

## MacNeil-Lehrer Partnership

MacNeil-Lehrer Productions and the University of Southern California have formed a long-term partnership to pursue research and development of Next Generation Journalism technologies.

The project will explore immersive, interactive, three-dimensional audio and video formats and tools for recording, production and transmission of news and information. The technologies will be deployed initially for a new daily in-school news program, theNews, now being developed by MacNeil/Lehrer Productions (MLP).

The research will be conducted at the Integrated Media Systems Center (IMSC), the U.S. National Science Foundation Engineering Research Center for multimedia, located at USC's Viterbi School of Engineering.

"Journalism, especially for the young, must take advantage of emerging technologies" said Dan Werner, executive producer for special projects at MLP. "We are extremely pleased by this opportunity to team up with the IMSC which is a leader in

research efforts to more effectively transfer information in the digital age."

The project will build on recent milestones in IMSC's decade-long research in immersive media, including its GeoDec family of visualization

technologies introduced in 2005 and IMSC's immersive audio-video Internet transmissions of symphony and chamber music concerts.

"We are delighted to work with such a distinguished partner," said Adam Clayton Powell III, Director of IMSC. "This will combine our laboratory's longstanding multimedia research with the Viterbi School Serious Games Initiative, an investigation of interactive media for applications including education, health care and emergency preparedness."

The project will be a collaboration among several engineering disciplines represented at IMSC and the journalism expertise of USC's Annenberg School for Communication.

MacNeil Lehrer Productions produces The NewsHour with Jim Lehrer, which airs weeknights on more than 300 local PBS stations, as well as other programs for public, commercial and cable television. Other recent television programs produced by MLP include *Do You Speak American?*, Robert MacNeil's journey across America to look at why Americans speak the way we do; *Debating Our Destiny: A History of Presidential Debate*; *LadyBird*, a profile of LadyBird Johnson. MLP is also the leading force behind the *By the People* a local-national journalism-civic engagement project.



## IMSC Research supported by new Annenberg Center Grant

**IMSC has received additional support from the Annenberg Center for Communication for IMSC GeoDec project research to explore a range of applications in urban planning and democratic empowerment.**

The new grant, which is in addition to the Annenberg Center's annual support for IMSC research, will fund research to extend GeoDec's interactive three-dimensional tools to downtown Los Angeles, to depict the area as it now exists and to support planning of the proposed \$1.8 billion redevelopment of downtown Los Angeles.

This research project will be conducted in conjunction with the Norman Lear Center at the USC Annenberg School for Communication and the Lear Center's Grand Avenue Intervention, focusing on a proposed new park for downtown Los Angeles.

IMSC's GeoDec research includes a family of interactive, three-dimensional, highly accurate visualization tools, from rapid modeling to depiction of live dynamic data, including live video. Led by Professor Cyrus Shahabi, GeoDec is part of IMSC's Decision Support research area, which is devoted to research on presenting massive amounts of data in real time in forms and displays that can be quickly understood.

"This is precisely the type of cutting edge interdisciplinary project that the Annenberg Center for Communication should be supporting," said Jonathan Aronson, professor and executive director of the Annenberg Center for Communication, announcing the new grant.

"We are grateful for the recognition of IMSC research in this area," said Adam C. Powell III, Director of IMSC. "We are eager to expand the Center's research into new and exciting areas of urban planning and civic engagement."

"The beauty of these tools," added Martin Kaplan, associate dean of the USC Annenberg School and director of the Norman Lear Center, "is that they will help both citizens and design professionals,"

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*Pictured above: Grand Avenue Intervention site framed in yellow.*



from the Director

## Welcome to the Spring edition of the IMSC newsletter!

To old friends, welcome back; to newcomers, we hope you return often.

Looking back at 2005, IMSC strengthened its traditional base of industry relationships in the computer and aerospace industries while expanding our laboratory's initiatives in media, online information, journalism, education and entertainment.

In all of these fields, our research is characterized by its broad and inherent combination of disciplines. Cinema, Communications, Fine Arts, Journalism and Music are all integral to IMSC's initiatives:

For example, our newest partnerships include MacNeil-Lehrer Productions, among the most honored broadcast journalism organizations in the U.S. To pursue a research program for MacNeil-Lehrer — even to design the research agenda — requires an interdisciplinary effort among multiple disciplines of the USC Viterbi School of Engineering together with our USC colleagues across the campus, especially in the Annenberg School for Communication.

For our laboratory's partnership with McKinley Technology High School in Washington, D.C., funded by a supplemental grant from the National Science Foundation, IMSC's Serious Games initiative draws on engineering, games, design and education expertise.

For IMSC's research extending the laboratory's GeoDec visualization tools into urban planning and civic engagement applications, IMSC researchers worked with the Annenberg School for Communication and the Norman Lear Center, supported by a new grant from the Annenberg Center.

And for continuing milestones in IMSC Immersive Scalable Immersive Environments and Human Performance Engineering, faculty from several different fields working with sister laboratories and schools across USC combine their efforts in research that rises well above the sum of their parts.

IMSC even helped create a new CD, "All Is Bright," which hit #5 on Billboard magazine's classical top ten chart over the Christmas season!

Looking ahead to 2006, this will be an exciting and challenging time for IMSC. The only constant will be change — and that is what makes research interesting.

—Adam C. Powell III  
Director, IMSC

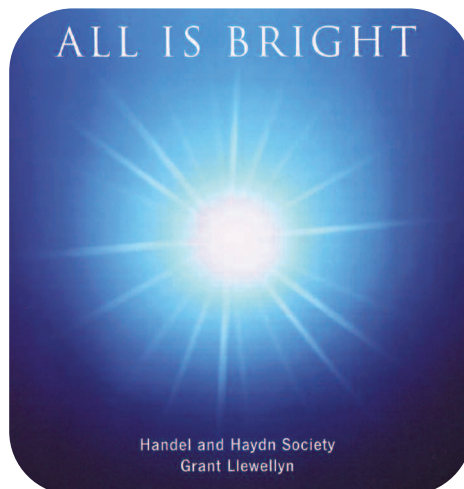
## IMSC's First CD

The IMSC Immersive Audio Laboratory participated in the recording of a CD that is now available from AVIE Records. IMSC faculty Chris Kyriakakis and Tomlinson Holman worked with James Donahue, a long-time IMSC collaborator in immersive audio and the Principal Recording Engineer at WGBH in Boston. The recording took place in Methuen Memorial Music Hall in Methuen, Mass. that houses the largest concert organ in the US.

Maestro Grant Llewellyn led the Handel and Haydn Society chorus to record a collection of carols from both sides of the Atlantic. Some are well known and others were commissioned specifically for this project. The Handel and Haydn Society is its 191st season and has a long tradition of musical excellence. Among its achievements are the American premieres of Handel's Messiah (1818), Verdi's Requiem (1878), and Bach's St. Matthew Passion (1889).

The CD is entitled "All is Bright" and reached #5 on the Billboard Classical charts.

One of the songs that was commissioned from composer Tom Vignieri has been processed and rendered for 10.2 Immersive Audio and is available for demonstration in the IMSC Immersive Audio Lab. Vignieri and Maestro Llewellyn plan to visit IMSC to discuss further collaborations with IMSC in immersive performance.



## Annenberg Center Grant

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no matter where they are located, imagine alternate futures for a real physical space."

"We are very excited to work with Annenberg on this project and we see it as an opportunity to extend GeoDec's utilities to the Urban Planning application area," said Cyrus Shahabi of the IMSC.

The Annenberg Center for Communication is an independent USC center that identifies and supports cross-disciplinary communications research, education and dissemination across the university. *More at <http://www.annenberg.edu/>*

Based at the USC Annenberg School for Communication, the Norman Lear Center is a multidisciplinary research and public policy center exploring implications of the convergence of entertainment, commerce, and society. *More on the Norman Lear Center's Grand Avenue Intervention project at <http://www.grandintervention.org>.*

# IMSC Offers an Introduction to Video Game Design Seminar

The Video Game industry has emerged as the hottest field in interactive entertainment. Video game development is a dynamic, multifaceted discipline requiring a diverse blend of skills, practical experience, current and historical knowledge and theoretical foundation. Through the diversity of course work, theory and application, including hands-on experience with industry-standard management and development tools, this seminar is designed to align with students' academic and professional goals.

implement and integrate current and emergent video game features and technologies.

Given its strategic location in southern California, USC has developed relationships with various game companies including Electronic Arts, Sony Playstation, Activision, and others. These key relationships have enabled USC to bring a variety of guest speakers into the classroom. Over the past three years, lead game designers, programmers and artists from a variety of companies have provided

# IMSC research featured at conferences in Africa

Adam Clayton Powell III, Director of the Integrated Media Systems Center, presented the Center's latest research in communication technology at two fall conferences in Africa.

Delegates from around the continent attended and discussed IMSC research on the future of communications technology and information at September's annual "Highway Africa" conference at Rhodes University, in Grahamstown, South Africa. Subjects included immersive audio and video, three-dimensional and 360-degree representations of information and entertainment, and two-way haptics for remote health applications.



Summer 2005 IMSC Video Game Design Seminar participants

This summer, IMSC will once again offer students the opportunity to learn about video game production at a seminar being offered by Dr. Anthony Borquez. The IMSC Video Game Design Seminar will provide students with not only an overview of the video game production process, but also foundation knowledge for game design. In the course, students will gain hands-on experience developing video games utilizing various software applications. Upon completion of the course, students will be able to conceptualize, design, develop,

USC students with insight and guidance for creating compelling games. A highlight from the 2005 summer game design program included weekly field trips to the Electronic Arts (EA) campus in Playa Vista where students engaged in Q/A sessions from different EA product groups.

For more information on the Introduction to Video Game Design Seminar, please contact Dr. Anthony Borquez at [anthonyb@usc.edu](mailto:anthonyb@usc.edu) for details, or visit [http://www.usc.edu/dept/admissions/programs/summer/seminars\\_seminars.shtml](http://www.usc.edu/dept/admissions/programs/summer/seminars_seminars.shtml).



The rapidly falling barriers to entry, both technological and financial, were also discussed, as the presentation touched on content creation and origination in Africa and the Middle East. Examples from South Africa, Egypt and Saudi Arabia were reviewed.

In response to the presentation, delegates debated how the accelerating pace of technological change is affecting the evolution of formal African media and of unofficial information sources across the continent.

The presentation was summarized in an article which was published in the November, 2005, issue of the *Rhodes Journalism Review*.

In December, IMSC was invited to participate in the African Media Forum in Nairobi, Kenya, where the focus of discussion was the future of global video journalism.

IMSC research that was discussed included streaming and synchronization of multiple video and audio streams, and the cost-effective capturing, storage, and rendering of high-resolution video and immersive audio under difficult field conditions.

The Nairobi conference attracted more than three dozen delegates from Africa, Asia, Australia, Europe and the U.S. Participants included senior managers and editors of news organizations ranging from CNN to Al Jazeera, executives of African media groups from East Africa's Nation Media Group to South Africa's SABC and e.tv television networks, and delegates from political and technical organizations including the African Union and Intelsat.

A team from USC has been invited to return in September for the next "Highway Africa" conference, to participate in and help coordinate the closing day's presentations on the future of communications technology on the African continent.

**IMSC: Celebrating 10 Years  
1996-2006**

# With a new 3-year NSF grant, IMSC's HYDRA Rears its Many Streams

Roger Zimmerman, research assistant professor in computer science and research area director for media immersion environments at IMSC, and his team have received prestigious NSF support for their HYDRA project. The grant is part of an NSF program focusing on *Advancing Collaborative and Intelligent Systems and their Societal Implications*. The focus of HYDRA — the name loosely represents an acronym for *High-performance Data Recording Architecture* — is to study fundamental research questions in the area of streaming media architectures.

The goal of the IMSC researchers is to investigate the challenges inherent in a broad class of innovative applications that acquire, store, manipulate and disseminate digital continuous media (CM) streams, such as audio, video, and haptics, in real-time and on a large scale.

With the widespread deployment of broadband networks, streaming media are driving many existing and new applications. To name just two examples, Voice-over-IP (VoIP) telephony and personal video recorders (often called "TiVos" after the company that pioneered the technology) are now permeating our daily lives. However, most often each application in itself is a custom solution that does not "play well with others."

One of the most glaring examples is the lack of media integration in the home, where numerous digital media devices and networks exist such as still cameras, camcorders, media servers, home gateways, broadband and wireless networks. Currently, the seamless manipulation and sharing of data among, for example, TVs around the house remains elusive.

The research team plans to change this with HYDRA by focusing on a unified paradigm that integrates multi-stream recording, retrieval and control in a synergistic manner to provide well-defined services for all media, cognizant of their characteristics such as bandwidth requirements, resolution and modality.

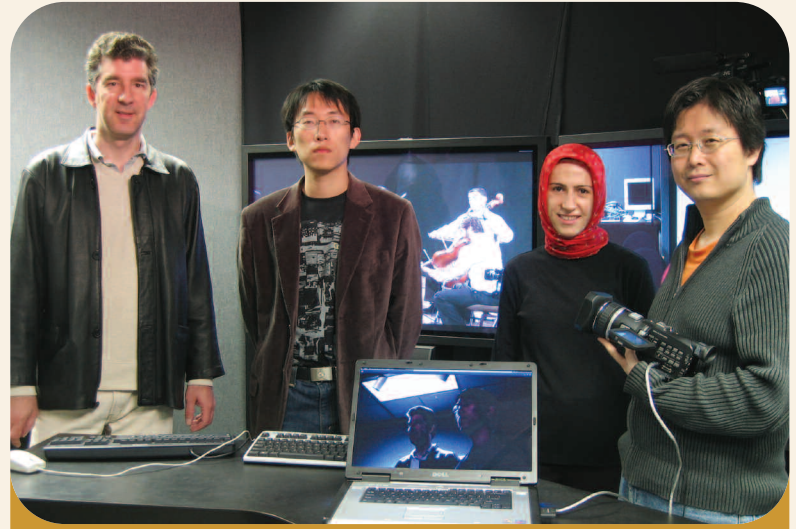
The results and insights obtained from the HYDRA project through fundamental research and testbed evaluations are directly applicable to IMSC's long-term vision of Immersive Reality, specifically the area of Scalable Immersive Environments (SIE) led by Professor Shri Narayanan. The aim of SIE is to enable a world in which people are connected and empowered by their digital environment. The goal is to develop

technologies that reproduce audio and video reality with extremely high fidelity; and are cognizant of and facilitate the interaction of people with one another while scaling to different device capabilities ranging from high resolution, stationary room environments to mobile, handheld form-factors. A critical component of SIE is multimodal stream

processing and some of the topics of study addressed by Zimmermann and his team include low-latency live streaming, large-scale media storage and retrieval, admission control algorithms, and protocols enabling smooth stream acquisition and playback.

At IMSC researchers are pursuing a number of testbeds that pervasively use streaming media. These projects are prime candidates to benefit from the HYDRA research. One example is the *Distributed Immersive Performance (DIP)* project, involving a multi-disciplinary group of key investigators. In addition to Zimmermann, the DIP team is comprised of Elaine Chew (ISE), Alexander A. Sawchuk (EE), Chris Kyriakakis (EE) and Christos Papadopoulos (CS). DIP explores one of the most challenging scenarios of networked media technology: creating a seamless environment for remote and synchronous musical collaboration. The objective of DIP is to develop the technology for interactive musical performances in which the participants — subsets of musicians, the conductor and the audience — are in different physical locations and are interconnected by very high fidelity multichannel audio and video links. In this environment achieving a low end-to-end delay is extremely crucial to achieve a coherent ensemble performance.

The DIP team has conducted pioneering experiments in networked musical performance with expert musicians from the Thornton School of Music and has used a HYDRA prototype to capture and store



Left to right: Roger Zimmerman, Min Qin, Sakire Arslan Ay and Beomjoo Seo

sessions including high-definition video, audio and MIDI streams for time-shifted rendering and performance analysis.

HYDRA's capabilities are also crucial to the remote maintenance and training operations that are being studied by *Pratt & Whitney Institute for Collaborative Engineering (PWICE)*, established jointly between Korean Air, Pratt & Whitney, Inha University and IMSC. The mission of this project is to develop advanced information processing and communication technologies that target aviation maintenance and training. Here HYDRA's capability to manipulate live, interactive streams is of critical importance.

HYDRA is enabling high-definition (HD) live streaming over traditional IP networks, such as the Internet, and it forms the basis of a multi-site, trans-continental HD remote collaboration system with the ultimate objective to allow aircraft and engine inspections and repairs with a rapid turn-around time. Such tasks require technicians in multiple locations to collaborate for problem solving.

Korean Air experts at Incheon airport offices and with the aircraft on the tarmac in South Korea are interacting with engine technicians at Pratt & Whitney's Hartford, CT, facility. Proving seamless live media streaming is very challenging in this heterogeneous environment where devices range from low-power handhelds with wireless connections to sophisticated room installations on gigabit networks.

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## Joint IMSC/Marshall Team Qualifies for the Largest Business Plan Competition in the U.S.

Other areas that are being studied by his team include industrial monitoring — such as intelligent traffic management — and remote tele-rehabilitation in collaboration with IMSC investigator Margaret McLaughlin.

"The capabilities developed under the HYDRA umbrella have tremendous appeal and we expect them to have a significant practical impact on a broad range of applications that make use of multimedia sensors," Zimmermann pointed out.

An integral part of the project is the evaluation of the HYDRA design in several of these domains. The prototype implementation and experimental research of this project will also be used as a teaching tool for courses covering multimedia and server technology. The latest results are available from the project Web site at <http://dmrl.usc.edu/hydra.html>.

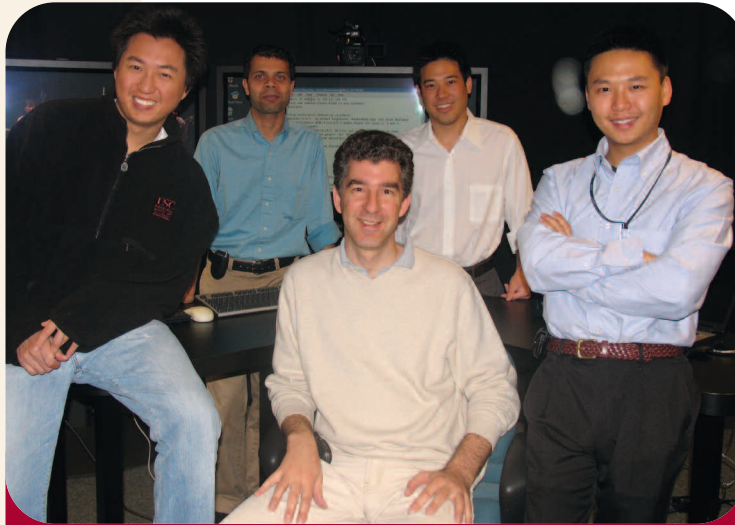
A group of students from USC's Viterbi School of Engineering and the Marshall School of Business were selected to compete this spring in the Rice University Business Plan Competition. This three-day competition is the largest of its kind and is intended to simulate the real-world process of

Other qualifying business schools from elite universities such as Harvard, MIT, Stanford, and University of Pennsylvania will be competing with USC for over \$200,000 in prizes.

The USC team is comprised of Ph.D candidate Leslie Liu from IMSC, four Marshall MBA students — Daniel Owen, Jackson Hsieh, Joseph Lin, and Kamalesh Jha — as well as Tina Hsieh from UCLA's Anderson School of Management. Leslie Liu has been pursuing his studies at IMSC for the past four years, focusing in his research on multimedia streaming architectures. He met the other teammates at the Marshall Graduate Technology Alliance 2005 event when he gave a presentation on IMSC's streaming technology.

The team's business plan evolves around a dynamic peer-to-peer Internet streaming solution that will give consumers the freedom to control their music and media from anywhere they go. The core technology was developed under the guidance of Leslie Liu's advisor, Roger Zimmermann, one of IMSC's key investigators.

Teams attending the competition have the opportunity to meet and network with over 100 venture capital principals, early stage investors, successful entrepreneurs and senior business leaders who will serve as judges for the event. The judges make decisions on which business venture they would most likely fund based on both the technology's strength and business potential.



Left to right: Jackson Hsieh, Kamalesh Jha, Roger Zimmermann, Daniel Owen and Leslie Liu

young entrepreneurs soliciting start-up funds from early-stage investors and venture capital firms.

Over 120 schools submitted business plans worldwide and only 36 were selected to compete at Rice University in Houston, Texas.

## IMSC Partners with Washington D.C. High School

McKinley Technology High School in Washington, D.C., became IMSC's newest K-12 education partner this year.

The product of several years of research, BioSIGHT's Interactive Streaming Storyboard tool along with a modest digital library of Immunology and Cell Biology animations, as well as Metalloman, IMSC Serious Games software for high school biology study, have been deployed at McKinley following evaluations last year in Los Angeles, with over 200 current users at McKinley.

"The integration of these

products into McKinley's curriculum and the anticipated benefits to McKinley's students validate IMSC's effort to impact science education with innovative technology tools and applications," said Prof. Wee Ling Wong of the Serious Games Lab at IMSC. Wong further asserted that "it will enable us to incorporate assessment data and teacher and student experiences in future research."

Not quite two years old, McKinley Technology High School offers students intensely focused curricula in bio/medical technology, information technology, and broadcast technology, together with a traditional liberal arts education. *More at* <http://lmths.k12.dc.us/>.



McKinley High School students using IMSC's digital library of science content animation.

# Viterbi Voice for Kids Interface Wins IEEE Signals Prize

## Three-part project teaches machines to understand children's speech

Creating a system that lets children talk to computers instead of using conventional mouse or keyboard controls won the 2005 IEEE Signal Processing Society "Best Paper" Award for the USC Viterbi School of Engineering's Shrikanth Narayanan and a collaborator.

Narayanan, who holds appointments in the Viterbi School's departments of electrical engineering and computer science, as well as the USC College department of linguistics, based the paper on research done in 2000-01 with his

First, it describes at length the particular problems of creating systems that can recognize children's speech, which is acoustically quite distinct from that of adults. Children also have much wider variation in their pronunciation of words than do adults, creating additional difficulties.

The bottom line was that standard methods for Automatic Speech Recognition (ASR) did four times worse on children's speech than adults. However, special adjustments made by Narayanan and

Potamianos were able to bridge the gap and bring the error rate down into the standard adult ranges.

But is voice control a useful and effective technique for children? The next part of the study was

a controlled "Wizard of Oz" setup in which children played a well-known educational game (Where in the USA is Carmen Sandiego?). Half of the children used the standard mouse and keyboard techniques. The other half spoke their commands and choices, which an unseen human observer ("the Wizard") then executed.

Quizzed afterward on how they liked

playing using voice versus mouse, an overwhelming number loved it — "Ninety-three percent rated the interface 4 or 5."

The final element in the paper describes how the researchers built an interface for a simple game using ASR. The prototype was a program that prompts children to play a spelling game, while also casually interacting with them and offering praise. The character was Agent Chimp, and while the game was elementary, it was effective in holding the attention of the eight small children (ages 8-14) who played.

"Overall, the prototype represents a successful first effort at building a multi-modal system for children with an emphasis on conversational speech," concluded the authors at the time. "We expect the data from such prototypes will help further conversational human-machine interaction."

In fact, according to Narayanan, this is happening: "Some of the work in this paper serves as a basis for a current project on automated literacy assessment [for young children] funded by NSF, and we are hoping that some of these ideas will be used in some of the advanced virtual learning environments that we are trying to create presently at USC," he said.

NSF funded the research described in the paper

The "Best Paper" honor is only the latest distinction for Narayanan, who was most recently named a fellow of the Acoustical Society of America in November 2005.



Abigail Kaun

"These ideas will be used in some of the advanced virtual learning environments that we are trying to create presently at USC."

co-author, Alexandros Potamianos of the University of Crete.

The award will be presented at the annual meeting of the 16,000-member society, to be held this May in Toulouse, France.

The paper, "Creating Conversational Interfaces for Children," addresses three separate problems.



Integrated Media Systems Center  
Viterbi School of Engineering  
University of Southern California  
Charles Lee Powell Hall, Floor 3  
3737 Watt Way  
Los Angeles, CA 90089-0274

213-740-2592

Email: [brandosb@usc.edu](mailto:brandosb@usc.edu)

<http://imsc.usc.edu>

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PAID  
University of  
Southern  
California