-Capsular Tissue Coverage of Whole Mount Sections after Retropubic and Laparoscopic Radical Prostatectomy, *Urology*. Accepted for publication in May 2007.

Drake, R.R., Cazares, L.H. and Semmes, O.J. (in press). Mining the Low Molecular Weight Proteome of Blood. *Proteomics*.

Shin, S., Cazares, L.H., Schneider, H., Mitchell, S., Semmes, O.J., Laronga, C., Perry, R.R. and Drake, R.R. (2007). Serum Biomarkers to Differentiate Benign and Malignant Mammographic (BIRADS4) Lesions. *J. Am. Coll. Surg.*, 204, 1065-1071.

Van Dongen, H.P.A., Mott, C.G., Huang, J., Mollicone, D.J., McKenzie, F.D., & Dinges, D.F. (in press). Optimization of Biomathematical Model Predictions for Cognitive Performance Impairment in Individuals Accounting for Unknown Traits and Uncertain States in Homeostatic and Circadian Processes. *SLEEP Jo*urnal. Accepted for publication in April 2007.

Stefanidis, D., Scerbo, M.W., Korndorffer, J.R. Jr., & Scott, D.J. (2007). Redefining simulator proficiency using automaticity theory. *The American Journal of Surgery, 193*, 502-506.

Combs, C.D. (2006). Startling technologies promise to transform medicine. *British Medical Journal (BMJ), Volume 333, 1308-1311.*

Scerbo, M. W., Schmidt, E. A., & Bliss, J. P. (2006). Comparison of a virtual reality simulator and simulated limbs for phlebotomy training. *Journal of Infusion Nursing, Volume 29, Number 4, July/August, 214-224.*

Scerbo, M. W., Bliss, J. P., Schmidt, E. A., & Thompson, S. N. (2006) The efficacy of a medical virtual reality simulator for training phlebotomy. *Human Factors, Volume 48, Number 1, Spring 2006, 72-84.*

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Book Chapters

Scerbo, M. W. (2006). Medical virtual reality simulators. In W. Karwowski (Ed.), *International encyclopedia of ergonomics and human factors, 2nd Ed.* (1181-1185). Boca Raton, FL: CRC Press.

Schmidt, E., & Scerbo, M.W. (in press). Simulation advances in medical education and training: Laparoscopic skill acquisition. In D.A. Vincenzi, M. Mouloua, & J.A. Wise (Eds.), *Human factors in simulation and training.* Mahwah, NJ: Erlbaum.

Proceedings Articles

Sun, B., and McKenzie, F.D. (2007). Real-time simulated sonography with virtual pathology for augmented standardized patients. In *Proceedings of the 10th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2007):* Workshop on Interaction in Medical Image Analysis and Visualization. October 29 to November 2, 2007, Brisbane, Australia.

Anderson, B.L., Scerbo, M.W., & Belfore, II, L.A. (2007). Stress and workload associated with monitoring simulated maternal-fetal heart rate signals. In Proceedings of the MODSIM World 2007 Conference and Exposition, September 11-13, 2007, Virginia Beach, VA.

Baydogan, E., Belfore, II, L.A., & Mazumdar, S. (2007). Decoupled agent architecture for virtual operating room training simulations. In Proceedings of the MODSIM World 2007 Conference and Exposition, September 11-13, 2007, Virginia Beach, VA.

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BOOK REVIEWS, ABSTRACTS, AND OTHER PUBLICATIONS

Basu, G., Jing, Y., Schwegler, E.E., Chen, N., Gravenstein, S., Deng, Y. and Drake, R.R. Serum and plasma protein biomarkers of influenza vaccine response in the elderly and young adults. Options for the Control of Influenza VI, Toronto, Canada; June 2007

Sun, B., McKenzie, F.D., Garcia, H.M., Hubbard, T., Ullian, J., & Gliva, G. Medical student evaluation using augmented standardized patients. *The Journal of the Society for Simulation in Healthcare (SSH).* Special issue of Simulation in Healthcare selected papers from the Computer Simulation in Medicine (CompMed) Symposium, co-supported by the Society for Simulation in Healthcare. Extended abstract accepted for publication January 2007.

Sun, B. & McKenzie, F.D. Prostate cancer tool kit and data repository. The Journal of the Society for Simulation in Healthcare (SSH). Special issue of Simulation in Healthcare selected papers from the Computer Simulation in Medicine (CompMed) Symposium, co-supported by the Society for Simulation in Healthcare. Extended abstract accepted for publication January 2007.

Scerbo, M. W. (2005). Medical virtual reality simulators: Have we missed an opportunity? *Human Factors and Ergonomics Society Bulletin, 48* (5), 1-3.

UNPUBLISHED MANUSCRIPTS

Scerbo, M.W. (2006) Transfer of training measures. 3 pages.

Scerbo, M.W., Garcia, H.M., Nalu, A., & Baydogan, E. (2006) Virtual reality chain saw safety trainer. 7 pages.

Sokolowski, J.A., Manepalli, S., Manepalli, G. & Davis, M. (2004). Designing an agent-based population model to support mass casualty planning.

Vickers, R.R. (2004). Patterns of disease in the U.S. military: Looking back, thinking ahead.

Mendoza, K. (2003). Procedural skills for undergraduate medical education (UME).

Mendoza, K. (2003). Current and proposed simulation training for medical students, surgical assistant students, physician assistant students, general surgery residents, pediatric residents, Ob-Gyn residents, vascular surgery fellows, urology residents, head and neck surgery residents and emergency medicine residents.

Mendoza, K. (2003). Three-year illustration of courses at proposed EVMS minimally invasive surgical simulation center.

Mendoza, K., & Britt, L.D. (2002). Minimally invasive surgical simulation training center.

CONFERENCES AND SYMPOSIA

Semmes, O.J. (2007) Dr. Semmes was an invited participant in the Early [Cancer] Detection Research Network – WHI Proteomic Interest Group meeting in Bethesda, MD.

Combs, C.D. (2007, Sept.) Dr. Combs served as the Chair of the Medical Track of the MODSIM World 2007 Conference and Exposition, September 11-13, 2007, Virginia Beach, VA. In addition, Dr. Combs served as a panel moderator for five panels at the conference.

Scerbo, M.W. (2007, Sept.) Dr. Scerbo served as Co-Chair of the Medical Track of the MODSIM World 2007 Conference and Exposition, September 11-13, 2007, Virginia Beach, VA. In addition, Dr. Scerbo served as a panel moderator for two panels at the conference.

Semmes, O.J., (2007). Dr. Semmes was an invited participant in the National Cancer Institute Animal Models in Research meeting in Bethesda, MD.

Scerbo, M.W. (2006, Jan.). Patient safety and medical simulation: Issues, challenges and opportunities. A panel presented at Medicine Meets Virtual Reality, 14, Long Beach, CA.

Scerbo, M.W. (2005, Jan.). Emerging trends in medical simulation: Identifying the needs of the medical community and methods to address them. A panel presented at Medicine Meets Virtual Reality, 13, Long Beach, CA.

Scerbo, M.W. (2004, Sept.). Virtual reality simulators in medicine: Current and future concerns. A panel presented at the 48th Annual Meeting of the Human Factors & Ergonomics Society, New Orleans, LA.

SELECTED PRESENTATIONS, DEMONSTRATIONS and INTERVIEWS

Cazares, L.H., Shaub, N., Mendrinos, S., Lance, R., Clements, M.A., Drake, R.R., and Semmes, O.J. MALDI mass spectrometry imaging discriminates malignant and nonmalignant disease of the prostate and identifies specific protein markers. To be presented at the Delaware Valley Mass Spectrometry (MS) Discussion Group Meeting, Villanova University, Villanova, PA on November 12, 2007.

Scerbo, M.W., Belfore, II, L.A., Garcia, H.M., Weireter, Jr., L.J., Jackson, M.W., Nalu, A., Baydogan, E., Bliss, J.P., & Seevinck, J.A. Virtual operating room for context-relevant training. To be presented at the 51st Annual Meeting of the Human Factors & Ergonomics Society, October 1-5, 2007, Baltimore, MD.

Belfore, II, L.A. (September 13, 2007). A fetal heart rate monitor. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Cuper, T.T. (September 13, 2007). Registration of 3D CT model of the pectus excavatum chest to subject: methodologies utilizing 3D laser surface scanning. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Baydogan, E. (September 12, 2007). Decoupled agent architecture for virtual operating room training simulations. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Nalu, A.T. (September 12, 2007). Individual personality characteristics for virtual agents in a virtual operating room. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Scerbo, M.W. (September 12, 2007). Medical errors and the need for simulation. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA

Tierney, N.W. (September 12, 2007). Virtual reality in gait rehabilitation. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Anderson, B.L. (September 11, 2007). Stress and workload associated with monitoring simulated maternal-fetal heart rate signals. A poster presentation at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Britt, L.D. (September 11, 2007). Simulation and graduate medical education: a 2007 update. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Combs, C.D. (September 11, 2007). The emerging imperative for medical simulation. Presented at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Heyl, A.R. & Schmidt-Panos, E.A. (September 11, 2007). Improving residency training in ob-gyn emergencies utilizing simulated team drills. A poster presentation at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Jackson, M.W., Kelly, A., Newlin, E.T., & Scerbo, M.W. (September 11, 2007). Evaluation of a procedural checklist for anesthesia pre-induction and induction. A poster presentation at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Mazumdar, S. (September 11, 2007). OntoVOR: the design of a knowledge-base for a virtual operating room. A poster presentation at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

Pedada, R. (September 11, 2007). Procedural modeling of wound textures. A poster presentation at the MODSIM World 2007 Conference and Exposition, Virginia Beach, VA.

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DISSERTATIONS

Hope S. Hanner-Bailey – (Mark W. Scerbo, Chair, James P. Bliss, Kathryn A. Mendoza, Robert M. McIntyre and Leonard J. Weireter, Jr., Members) Understanding the nature of surgical excellence using a competency modeling approach (2004-December, 2006). Industrial/Organizational Psychology, Old Dominion University, 147 pp.

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feature article

virtual OR

Engineers are developing systems that enable future healers to practice surgery and other skills on model patients in simulated spaces.

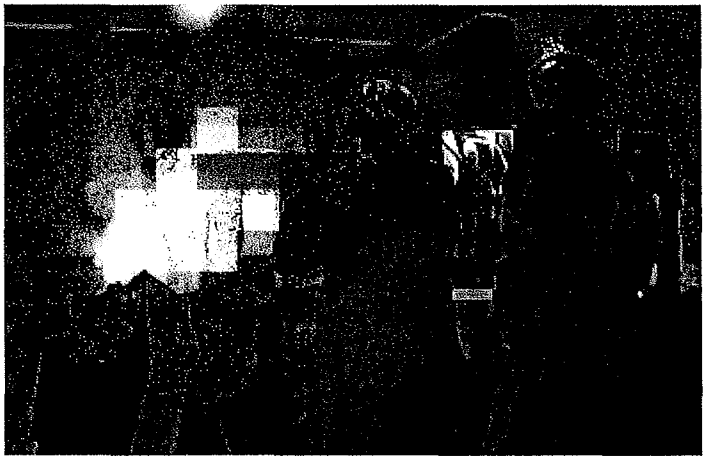
by Alan S. Brown, Associate Editor

Cool heads prevail in emergencies, and the coolest heads rest on experienced shoulders. It's the "been there, done that" attitude that comes from time, trial, and error.

But when the stakes are life and death, as they often are in operating and emergency rooms, no one is going to let medical students or residents learn from their mistakes. That's why the medical profession is turning to engineers to develop tools that give doctors crash courses in facing life and death decisions as part of an operating team.

"There's a coordinated sequence of events that has to take place in an operating room," said Leonard Weireter Jr., a surgeon at Eastern Virginia Medical School who also heads Sentara Norfolk General Hospital's Shock Trauma Center. "If the anesthesiologist, surgeon, and circulating nurse know how to communicate with one another, a lot can get done." If not, the ballet devolves into something more like a mosh pit. It can happen quickly in an emergency, such as cardiac arrest or allergic reaction. It may also occur if a member of the operating team misreads an instrument or misunderstands a command.

The virtual operating room allows real surgical students to interact with virtual instruments, and work with virtual surgeons, nurses, and anesthesiologists.



Today, medical students and residents learn to cope with life-threatening emergencies by living through them. They stand beside skilled practitioners, the same way apprentices learned from their masters for hundreds of years. They watch, assist, and ultimately take the scalpel into their own hands under the watchful eye of an experienced surgeon.

Yet even the busiest hospital presents only a limited range of experiences for any given type of operation. While human beings vary widely, most operations follow a routine set of procedures. Doctors may go through years of medical school and residency, and never encounter more than a handful of true emergencies. They may never confront a life-and-death decision until they are out on their own.

That may be about to change.

Taking a lesson from other professionals who must sometimes face critical decisions—pilots, chemical and nuclear power plant operators, or military officers—the medical profession has begun to use advanced simulations and mechanical feedback to train doctors. The work is still in its very early stages. Yet the new technologies promise interactions that will blur the distinctions between reality and models in virtual space.

Imitation of Life

The concept is simple. Doctors, nurses, and paramedics learn and practice procedures on simulators until they become proficient. The simulators then vary symptoms to depict medical emergencies that most medical personnel rarely encounter. Future doctors, for example, can rehearse emergency procedures the same way pilots use simulators to learn how to pull out of a spin or fly with a damaged engine.

Over the past decade, several companies have introduced simulators. Most consist of a plastic and rubber mannequin, a haptic feedback system that simulates the resistance of medical instruments moving through the body, and imaging systems that show the locations of the instruments.

Today's medical simulators have limitations, but they are moving rapidly into the medical mainstream. Two years ago, for example, the Food and Drug Administration approved a carotid stent, developed by Guidant Corp. of Indianapolis, that expands blocked arteries in the neck. Before doctors could perform the risky procedure implant, the FDA required doctors to undergo four hours of simulator training.

"This is the first time that FDA required simulator training," said Mark Scerbo, a professor of psychology at Old Dominion University in Norfolk, Va., and co-director of the National Center for Collaboration in Medical Modeling and Simulation. "This may be the start of a new model for training doctors. Simulations can also let us test new devices and procedures without putting patients at risk."

Scerbo is at the forefront of those changes. As a human factors psychologist, he has studied how doctors learn their craft. He is quick to point out the flaws in existing simulators. Each system covers only one specific type of procedure, such as gall bladder removal or ectopic pregnancy (where a fetus grows outside the uterus). While some simulations are realistic, others are not. All are expensive and usually carry six-figure price tags.

More significantly, today's simulators reproduce only a handful of emergency conditions. None teaches the critical thinking and teamwork skills needed inside an operating room.

Scerbo's National Center for Collaboration in Medical Modeling and Simulation wants to change that. It was formed four years ago when Old Dominion's Virginia Modeling and Simulation Center, which has close ties with the military, teamed with neighboring Eastern Virginia Medical School.

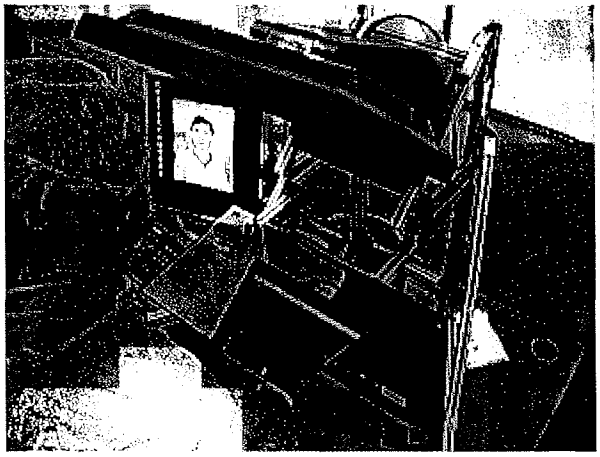
On one hand, the center evaluates existing simulations. "The biggest question medical schools have before they invest a few hundred thousand dollars in a simulator is, ÔDoes it work?' There's no empirical evidence that one is better than another or whether any of them are effective," Scerbo explained. His goal is to quantify their efficacy.

The center also hopes to commercialize new technologies. Its debridement system, for example, uses virtual reality to walk students through cleansing large surface wounds. "A person can come in, practice a skill on a simulated limb, and receive feedback from the system," Scerbo said. "The first time that person sees a patient, he or she can perform the procedure."

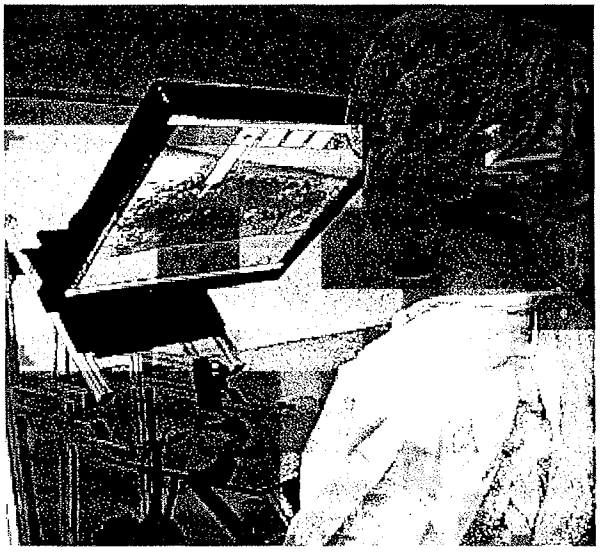
Finally, the center is building a comprehensive operating room simulator. The researchers have built a complete operating room around two existing procedures, gall bladder removal and an ectopic pregnancy. Inside that virtual environment, medical students can interact with simulated doctors and nurses while they operate on a mannequin. The unit is intended to train doctors in both critical thinking and teamwork.

The modeling environments and haptic feedback devices now being adapted for surgical training have existed for decades. Why are physicians only just beginning to tap their power? The answer, Scerbo said, involves litigation and changes in operating room practice.

"Medicine is a lightning rod for litigation, and anesthesiology is one of its riskiest specialties," he said. Starting in the late 1980s, anesthesiologists teamed with engineers to reduce operating room errors. They developed training mannequins that simulated such physiological responses as high blood pressure and choking.



A debridement center uses haptic feedback to provide medics with a realistic experience as they remove debris and cleanse a virtual wound.



"One of the most serious issues in the field is intubation, getting a tube down the throat without choking the

patient," Scerbo said. "The more you do it, the better you learn. Doctors joke that the reason they call it a practice is because they practice on you and me. With mannequins, they're learning on a device and not on a patient."

The use of mannequin simulators coincided with the advent of minimally invasive, or laparoscopic, surgery. Instead of slicing open a body, surgeons inserted cameras and surgical instruments attached to long rods through small incisions. They then performed the procedure guided by camera displays of the organs.

Minimally invasive surgery reduced recovery times dramatically, but proved difficult to learn. "It's like doing very sophisticated surgery with chopsticks in your hands," Scerbo said. "It takes a lot of training to look at a two-dimensional display and understand what your instruments are doing. There's a real need to train doctors, and not on patients."

Working laparoscopic instruments takes more than looking at a video monitor. It also requires a sense of touch. Off-the-shelf haptic feedback devices reproduce the forces laparoscopic instruments encounter in the body.

Haptic devices provide force feedback. In surgical simulations, they are typically robotic arms that work in reverse: Instead of applying force to an object, they provide force feedback when someone moves an object. When a student moves a clamp at the end of a robotic arm, the haptic system calculates the amount of force to apply against that motion by gauging how the scalpel interacts with a computer-generated model of tissue in which it moves.

"It's very difficult for a haptic device to replicate what the skin senses, such as the sensation of picking up a tennis ball in your hands," Scerbo said. "It's much easier to replicate the resistance of a rod moving through a body."

Faithful Enough

"For years, we thought medical simulator haptics had to be incredibly precise," Weireter said. "We talked to the Air Force about their high-fidelity models of airflow over

an F-16, but the shape of a liver is far more complex than a wing. But we found we didn't need to spend a billion dollars to create high-fidelity haptics."

In fact, students typically learn laparoscopic surgery using low-tech devices. They simply poke their camera and instruments through holes in a black box and practice hand-eye coordination skills, such as transferring objects from one hand to another and tying knots while watching a video display. Simulators eventually add haptic feedback. "It turns out you don't need the high-fidelity haptics," Weireter said. "It's the repetitive practice of the motion that counts."

Yet haptics plays a large role in the center's debridement system. Debridement is the system for cleansing wounds that are too large to stitch closed. Medics, paramedics, and nurses must learn to clean the wound and remove dead tissue, glass, and other foreign objects to prevent gangrene and infection.

"It's really a simple procedure," said Hector Garcia, a Virginia Modeling Analysis & Simulation Center research scientist. "If you can use a fork and knife to cut chicken, you can do this. But we don't want to have to take a medical doctor's time away from other tasks to teach this simple procedure."

The debridement system attempts to replace a physician with instructional materials and simulations. First, a virtual instructor describes different types of wounds and lacerations. Then it shows videos of procedures. Finally, the system walks the student through the cleansing of a wound containing glass shards or other objects by using a three-dimensional simulation projected onto a large reflective screen.

No one would mistake the virtual wound for the real thing, but it has enough fidelity to give students practice. "They grab the grasper-type tool affixed to the end of the robotic arm and use it to clean the wound," Garcia said. "The robot has six degrees of freedom and the ability to provide resistance or deny movement in any direction."

As the robotic arm moves, it interacts with a computer-generated wound. The computer represents the skin's surface as a mass-spring model, a mesh of nodes

connected by lines. Each node has a mass associated with it. The lines between them act like springs. When the instrument touches a spring, the model calculates the resistance based on the mass of the node and the resilience of the spring. This calculation determines the haptic resistance of the robotic arm.

"Some surfaces deform and bounce back when pushed," Garcia said. "Others offer more resistance. It doesn't behave like real tissue, but our model is based on a more precise and computer-intensive model of how skin deforms. It's close enough to give the illusion of skin, but simple enough to run in real time on our computers."

According to Weireter, "It's a great device, intended to teach real novices how to clean up a sophisticated wound so you can move the patient safely." Weireter and other team members are now looking at ways to make the debridement simulator generate a broader variety of wounds and teach students to monitor them for signs of infection after treatment.

Virtual Operations

The virtual operating room creates even more complex interactions between real and virtual space than the debridement system. The space itself is a combination of the real and the virtual. High-intensity lights glare down on a mannequin lying on the operating table. The room's walls display virtual monitors, instruments, and a transfusion kit. Two live students share the room with simulations of other medical professionals.

"The room combines psychology and engineering," Scerbo said. "If you look at advances in safety made in other high-risk domains—aviation, nuclear power, military operations—they were achieved by people who understood the entire environment in which they perform. They understood their tasks, their tools, and the role of their coworkers.

"Doctors and surgeons don't perform individually. They perform with other doctors and nurses, with instruments and displays, and often with lack of sleep. They may go in for a 90-minute procedure, but wind up standing through a

four- or five-hour operation."

The new technology promises interactions that will blur the distinctions between reality and models in virtual space.

Decision-making and communications are critical in that environment. "First-year surgeons learn procedures, but then they have to understand the interaction of drugs, operating room conditions, and patient status," Scerbo said. "If something unexpected happens, they have to be able to handle that, too."

Today's surgery simulations teach only procedures, he noted. None shows doctors the context in which they have to perform. Scerbo's goal is to take existing skills-oriented simulations and then add operating room interactivity.

"What we've done," added Weireter, "is put a simulation that teaches technical skills into an interactive environment, where the other people in the room are not real people but virtual images. We're not going to teach you to do the operation, but how to act with other people so you know how to interact when catastrophes occur. Instead of making it up at the line of scrimmage, we're going to drill team behavior so that when something happens, it's no big deal because we've prepared for it."

As the virtual operating room evolves—and this may take years—it is expected to drill students and residents in critical thinking and communications skills. They will see more and more varied emergencies than the cases that come through the hospital doors when they are on shift. They can also schedule virtual team practice at their own convenience.

Into the World

Equally important, the virtual operating room gives human factors researchers a tool to study how and why surgeons make mistakes. "We can look at the sources of errors that creep into procedures and design countermeasures," Scerbo said. "We can build better

systems that match the capabilities of human users without overloading or underloading them."

Scerbo, Weireter, and Garcia freely admit that virtual surgery is still in its infancy. Many commercial systems have design flaws or leave out critical steps. A simulator that's designed to teach how to draw blood, for example, doesn't let doctors or nurses feel an arm to get a sense of a vein's location. "People who trained on that system did worse when they went to take blood than those that trained conventionally," Scerbo said. "It was like learning to fly on a flight simulator that doesn't let you fly in the wind."

Yet simulation systems have already scored victories. Several years ago, members of the U.S. military's Special Forces challenged Weireter to use his system to solve a battlefield problem. "The medics we trained performed great in well-lit rooms with elevated operating tables," he recalled. "But they didn't know how to perform when people were shooting at them in the dark.

"So we took medics and put them in an environment where they had to keep their heads down or they were shot by a sniper. When they mastered that, we turned off the lights so the only light they had came from explosions. We showed we could train them to perform in that environment, to focus on what's important, and keep their heads down so they didn't get shot."

Those medics are now saving lives in Iraq. They are not succeeding because their medical skills are different from the medics who trained before them. Instead, they save lives because they understand the context in which they must put their skills to use.

One day, thanks to medical and surgical simulations, that might be true of all doctors and nurses.

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Simulating Surgery: Virtual Operating Room Changing The Way DoctorsTrain

Old Dominion University researcher Mark Scerbo believes virtual reality will change the way physicians are trained.

In recent years he has used virtual environments to show how battlefield surgeons and military checkpoint sentries can be trained effectively without exposing them to the real-world dangers of their jobs. Now, he and colleagues at the National Center for Collaboration in Medical Modeling and Simulation, which is jointly run by ODU and the neighboring Eastern Virginia Medical School, have developed a virtual operating room.

An EVMS faculty member, Dr. Gayatri Kapur, and a team of other EVMS medical professionals and ODU students demonstrated the virtual OR in early November for an audience of national and state technology writers and representatives of the Virginia Economic Development Partnership.

The demonstration in ODU's Cave Automated Virtual Environment (CAVE) involved neither a patient, nor functioning medical equipment. Nevertheless, four real people dressed in surgical garb and two virtual physicians projected onto the CAVE walls performed a faithful simulation of a laparoscopic surgical procedure.

Dr. Kapur portrayed a resident who was performing the procedure under the guidance of a more senior surgeon. She used instrumentation similar to actual laparoscopic instruments and her snips and suction inside her "patient" were simulated on a computer screen. A voice-recognition system allowed normal dialogue between the real and the simulated people in the "operating room."

When the procedure was completed, the virtual senior surgeon assessed the performance of the "resident" and offered follow-up instruction. The script reflected the traditional apprentice method of medical training, but the setting and technologies involved were not at all traditional.

Dr. Leonard Weireter, professor of surgery at EVMS, helped to formulate the original idea for the virtual OR and collaborated in the design and implementation with Scerbo, Kapur and Hector Garcia, visualization lab manager on the ODU campus for the Virginia Modeling, Analysis and Simulation Center (VMASC).

Scerbo is trained in neither medicine nor engineering, the two professions that have been most responsible for the boom in simulated medical training over the past 15 years. He is a human-factors psychologist who believes his specialty can provide a closer match between the users and developers of medical simulation technology, as well as make contributions to other VMASC projects.

Compared with other "lives-in-the-balance" professionals such as airplane pilots and soldiers, physicians have been exposed to very little simulation training. Pilots have been required for years to qualify on flight simulators before they fly modern jets. But only last year did the U.S. Food and Drug Administration establish its first virtual-reality training requirement for a specific surgical procedure. The rule requires surgeons to demonstrate mastery of a simulated carotid artery stent implant before they try the procedure in an actual operating room.

"This action taken by the FDA is an historical event of unimaginable proportions," Scerbo wrote in a paper he presented at this year's annual meeting of the international Human Factors and Ergonomics Society. "It is the first time in the history of medicine that performance-based competency measures will determine who can and cannot perform a medical procedure."

The traditional, "see one, do one, teach one" apprentice training of physicians, Scerbo said, does not expose residents to a standard set of medical conditions and procedures, or to standard performance measures. Also, he pointed out, the American Medical Society's accreditation council has recently established an 80-hour work-week limit for residents, which actually represents a cutback in apprentice training hours for the typical resident.

He believes the time is ripe for simulation medical training. "Simulation offers the opportunity to study the practice of medicine from a more scientific perspective," he said. "It will never replace the apprentice system, but it can make the system much better."

Weireter emphasizes the value of a "controlled environment" during medical training. "Much like a flight simulator where the trainer can mimic situations, we can induce situations we want to drill an individual or team on," he said.

Tell-tale sounds heard through a stethoscope that a physician needs to be able to recognize can be simulated. So can other symptom-recognition requirements and dexterity feats, as were demonstrated in the virtual OR performance earlier this month.

But the virtual operating room can simulate more than a physician's core duties, Scerbo said. It can expose trainees to real-world team-building challenges and pitfalls brought about by cultural, gender and age differences. It also can be a test lab to study task sequencing and other aspects of how people learn in a stressful environment. Scerbo believes the basic virtual reality created to simulate an operating room can be adapted to simulate an emergency room.

"With VMASC and our Center for Collaboration in Medical Modeling and Simulation, we could have in this region a medical training simulation facility that is one of a kind, that people would come from all over to use," Scerbo said.

His paper at the 2005 Human Factors and Ergonomics Society meeting listed 10 ways human factors psychology can contribute to simulation medical training.

One that he believes is most critical at present is the use of human-factors measures to determine the fidelity of

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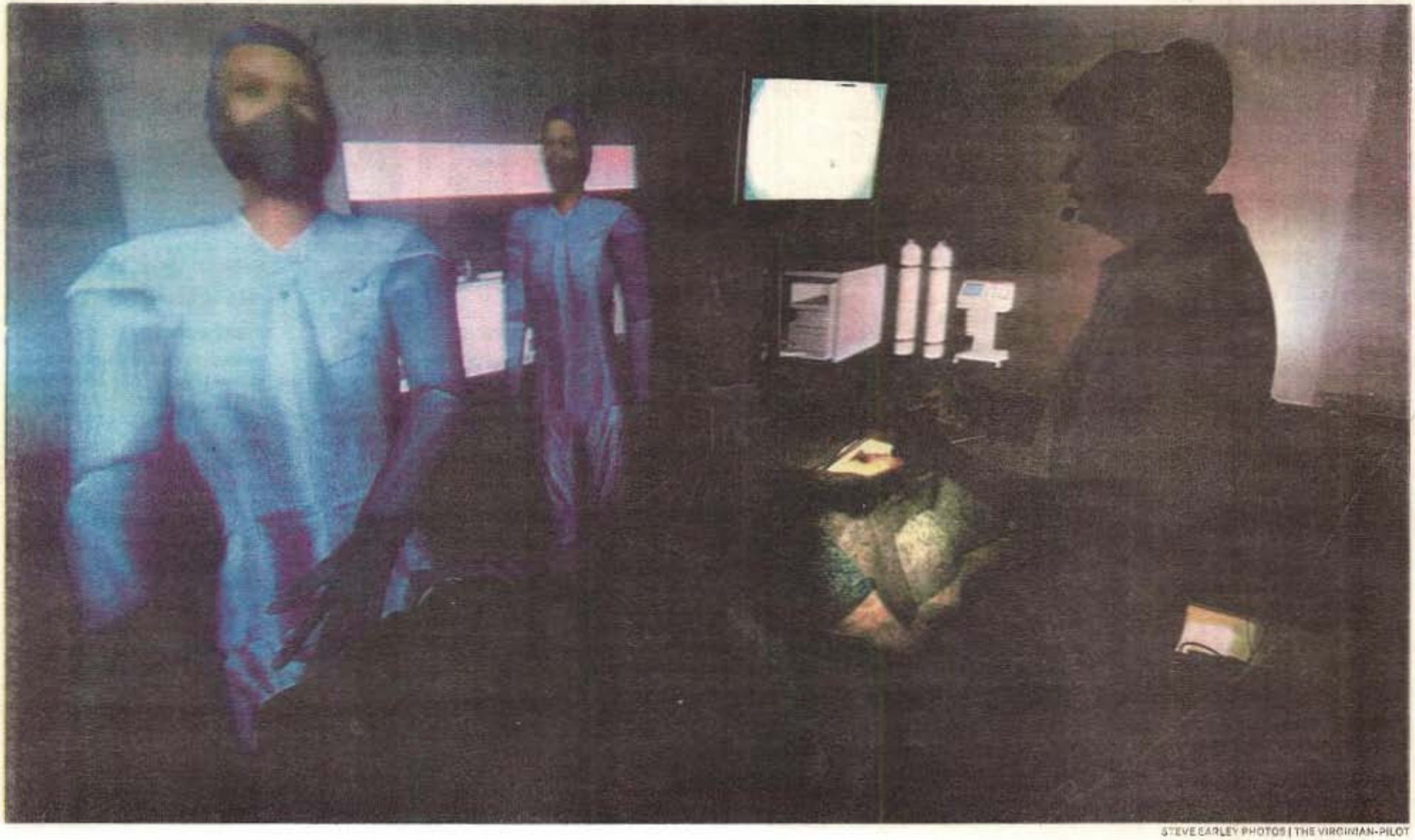
VMASC is an enterprise center of Old Dominion University.

Sunday

MODELING AND SIMULATION



STEVE EARLEY PHOTOS | THE VIRGINIAN-PILOT

VIRTUAL SURGERY
VIRTUAL DISASTER
VIRTUAL TRAFFIC

REAL OPPORTUNITIES FOR HAMPTON ROADS

Sure, it sounds a little geeky, but modeling and simulation just keeps growing locally, and the lucrative industry is ever-so-slowly starting to find some promising commercial applications.

ABOVE Psychology professor Mark W. Scerbo demonstrates how medical students would perform simulated surgery in Old Dominion University's virtual operating room.

LEFT Doctorate student Liz Newlin explains how she creates avatars to represent medical characters.

The Virginia Modeling, Analysis and Simulation Center, an ODU research hub, will soon move into a new $11 million facility off Va. 164.

JOHN H. SHEALLY II | THE VIRGINIAN-PILOT

[illegible] 'NG POINT' LOCALLY? OF [illegible] HAVE MIXED VIEWS

By Jon W. Glass
The Virginian-Pilot

IN A DARKENED ROOM at Old Dominion University, Mark Scerbo spoke a command into a headset. Instantly, the space morphed into a hospital operating room.

A simulated surgical team beamed onto the walls. The 3-D team, outfitted in blue scrubs, included a testy attending surgeon given to such sarcastic zingers as: "Your incompetence is mind-boggling. Please state your procedure." A beeping heart monitor and a patient's rhythmic breathing added realism.

Scerbo, an ODU psychology professor who studies human use of technology, thinks this virtual operating room could transform the way doctors train to become surgeons.

"For the first time, this opens up the possibility of doing alternative forms of training without putting a patient at risk," he said.

For Hampton Roads, the significance extends well beyond medicine.

Local officials say it's the kind of cutting-edge work under way here that could turn the region into a national magnet for business in computer-based modeling and simulation.

See NEAR, PAGE 3

Continued from Page 1

Besides bragging rights, the move to grow modeling and simulation could add hundreds of millions of dollars to the region's economy and create jobs that pay far higher than the average local salary.

While the military remains the industry's No. 1 customer, university researchers and some private companies now use computer simulations to try to solve problems encountered in medicine, homeland security, transportation planning and education.

There's also efforts to tap into game-based technology to lure the Xbox and PlayStation generation into math and science careers – considered crucial to maintaining the nation's competitive edge.

This week, the region will showcase such non-military work at the ModSim World Conference and Expo, a three-day event starting Tuesday at the Virginia Beach Convention Center.

Local officials said the homegrown conference, the first of its kind and more than a year in the making, could draw 500 participants.

They hope it will help brand the region as a hotbed for modeling and simulation – and show that work being done here is not all about defense.

The [illegible] virtual displays should be [illegible]. There will be sessions with panel members [illegible] across the country and the globe. They will explore the use of high-tech computer tools for such things as managing port and air traffic, improving the response to disasters and training doctors in laparoscopic surgery.

Officials aim to demystify the subject to a public inclined to relegate it to computer geekdom.

"There will be plenty to do and see and touch," said Bob Sharak, director of special projects for the Hampton Roads Partnership, which helped organize the event. "We thought it was good to have a conference that would sort of put us on the map."

Since the late 1990s, the nation's top defense contractors have set up shop in Hampton Roads, drawn here to work with the Pentagon's Joint Forces Command.

Along a bustling corridor in northern Suffolk, dubbed Sim City, the military command uses computer models and simulations to test war-fighting technologies and run virtual battlefield exercises.

It's been good business. A 2004 study showed that the modeling and simulation sector pumped more than $400 million and 4,000 jobs into the local economy. The high-paying jobs are the kind city leaders salivate over – an average salary then of $59,405, nearly two-thirds more than the region's $34,918 average.

As a measuring stick, though, those numbers pale beside Orlando, Fla., long regarded as the industry powerhouse. A 2003 study showed that modeling and simulation generated around 17,000 jobs and $2.5 billion in metro Orlando.

Want to go to ModSim World?

Registration is required for the three-day event starting Tuesday at the Virginia Beach Convention Center.

A one-day pass with access only to the exhibit hall is $75.

The daily rate to attend seminars, plus breakfast and lunch, is $125.

Special military, government, teacher and student rates are available for all three days.

For details, go to www.modsimworld.com.

Defense work is heavy in Florida, too, where contractors design training simulators for driving tanks or flying fighter jets, for example. But the entertainment industry there, including Universal Studios, Disney and electronic-game makers, adds diversity.

Even so, Russ Hauck, executive director of the Orlando-based National Center for Simulation, said Hampton Roads has become a "significant player."

"If you want to view it as a horse race," Hauck said, "generally people have looked at us as No. 1 and Hampton Roads as No. 2, and coming on fast."

That may be so, but local officials have mixed views on how far modeling and simulation has advanced here beyond its military roots.

Some, like Jones Hooks, president and chief executive officer of the Hampton Roads Economic Development Alliance, say the commercial industry is still emerging.

Over the past five years, Hooks said, the alliance has spent around $300,000 pitching the region to modeling and simulation businesses. So far, the marketing effort has snagged only two companies – a defense contractor and a games-based technology firm. This month, the alliance is trying again at a modeling and simulation conference in London.

"I think we're still trying to build our case and position Hampton Roads as a leader," Hooks said. "A lot of things are beginning to come together, it just takes a while. Our expectations are not to make mega announcements; we're building awareness."

Others see the current mix of businesses, academic researchers and government interest reaching a critical mass.

"I think we're at the tipping point where we're getting ready to explode," said Bob Harper, a program manager for Northrop Grumman Corp. who works at Joint Forces Command. "If you look at north Suffolk, you can see the tremendous impact it has had, and it has the potential to do that for all of Hampton Roads."

In the past 10 years, the influx of defense contractors has turned the Harbour View section into Suffolk's largest office submarket, said Tom O' Grady, the city's economic development director.

Counting the military command's leases, more than 1 million square feet of office space has been built and occupied there. Defense contractors, including Lockheed Martin, Raytheon, SAIC and General Dynamics, are in about 350,000 square feet, O'Grady said.

That growth has attracted new hotels, restaurants and shops. And there's more coming, including a new technology park that straddles Suffolk and Portsmouth.

The Virginia Modeling, Analysis and Simulation Center, an ODU research hub known as VMASC, will begin moving this month into a new $11 million facility in the park, off Va. 164. The 60,000-square-foot building, nearly triple its current space, "will give us a phenomenal capability," said VMASC executive director Mike McGinnis.

Since opening in 1997, VMASC has spun out three start-up businesses. One, WernerAnderson Inc., has licensed technology developed at the center that models crowd behaviors. Company founder Eric Weisel, a former Navy submariner, earned a doctorate in modeling and simulation from ODU – one of a handful of universities to offer such a degree.

The behavior model, Weisel said, was designed for the military to analyze tactics of dealing with crowds, such as hostile, rock-throwing mobs. However, Weisel said, the model could be used by civilian police and emergency responders for training in disaster situations, and "we're excited about the possibilities."

In five years, the company has grown from a one-man operation to 10 employees and parlayed first-year revenue of $30,000 into business expected to top $1 million this year, Weisel said. Grassroots companies like his and not large corporations, he said, likely will spur further expansion of modeling and simulation in the region.

Ultimately, the region's goal to become a national nexus for modeling and simulation will depend on its ability to expand into new markets, officials said.

"Almost all the companies here have some military realm, because that's the one constant. We're really just starting to make some progress in other areas," said Mike Robinson, VMASC's director of programs advancement.

One of the most promising prospects seems to be in medicine.

Last month, a joint venture between Eastern Virginia Medical School and ODU scored its first commercial success. A Texas company, Cardionics, licensed the research team's technology to a virtual pathology stethoscope. It plans to market the device as a tool to help medical students learn how to detect lung and heart diseases.

The virtual operating room, still under development by EVMS physicians and ODU scientists, represents another project with commercial potential.

Scerbo, the ODU psychologist, said the operating room could be sold to train surgeons. It also could be used as a research facility to test the effectiveness of medical simulators now being built by commercial vendors.

Using a variety of off-the-shelf software, local researchers programmed the virtual surgical team using voice-recognition cues to guide trainees through a gall bladder removal. The animated team includes an anesthesiologist, a circulating nurse and an attending surgeon, who zings a trainee who fails to ask the right questions or give correct answers.

Surrounded by the sights and sounds of an operating room, trainees use real surgical instruments and "operate" on a commercially available simulator that models a gall bladder. The purpose, Scerbo explained, is to mimic the social dynamics that might occur in a real operating room – and to eliminate errors on live patients.

If successful, it could draw medical manufacturing companies to Hampton Roads, Scerbo said, "opening up a whole new area for pilot-testing equipment" in an operating-room setting.

Armed with $6.2 million in federal and private grants,

> Generally people have looked at us as No. 1 and Hampton Roads as No. 2, and coming on fast."
>
> *Russ Hauck, executive director of the Orlando-based National Center for Simulation, comparing Hampton Roads and Florida*

EVMS researchers are working on a range of other modeling and simulation projects.

One examines the effects of cosmic radiation on the brain, in support of NASA's plan to send humans to Mars. Another focuses on early detection of breast and prostrate cancers. A third involves developing a chainsaw simulator to train relief workers who need the real thing after natural disasters.

With the national market in medical modeling and simulation expected to grow to $1.5 billion by 2012, the aim is to steer some of that business to Hampton Roads, said Don Combs, an EVMS professor and associate dean.

"Our goal is to carve out a niche that focuses on the world of practice and that is concerned about patient safety and health care," Combs said. "I think you're beginning to see results."

Across the region, other efforts to diversify beyond defense are under way. VMASC is working on several transportation-related projects, including a simulation to help planners manage the flow of trucks and cargo at the new APM Terminals Virginia in Portsmouth.

Also, a VMASC researcher is looking into ways that computer simulations could be used to teach algebra to high school students, said John Sokolowski, the center's research director.

Even defense contractors are fishing for ways to expand.

At the Center for Innovation, a $35 million facility Lockheed Martin opened two years ago in Suffolk, researchers are delving into homeland defense, port security and movement of freight, said Mort Forker, Lockheed's director of business development.

"There are so many potential customers and partners here," Forker said.

The ModSim World conference, boosters said, has been a regionwide collaboration, with some companies ponying up $25,000 to help sponsor it.

"We think it can be a springboard, so more people can see how this technology can be used in their everyday business, to help them do planning, to help them make better decisions," said Bill Younger, conference co-chairman.

Younger is an executive with Portsmouth-based Mymic, a modeling and simulation firm whose work has tripled in two years. A decade ago, he said, modeling and simulation was "like a foreign language" locally.

"Now, it's amazing," he said. "We've come a long ways very quickly. It's going to be a growth area for this region."

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