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## Landmark Internet event draws national attention

In a landmark event in the evolution of Internet applications in May, IMSC investigators demonstrated breakthrough Internet technology for capturing, streaming, and rendering high-resolution, big-screen video and multichannel audio.

The demonstration was covered by *The New York Times*, three Los Angeles television stations (KNBC, KTLA and Fox), and other media. Industry representatives also attended the event.

“Our new Internet technology will have a major impact on how the Internet will be used in the future in home entertainment, commerce, education, medicine, research, personal communication, and many other areas. It transforms the Internet from a low-fidelity medium for browsing information to a high-fidelity medium for delivering rich experiences,” according to Prof. Ulrich Neumann, IMSC Director.

The IMSC researchers used a commercial high-speed



**REMOTE MEDIA IMMERSION**—IMSC researchers unveiled the Center’s Remote Media Immersion (RMI) Internet technology in a landmark event in May. On the left, RMI shows video of a space shuttle taking off. On the right, IMSC key investigator Chris Kyriakakis (far left) answers questions from attendees. From left, standing, are IMSC Director Ulrich Neumann; Dean C.L. Max Nikias of the School of Engineering; Dr. John Silvester, USC Vice Provost for Scholarly Technology; and a TV news cameraman.

### Director’s Message

## IMSC hosts NSF site visit and SAB meeting

IMSC hosted the annual visit of the National Science Foundation (NSF) site review team and the Scientific Advisory Board (SAB) meeting in early June. The meetings went very well by all accounts, and we await the final renewal decision sometime in the Fall of this year.

Special thanks go out to Jim Baker, who chairs the SAB, and all the SAB members for their participation and excellent coordination of their



**Dr. Ulrich Neumann**

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Internet link to transmit multiple streams of picture and sound across the nation from an IMSC dynamic media server located at USC’s Information Sciences Institute/East, in Arlington, Virginia, that delivered on-demand high resolution video and multichannel audio content, which dramatically surpassed the quality of today’s high-definition broadcast television.

IMSC’s new technology, termed Remote Media Immersion (RMI), integrates the Center’s unique video and audio streaming technology with its unique multichannel audio technology, which overcomes the limitations of today’s stereo and surround sound. IMSC’s multichannel Immersive Audio generates a true three-dimensional sound field by using audio signal processing to both localize individual sounds and envelop listeners in a seamless sonic environment.

IMSC has established a Web site for RMI at <http://imsc.usc.edu/rmi> that provides details on the new technology.

RMI is not simply an incremental improvement in streaming media. IMSC researchers are looking at the entire problem of re-creating the experience of being at a remote event (e.g., sports

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## NSF site review team & SAB visit IMSC

The National Science Foundation (NSF) site review team made its annual visit to IMSC in June and met with IMSC staff, faculty and students as well as with the Center's Scientific Advisory Board (SAB) members.

The NSF team visited from June 4 through 6, and the SAB started its meeting on June 3 and overlapped on the second day, June 4, in order to meet with NSF team members. SAB members developed their annual IMSC Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis for NSF and presented it to the site review team.

The NSF team and SAB members toured IMSC labs and viewed demonstrations of the Center's latest research.



**I-NEWS PROJECT**—IMSC key investigator Prof. Larry Pryor (right) describes the Center's I-News journalism project to Dr. Lois M.L. Delcambre, an NSF site review team member. IMSC key investigator Prof. Skip Rizzo looks on.



**YODA PROJECT**—IMSC student Yishin Cheng discusses the IMSC project, "Yoda: A Soft Query Customized System," with Daniel Tretter of Hewlett Packard (left) and Bernard Goodwin of Prentice Hall Professional Technical Reference.



**PARTNERS AWARDED**—At the SAB meeting, IMSC awarded plaques to five companies for their commitment as industry partners from the Center's beginning in 1996. From left to right are Pat McCarthy and Daniel Tretter, Hewlett Packard; Warren Sterling and Dave Schrader, NCR; Mark George, Lockheed Martin; IMSC Director Ulrich Neumann; Bob Remington, Lockheed Martin; Jim Baker, FX Palo Alto Laboratory; Isaac Maya, IMSC Director of Industry and Technology Transfer Programs; and Ann Spurgeon, IMSC Associate Director of Industry Programs. TRW also received an award.



**HAPTICS PROJECT**—IMSC student Wei "Karen" Peng points out information about IMSC's haptics project to Dr. Anthony Majoros of Boeing.

### IMSC technology hits consumer market

Three-dimensional face modeling technology licensed from IMSC has now entered the consumer market in Japan as a key technology of the 3D i-Station, a system that people are using to select new eyeglasses.

Hoya of Japan, the world's second largest manufacturer of eyeglass lenses with more than 7,000 retail stores in Asia and a major supplier to LensCrafters in the United States, has

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## Comfort Control exhibit combines art & technology



IMSC Ph.D. student Clint Chua tries out participatory exhibit.

Comfort Control, a participatory exhibit co-sponsored by IMSC and the School of Fine Arts that debuted on campus last fall, opened for a second showing for three weeks in April in downtown Los Angeles.

Combining art and technology, the exhibit was developed by Doug Fidaleo, an IMSC Ph.D. student who specializes in IMSC facial-expression recognition technology, and visual artists Brian Cooper and Tomo Isoyama.

A participant in Comfort Control first enters a room that looks like a comfortable den in a home, complete with wood-paneled walls and burnt orange carpet.

He or she sits in a lazy-boy recliner facing a large-screen TV. Wrist restraints are put in place, the television issues demands, and only the correct set of emotional responses wins the prize of freedom. Using software to detect and measure facial expressions, a digital video camera serves as an interface between the participant and the game.

The satirical “entertainment center” environment, involving penalties, rewards, goals and expressions, explores emotional expression in relation to social/psychological situations that demand specific responses.

The downtown Los Angeles exhibition at The Brewery was co-sponsored by IMSC and Raid Projects as part of USC’s Art in Motion, a festival of time-based media.

## Three IMSC investigators win NSF Career awards

Three IMSC investigators were among seven assistant professors in the USC School of Engineering who won Early Career Development Awards this year from the National Science Foundation (NSF).

The IMSC investigators are Dr. Mathieu Desbrun, Dr. Christos Papadopoulos, and Dr. Gaurav Sukhatme, all faculty members in the Computer Science Department. The awards provide funds for research, teaching and outreach activities during the next five years. The purpose of the NSF Early Career Award program is to identify future academic leaders and help them establish their research and teaching careers.

Prof. Desbrun is developing new mathematical and computational tools in 3D computer graphics and compression for use in medical imaging, biology, ecommerce, video games and haptics (touch-related technology).

Prof. Papadopoulos is working on network design and synchronization advances for the Internet. He also designed the selective re-transmission protocol used in IMSC’s Remote Media

Immersion demonstration (See page 1).

Prof. Sukhatme is one of the researchers with IMSC’s haptics projects and was an editor of *Touch in Virtual Environments: Haptics and the Design of Interactive Systems* from IMSC Press. He also conducts

research on large-scale, mobile, multi-robot teams.

IMSC investigators continue to be recognized for their research quality and accomplishments. Overall, the Center has seven investigators who have won the Career Award.

## New IMSC-developed degree to debut

This Fall undergraduates will be able to take a new USC degree developed by IMSC—the Bachelor of Science in Electrical Engineering with an emphasis in Integrated Media Systems.

“Students will be offered an in-depth study of integrated media systems in addition to all the benefits of the BSEE degree,” according to Dr. Jerry Mendel, IMSC’s Associate Director for Education and Outreach.

IMSC has developed five other USC degrees since its inception in 1996—a Master of Science in Integrated Media Systems; a Master of Science in Electrical Engineering with a specialization in Multimedia and Creative Technologies; a Master of Science in Computer Science, with a specialization in Multimedia and Creative Technologies; an undergraduate minor in Multimedia and Creative Technologies for engineering students; and an undergraduate minor in Interactive Multimedia for non-engineering students.

The new Bachelor’s Degree supplements the course of study of the BSEE by offering students such courses as Programming and Multimedia on the World Wide Web, Computer Graphics, Introduction to Computer Networks and Introduction to Digital Media Engineering.

# IMSC demonstrates breakthrough technology . . .

*(Continued from page 1)*

event, concert or teleconference). New methods have been developed for capturing the images and sounds of the experience, for streaming multiple channels seamlessly over the Internet, and for rendering the experience correctly for a large group of participants.

In the demonstration, the researchers used dramatic footage of a space shuttle launch to show how the new technology marries the flexibility and interactivity of the Web browser with high-quality television on a large, 9 by 5-foot screen. They demonstrated the Web interactivity by showing how a person can click to select a video clip on the Internet and display it on a home theater-sized screen. Today's Internet streaming technologies were designed for the small computer screen and show severe artifacts when presented on large immersive displays. RMI's high resolution capability overcomes this drawback by being able to stream higher quality media content without artifacts.

By transmitting from the ISI/East location in Arlington, Virginia, to IMSC, the researchers demonstrated how the new technology overcomes the major roadblocks to Internet transmission of high-quality video and audio over a great distance.

## Glimpsing the future of the Internet

"IMSC's new integrated technology provides a glimpse of the future of the Internet," said C.L. Max Nikias, Dean of the School of Engineering. He added that the new technology should serve as an important incentive to immediately accelerate the deployment of broadband, high-speed Internet transmission capacity.

Dean Nikias said he supports the recent proposal by many high-tech companies and others that President Bush and Congress set a goal of high-speed Internet access for every home and business by the end of the decade. "Such an accelerated broadband roll-out would create more than 1.2 million jobs and help lift the technology sector and the economy as a whole out of our economic downturn," he pointed out.

The proposal for the establishment of a national broadband policy was made earlier this year by The Technology Network (TechNet) ([www.technet.org](http://www.technet.org)), a national organization based in Palo Alto, California, representing more than 300 top executives from both large and small technology firms, including Intel and Cisco Systems; venture capital firms; and investment banking companies. TechNet called for the deployment of broadband services at a data rate of 100 Megabits per second in 100 million homes and small businesses by 2010, urging the federal government to develop policies that foster innovation and reduce regulations with respect to broadband applications and services.

Acceleration in broadband deployment would break through today's roadblock for homes—the slow Internet data rate of up to only 1.5 Megabits per second through digital subscriber lines (DSL) and cable modems. And, even though

IMSC's new technology was demonstrated at a much higher data rate—up to 60 Megabits per second—higher speed connections to the home up to this rate have been developed and are feasible for deployment. Additionally, IMSC's new technology can potentially be used now by major corporations, universities and government agencies because they have access to broadband services that provide the 60 Megabits per second data rate and higher. And, further, even though the highest quality experience for the viewer requires a data rate of up to 60 Megabits per second, the new technology still can provide substantial improvements over present technology even if used at a lower data rate.

## RMI comes at opportune moment

Dr. Neumann explained that RMI "comes at an opportune moment" for the consumer. "More consumers are buying big-screen TVs, including high-definition TVs, to outfit a home theater, because they want a much higher quality entertainment experience. In addition, consumers have been asking for years what more they can do on the Internet, besides sending email and playing video in a little box with tinny audio, and our demonstration showed the Internet's potential for something dramatically new and dynamic," he said.

"For instance," he pointed out, "you will be able to watch a movie or a concert in your home, when you want to, with sound and image that is better than today's best theaters. Or you will have a business meeting with people who are in different locations thousands of miles away and feel like you are in the same room with them. You will be able to tour faraway museums or galleries choosing the displays that you want to examine."

Dr. Neumann said the convergence of several factors will make this future immersive experience possible—broadband deployment, high in-home computing power and a consumer embrace of the Internet for information and content-on-demand. He added that game platforms will be transformed as well. He also noted that this convergence will have an impact

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## NVIDIA 3D architect gives seminar

Steve Molnar, a 3D Architect at NVIDIA, demonstrated the GeForce4, the firm's flagship graphics processor, in a seminar at IMSC in March.

He described the technology behind some of the GeForce4's novel features, including its crossbar memory architecture, programmable vertex shaders, z-correct bump-mapping and full-scene antialiasing.

Molnar has been with NVIDIA since 1998 and contributed to the architecture of the GeForce3, GeForce4 and NV2A, the graphics engine in Microsoft's Xbox.

## Conference promotes international collaboration

IMSC joined with corporate partner Institute for Information Industry of Taipei, Taiwan, to sponsor a highly successful two-day 2002 Conference on International Collaboration, Technology Transfer and Minority Business Opportunities in March at a downtown Los Angeles hotel and on the USC campus. The conference was also jointly sponsored by USC's Business Expansion Network, and attracted sponsorship from Allen Matkins and O'Melveny & Myers, LLC.

Ronald N. Langston, the National Director of the Minority Business Development Agency in the U.S. Commerce

Department, gave the keynote address on "Pursuing Entrepreneurial Parity." U.S. and Taiwanese company representatives attended to establish business relationships with international companies, take advantage of technology transfer opportunities and improve technical minority business expansion.

The conference featured presentations on technologies available from IMSC, the School of Engineering's Technology Transfer Center and the Information Sciences Institute. The conference included lab tours and demonstrations of new technologies by faculty and students at IMSC.

## Integration a hallmark of new technology . . .

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on how homes are designed—more attention will be paid to building home theaters because of the enhanced viewing experience.

### Integration is hallmark of RMI

Integration is a hallmark of RMI, and the process affords considerable scalability and flexibility. The software and hardware streaming architecture, called Yima™, handles multiple simultaneous high-bandwidth streams of images and sound, all synchronized to single-frame accuracy. IMSC investigators Dr. Cyrus Shahabi and Dr. Roger Zimmermann, who have pioneered the area of continuous media server design, oversee the Yima™ project. Yima™ has the following unique features:

- Complete distribution with all nodes running identical software and no single points of failure;
- Efficient online scalability allowing disks to be added or removed without interrupting continuous media streams;
- Synchronization of several streams of audio, video, or both within one frame (1/30 second);
- Independence from media types;
- Compliance with industry standards; and
- Multi-threshold buffering flow-control mechanism to support variable bit-rate (VBR) media.

In addition, a novel selective re-transmission protocol designed by IMSC investigator Prof. Christos Papadopoulos has been implemented in the architecture to enable missing packet recovery, resulting in zero packet loss in the delivery to the viewer.

For RMI's sound component, investigators employed IMSC's multichannel Immersive Audio, which uses multiple loudspeakers and algorithms to generate a sound field that can immerse a group—rather than just a single individual—in extremely realistic audio environments. Ten loudspeakers and two low frequency subwoofers (for 10.2 channels rather than the 5.1 channels of surround sound) were used in the demonstration to place sound seamlessly around the audience.

"With multichannel Immersive Audio, we overcome two key limitations of today's surround sound systems," according to Dr. Chris Kyriakakis, Director of IMSC's Immersive Audio

Laboratory. "We can move discrete sounds seamlessly around the listeners and create enveloping soundscapes." Multichannel Immersive Audio is one of IMSC's new technologies that can be used today in music industry applications as the next step beyond today's surround sound.

The approach taken by IMSC researchers is fundamentally different than what others have done in high-bandwidth Internet experiments. RMI was developed as a distributed application, rather than as a point-to-point application. In a point-to-point application, the different streams originate from the same computer. The nature of RMI as a distributed application affords flexibility in Internet transmission because a number of server computers can participate in the same transmission, so the video and audio streams can be routed more efficiently.

For example, a movie can reside on a number of servers in widely separated cities, and any of these servers can be called on to transmit any part of the movie's video and audio streams if necessary to overcome delays in Internet traffic or other problems, with all streams arriving at the destination in a complete, synchronized presentation.

### Less compression affords greater clarity

IMSC researchers used two and one-half times less compression than broadcast high-definition TV to achieve greater clarity of the final picture. The uncompressed video data rate of 1.5 Gigabits per second was compressed to 45 Megabits per second, as compared to standard high-definition television's data rate of 19.4 Megabits per second after compression.

For Immersive Audio, IMSC researchers sent 16 uncompressed audio channels combined as one stream at a data rate of 16 Megabits per second (1 Megabit per second per channel). In comparison, 5.1-channel Dolby audio (for five loudspeakers and one subwoofer) is compressed to decrease the data rate from 6 Megabits per second to 384 kilobits per second for all six channels, for a compression ratio of 15 to 1.

In streaming more channels than commercial technology, IMSC researchers avoided the potential degradation of the signal that results from repeated applications of compression.

# IMSC Press publishes two more multimedia books

Two more books on multimedia are available from IMSC Press, adding momentum to the Center's publication program that was launched last December with the inaugural title on haptics.

The new books are *Desktop Digital Video Production* by Frederic Jones and *Multimedia Fundamentals, Volume 1: Media Coding and Content Processing* by Ralf Steinmetz and Klara Nahrstedt.

In *Desktop Digital Video Production*, Dr. Jones presents a step-by-step description of digital video production, including video acquisition, lighting, sound acquisition and processing, project and data management, video and sound editing, basic and advanced effects, and assembling a final product.

He covers Internet video delivery, including RealVideo streaming media and multicasting; top desktop video software; making the most of audio; and choosing and using capture hardware, disk storage, and other digital video products.

In *Multimedia Fundamentals, Volume 1*, the authors present the state-of-the-art in multimedia content analysis, media foundations and compression. They cover:

—Generic characteristics of multimedia and data streams, and their

impact on multimedia system design;

—Essential audio concepts and representation techniques: sound perception, psychoacoustics, music, MIDI, speech signals, and related transmission issues;

—Graphics and image characteristics: image formats, analysis, synthesis, reconstruction and output.

—Video signals, television formats, digitization and computer-based animation issues.

—Compression standards.

—Optical storage technologies.

—Content processing techniques.

Volume 2 of this three-volume series will cover media processing and communications, and Volume 3 will

focus on documents, security and applications.

The inaugural title of IMSC Press was *Touch in Virtual Environments: Haptics and the Design of Interactive Systems*, which presents the full range of haptics (touch-based technology) research, including system control hardware, interface design, compression, capture of data, human factors, and applications.

IMSC Press has partnered with Prentice Hall Professional Technical Reference (PTR) to publish the books. All titles are offered for sale on Prentice Hall PTR's Web site at <http://www.phptr.com>.

## Director's Message . . .

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review and presentation to the NSF team. Our thanks also go to Karl Weiss, who chairs IMSC's Board of Councillors, for his participation and contributions to the review.

At the NSF and SAB meetings, IMSC presented its vision of Immersipresence, and the structure of the research program featuring the six research areas of Sensory Interfaces, Information Management, Media Communications, User-Centered Sciences, the Media Immersion Environment, and Application Research Projects.

Our fundamental vision remains that of harnessing engineering science to exploit the human information processing capabilities by advancing the science and engineering of "well designed" integrated media systems (IMS) that enable Immersipresence. By advancing the science and engineering of Immersipresence, our ultimate goal is to provide a customized multimedia environment and portal to immerse a person with other persons, objects, places, and information.

In addition to faculty presentations on the research and other IMSC activities, our students presented over 20 technology demonstrations and over 50 posters related to their research activities.

I would also like to welcome NTT DoCoMo of Japan as a new industry partner, and I would like to welcome back three others after a short absence—Boeing, the Industrial Technology Research Institute (ITRI) of Taiwan, and Intel. At the SAB meeting, we honored FX Palo Alto Laboratory, Hewlett Packard, Lockheed Martin, NCR and TRW with a special plaque recognizing their steadfast support of IMSC as industry partners over the entire life of the Center, starting in 1996.

Our Remote Media Immersion (RMI) demonstration of new Internet technology in May brought the Center increased national visibility, with coverage by *The New York Times*, Los Angeles television stations and other media. (See article on page 1 and our Web site at <http://imsc.usc.edu>.)

Congratulations to IMSC investigators Mathieu Desbrun, Christos Papadopoulos, and Gaurav Sukhatme for receiving prestigious Early Career Awards from the National Science Foundation this year. (See article on page 3).

I would also like to thank the IMSC Student Council for their activities this past year, which included organizing Industry Day in January and the Student Conference in April. (See article on page 7).

### IMSC News

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## Concert spotlights IMSC audio

IMSC's multichannel Immersive Audio was showcased in April for the first time in a large concert hall at USC's Alfred Neumann Recital Hall in "Flying Sonics! A Tale of Immersive Audio and Diverse Instruments," which presented a synthesis of live music and the advanced audio technology.

The cross-disciplinary endeavor was co-sponsored by IMSC and the Thornton School of Music and funded by a USC Arts Initiative Faculty Collaboration Grant.

Audience members heard live music played from the stage by two pianists, an electric bass player and a percussionist as in any other concert, along with music from electronic instruments playing synchronously with multichannel Immersive Audio. The system used 10 loudspeakers and two low-frequency sub-woofers to place sound seamlessly around the audience.

The free concert, attended by more than 200 people, featured music by Herbie Hancock, George Gershwin, Astor Piazzolla and Frederic Rzewski.

"Using our Immersive Audio rendering, we moved instruments around listeners in a way they have never experienced before," said Dr. Chris Kyriakakis, Director of IMSC's Immersive Audio Laboratory.

Immersive Audio uses multichannel signal processing to localize and maneuver sound in space to create the illusion of movement. The advanced technology uses multiple loudspeakers and algorithms to generate a true three-dimensional sound field that can immerse a group—rather than just an individual—in extremely realistic audio environments.

Multichannel Immersive Audio is a key element in IMSC's Remote Media Immersion technology (See page 1).

IMSC investigator Dr. Elaine Chew, an Assistant Professor in Industrial Systems Engineering and performing pianist, said that the performance illustrated how cutting-edge technology can be successfully combined with traditional types of concert music.

Dr. Chew was joined by Dr. Dennis Thurmond, an Associate Professor of Keyboard Studies and Director of Electro-Acoustic Media at the School of Music on the second piano; Ben Levine, a USC Music Instructor who played the electric bass; and Kevin Dooley, a USC senior studying music who played percussion instruments.

Levine and Dooley also wrote some original music for the concert.

Before the main concert began, Dr. Kyriakakis gave a 30-minute demonstration of various musical pieces processed for rendering with Immersive Audio.

## IMSC students organize events

The IMSC Student Council organized two successful events—the Third Annual Industry Day in January and the Sixth Annual IMSC Student Conference in April—that garnered significant industry support.

Speakers and panelists included representatives from HRL Labs, Hewlett Packard, IBM, NCR, Sun Microsystems, Qwest Communications and TMH Corporation.

On Industry Day, students heard representatives from IMSC industry partners speak on the latest trends in the multimedia industry. Fritz Koenig, the Chief Executive Officer of industry partner TMH Corp., gave the keynote address on "MP3 Ain't For Me."

The Student Conference, with the theme "Multimania," featured 13 conference papers presented by students. The keynote speaker, Marc Hamilton, the Systems Engineering Director of Global Education and Research for industry partner Sun Microsystems, spoke on "Multimania: USC and the World." Panelists on a luncheon panel discussed issues involving the creation of 3D immersive environments.

Best Presentation awards were given to two undergraduates and two graduates. The undergraduates who received the award were Joshua Katz for "Development of a Computer Agent Tool for Investigating a Spoken Language Interface for Young Children" and Tresno Santoso for "Yoda: An Accurate and Scalable Web-based Recommendation System." The graduates who won the award were Debojyoti Dutta for "Fair Stateless Aggregate Marking Techniques" and Ying Li for "Identifying Speakers for Daily Movies."

"These events represent unique opportunities for industry members to interact with students interested in permanent jobs and internships," according to Isaac Maya, IMSC Director of Industry and Technology Transfer Programs.

## IMSC technology reaches consumers . . .

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just started its launch of the 3D i-Station. The system adopted by Hoya was created by IMSC partner Geometrix of San Jose and offered as a commercial product through its channel partner Visionix. Geometrix licensed IMSC's 3D face modeling technology and used it to create a high-speed face capture solution, Face Vision™, and a virtual try-on solution for the retail optical market. IMSC key investigator Prof. Gérard Medioni, Chairman of the Computer Science Department, developed the IMSC 3D face modeling technology.

The 3D i-Station system creates a realistic 3D model of the consumer's face, and then the consumer tries out different types of lenses and frames on the model. The system also automatically performs all measurements previously taken by a skilled optician and transmits the data directly to the lens processing lab to drive the production system.

"This is a great example of how IMSC technology moves from a laboratory technology to a commercial product," according to Isaac Maya, IMSC's Director of Industry and Technology Transfer Programs.

## MUA & NMUA hold June graduations

Both the Multimedia University Academy (MUA) and the New Media University Academy (NMUA) graduated students in June.

The MUA, a community outreach program for multimedia training, was spun-off from IMSC last year to USC's outreach arm, the Office of Civic and Community Relations (CCR). It still receives funding from IMSC and the National Science Foundation (NSF). In June, Carolyn Webb De Macias, the University's Vice President, External Relations, was the keynote speaker as MUA graduated 17 students at its seventh graduation. This program was offered for people at least 18 years old who live in public housing in the City of Los Angeles.

The New Media University Academy, which was launched last year as a for-profit organization offering a multimedia training curriculum based on MUA's program, graduated 18 students in a ceremony at the Community Technology Education Center in the Cypress Park area of Los Angeles. State Sen. Richard Polanco gave the keynote address. Other speakers were Lillian Kawasaki, the General Manager of the Community Development Department of the City of Los Angeles and member of the Workforce Investment Board of the city; and David Tokofsky, a member of the Los Angeles City Board of Education. Together, MUA and

NMUA graduated a total of 35 of the 36 students who started the programs, providing strong evidence of the effectiveness of the two initiatives and NSF's investment.

## Pintaric wins USC award

Thomas Pintaric, an IMSC undergraduate student, won the Special Interdisciplinary Award at the Fourth Annual USC Undergraduate Symposium for Scholarly and Creative Work in April for a presentation entitled, "Virtual Reality Exposure Treatment of Phobias."

His presentation was based on a virtual reality system involving a head-mounted display and panoramic video that allows realistic phobia-related scenarios to be produced in less time and at lower cost. The system is being developed for marketing to therapists in clinical practice, health care groups, hospitals and education/research organizations. Pintaric works with IMSC investigator Prof. Skip Rizzo, who is developing the system.

Pintaric also worked with David Groves through the Marshall School of Business on the business feasibility of the project for a graduate-level MBA technology commercialization class. The project was chosen by a panel of venture capitalists out of all class projects to be featured at an exhibition in Washington, D.C. The team traveled to Washington in March for the "March Madness for the Mind" exhibition at the Smithsonian American History Museum, sponsored by the National Collegiate Inventors and Innovators Association. *NBC News* cited the project in a report on the event.

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