AES 21st INTERNATIONAL CONFERENCE

Architectural Acoustics and Sound Reinforcement

June 1–3, 2002
St. Petersburg, Russia

St. Petersburg, now only one year away from celebrating its 300th anniversary, has long been considered the crown jewel of Russia. Its many palaces, once the homes of the Czars and other Russian nobility, now serve as some of the greatest museums in the world. The Hermitage, most notable of all, symbolizes the art and culture of Russia, and displayed in the five palaces that make up its galleries are art treasures collected from around the world during more than 1,000 years. St. Petersburg also is known throughout the world for its performing arts: the Mariinskiy Theatre, the Kirov Ballet, the plays of Pushkin, and the music of Tschaikovsky, Borodin, and Moussorgsky to name but a few.

Now the Audio Engineering Society has raised its flag in Peter the Great's "window to the West." The Russian Sections of the AES in Moscow and St. Petersburg, formed less than a decade ago, have blossomed into very active and productive enclaves of scientists and educators who for decades before had been sequestered due to Cold War constraints, unable to communicate with their colleagues in the West. They have lost no time in catching up, however, and in early June assembled an international panel of experts to present the AES 21st International Conference, *Architectural Acoustics and Sound Reinforcement.*

The conference was based at the centrally located Hotel Moscow. The technical sessions were held in a grand ballroom refurbished especially for the conference. In fact, the conference commenced immediately after the renovations had been completed. As an early introduction to the city, delegates who had arrived by Friday evening were taken on a bus tour of some of St. Petersburg's most famous sites: the Church on Spilled Blood, St. Isaac's Cathedral, and the Bronze Horseman statue of Peter.

DAY 1

Chair Nickolay Ivanov opened the conference Saturday morning by explaining that the organizational work had been going on for more than five years. He praised the ded-

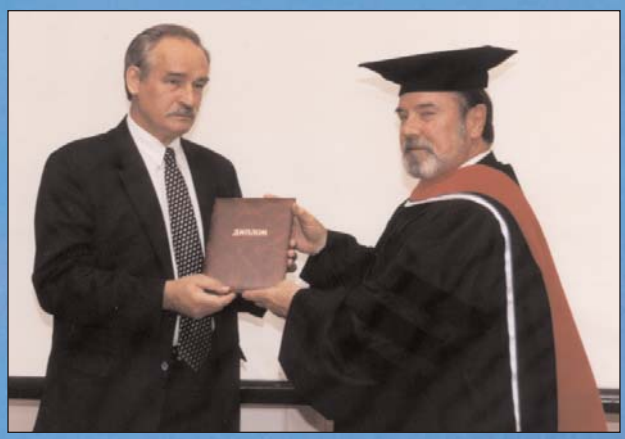
Clockwise from left: Scientific Committee Chair Irina Aldoshina, Chair Nickolay Ivanov, and AES President Garry Margolis speak at conference opening; AES Past President Roy Pritts receives honorary degree from Professor Alexander Belooussov of University of Cinematography and Television; Baroque-Koncort Quartet performs.

ication and hard work of his colleagues on the organizing committee, especially Scientific Committee Chair Irina Aldoshina and Papers Chair Natalia Tyurina.

Speaking next Irina Aldoshina, a former governor of the AES, praised the renewed vigor of the industrial and research organizations within Russia. She told the conference delegates how eager her Russian scientific colleagues are to share ideas and information with the professional audio community worldwide.

AES Past President Roy Pritts received special recognition from the conference committee for his tireless efforts in organizing the two Russian Sections and then promoting the development of the 21st Conference. Alexander Belooussov, rector and president of the University of Cinematography and Television in St. Petersburg presented him an honorary degree. In his heartfelt acceptance speech Pritts said, "It's easy to do good work for such good people."

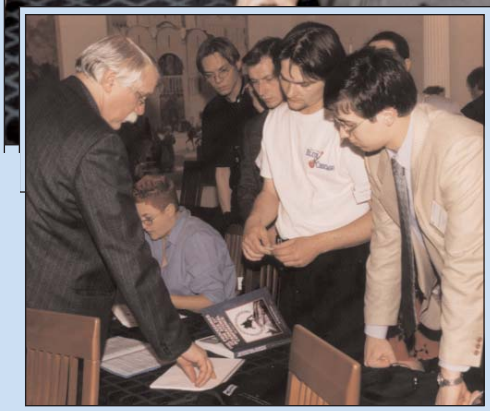
An interlude of music by Mozart and Rachmaninoff was performed by the Baroque-Koncort, a quartet of flute, two violins, and cello, before the first technical session began with four invited papers. All of the sessions on Saturday were translated simultaneously between English and ➥



Russian by a talented pair of professors from the two technical universities in St. Petersburg. These men not only were able to keep pace with the technical terms in the papers, they also understood the material and were even able to explain the diagrams to their listeners.

The first invited paper presented a detailed historical overview of the development of acoustical science in Russia. Principal author Michael Lannie of the Research Institute for TV and Radio in Moscow explained that there were three major periods in this history. The first comprised the years between 1921 and the early 1940s. During this time, considerable research was being done on reverberation time and the effects of acoustics on performing and recording spaces. The Research Institute for Television and Radio was founded in 1934, and the State House of Sound Recording and Broadcasting followed shortly thereafter. He noted that from the end of the Russian Civil war until the mid-1940s, however, only 25 studios were constructed in all of Russia and no new concert halls were built at all. The second period covered the years from around 1950 until 1991, when the primary areas of development in Russia were cinema studios; broadcast and recording studios; and new theaters and public performance halls. All incorporated contemporary theoretical and analytical techniques for their design criteria, adopted from work done around the world. The third period began in 1992 and continues to the present. New theoretical approaches to acoustics are being developed, many older concert halls are being restored or modernized, and new halls are being built. Lannie's presentation featured numerous photographs of historical and contemporary Russian performance halls.

The second invited paper was presented by Andrzej Czyzewski, head of the Sound and Vision Engineering Department at the Gdansk University of Technology, Gdansk, Poland. His paper, "Some Rules and Methods for Creation of Surround Sound," explored several signal processing techniques designed to preserve the acoustical properties of the performing space throughout the recording process. He



Above, Louis Fielder asks question. Top, delegates listen to presentation.

Left, author Wolfgang Ahnert answers questions after presentation. Above, Neville Thiele (left) and Richard Small.

said that among all of the various techniques examined, one common goal was to preserve the impulse response of the room. Monophonic impulse response tests were made, primarily using firecrackers and the human voice as the test subject, and then convolved to create a spatial impression from an array of loudspeakers. Listening tests then were conducted to determine which recording techniques tended to preserve the impression of the original performance space.

Returning to an historical theme, Konstantin Ershov of the St. Petersburg State University of Cinema and Television presented the next invited paper, outlining the development of audio equipment and techniques for cinematic production in Russia. He reflected that it was a major achievement to convert from silent to sound production during the 1930s, and that most of the work and equipment necessary had been developed in St. Petersburg, then called Leningrad. Special mobile cinema halls were constructed to bring films to areas of the country that did not have their own cinema theaters. The mobile units used 16-mm and 35-mm portable projectors and sound systems running on generators. By the late 1930s there were nearly 40 film studios throughout the Soviet Union, producing a variety of formats and levels of quality. There were only a very few large film studios, however, and even fewer strictly for music recording. By 1956 wide-screen projection and nine-channel sound systems had been installed in some of the country's more prominent movie theaters, and all of the equipment was still being produced exclusively in the Soviet Union. It wasn't until 1962 that 70-mm film techniques and modern multichannel sound systems began to be imported. Beginning slowly in the 1970s, and very rapidly in the 1990s, all types of equipment and technology from around the world have become a part of the Russian cinematic experience.

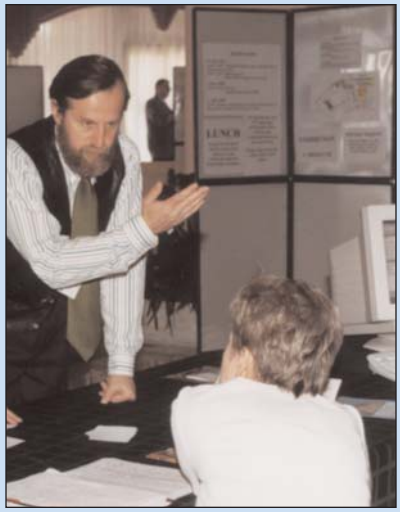
The final invited paper of this session was presented by Ron Streicher of Pacific Audio-Visual Enterprises, Pasadena, California, and secretary of the AES. The focus of this paper was a new mid/side boundary microphone currently under development and intended primarily for stereophonic recording and sound reinforcement of live theatrical and musical performances. Streicher played several recorded examples made with this microphone and several in comparison to more conventional techniques. Long an advocate of the mid/side microphone technique, he demonstrated that the same articulation, clarity, and accuracy of stereophonic imaging for which this technique is well known translates very well to a boundary microphone application. Early experiments had been done with conventional microphones arrayed on the floor of the stage. The recordings played were made with two prototype units developed in cooperation with the engineering team at Audio-Technica, U.S.

Session 2 was the first of two on architectural acoustics. Two papers in this session described the design and construction of concert halls. Wolfgang Ahnert described the Great Philharmonic Hall in the Moscow International Music Dome and Jan Voetmann discussed the New Symphony Hall in Las Palmas, Gran Canaria, Spain.

Ahnert, in an invited paper, reviewed the two primary approaches to the design of performance halls: physical models and computer simulation. Both are essential elements in the acoustical designer's toolbox. Physical models, often at a scale of 1:20 are used to evaluate acoustical reflections and the results are compared to new computer simulations. Ahnert spoke favorably about the latest version (4.0) of the program Ease. Even with advanced simulations, however, physical models will always be needed for proper validation of an acoustical design prior to construction.

In describing the Las Palmas Symphony Hall, Jan Voetmann explained that the architectural inspiration came ➥

Invited authors, clockwise from left: Andrzej Czyzewski, Michael Lannie, Konstantin Ershov, Ron Streicher, Thomas Lagö, Marshall Buck, and Wolfgang Ahnert.



Clockwise from right: Facilities Chair Valery Brevdo; Conference Treasurer Lyudmila Drozdova and translator Natalia Kurochkina, wearing scarves; assistant Yulia Lebedeva checks registration on computer while Papers Chair Natalia Tyurina and AES Executive Director Roger Furness assist author Alfonso Ortega; offering assistance at registration desk are, from left, Lyudmila Drozdova, Marina Drobakha, and Lubov Minina.

from the lighthouses on the Grand Canaria Island. Originally designed in 1990, the architect died before the hall was constructed, so Voetmann and his colleagues were called in to complete the project and resolve design anomalies. The original plan was for a multipurpose shoebox hall, but the reverberation time proved to be too long even for musical performances. This was because the entire wall behind the performers was made of glass to provide the audience a panoramic view of the Atlantic Ocean. The glass produced some very unpleasant hard reflections toward musicians on the stage, yet very few early reflections and poor projection for the audience. Voetmann's solution was the design and fabrication of a nearly invisible perforated plastic curtain to cover the window. The curtain significantly reduced the reflections from the glass without disturbing the audience's view of the ocean. This, together with additional absorptive material on the other interior surfaces, resulted in a reduction of the reverberation time in the empty hall from 3.7 seconds to 2.1. Not all the work has been completed, so no measurements have yet been taken with an audience present. Additional side reflectors also are being installed to increase the early reflections both on stage and for the audience. Early acoustical tests and computer simulations indicate that the changes will result in a very pleasant concert experience for all kinds of music, as well as conferences and other public events.

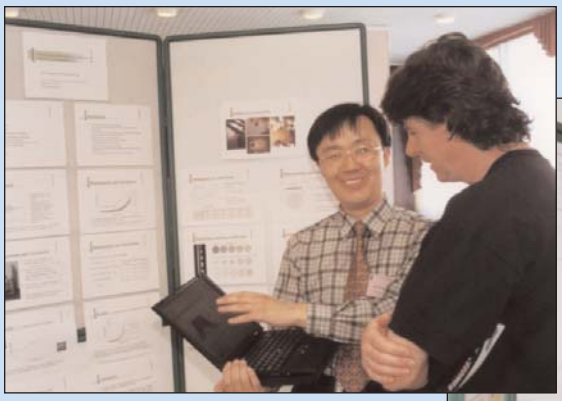
Next was the first of two sessions on sound reinforcement, which featured an invited paper by Marshall Buck, consultant to Gibson Labs, Redondo Beach, California, and treasurer of the AES. In his presentation, "Dual Range Horn with Acoustic Crossover," he discussed the problems associated with attempting to utilize horn-loaded loudspeakers over a broad frequency range. Several attempts have been made to produce a coaxial system, but these have resulted in high-frequency shadows, significant delays between the mid- and high-frequency drivers, and very uneven off-axis response. Buck developed a new configuration for a dual-horn that minimizes these problems by achieving nearly perfect symmetry between the HF and MF drivers. This results in no crossover dip, and both the horizontal and vertical projection patterns are quite even over the entire bandpass. He stated that these same techniques could be incorporated into the design of a quad horn with two each mid- and high-frequency drivers.

In the evening conference delegates strolled from the Hotel Moscow to a nearby dock on the Neva River, where they boarded a dinner boat for a pleasant cruise. The brilliant, late evening sunlight illuminated the spectacular St. Peters-

From left, Natalia Tyurina, Irina Aldoshina, and Roger Furness review scheduled events.

AES representatives from left, Secretary Ron Streicher, President Garry Margolis, and Peter Swarte, chair of next year's 114th Convention in Amsterdam.

Author Jin Yong Jeon discusses his poster presentation, "Measurements of the Scattering Coefficient of Surfaces in a Reverberation Room," with John Basset.



Author Shakir Vakhitov reviews his poster presentation, "Nonlinear Model of Condenser Microphone Capsule," with Isabelle Schmich.

burg sites along the Neva—Smolnyy Convent, Peter and Paul Fortress, the Hermitage, and the Naval Museum and Rostral Columns on Vasilevskiy Island—while cruising to the Palace Bridge (Dvortsovyy most). The leisurely voyage provided a wonderful opportunity for conversation in an informal and peaceful setting.

DAY 2

Sunday began with the second session on sound reinforcement. There was no simultaneous translation and all papers were presented in English. Among the papers presented in this session was the seventh invited paper of the conference, "Loudspeaker Placement for Enhanced Monitor Sound Field and Increased Performer Source Positioning" by Thomas Lagö from Jönköping University in Sweden. Lagö described a system being tested in a church in Bankeryd, Sweden, using a loudspeaker arrangement on the podium wall behind the performers. According to Lagö such a system offers numerous advantages: better first sound wave creation, resulting in better localization for listeners; an opportunity to use the Haas effect for the complete concert hall; an automatic monitoring system with fixed sound levels for ease of use; and better artist microphone handling.

To accommodate the large volume of papers, there were poster sessions during the coffee breaks on Sunday where authors discussed their work informally with the delegates.

Room auralization was the focus of the next session, which began with a paper by Diemer de Vries of the Delft University of Technology in The Netherlands. He described a joint study with Fraunhofer Institute done in a church in Weimar, Germany. A special circular array of microphones was used to measure impulse response; then the original soundfield of the recording environment was reconstructed utilizing an array of loudspeakers spaced widely enough so that a listener could walk around in a true sonic space. This was an application of the recording and rendering system described in the Carrouso Project.

In another concession to the large number of high-quality papers, parallel papers sessions were scheduled on Sunday afternoon: *Psychoacoustics* opposite *Transducers*, followed by *Binaural and Transaural Stereophony* opposite *Wave Field Synthesis*.

Counterclockwise from top left: guests enter ornate Beloselskiy-Belozerskiy Palace; tour of wax museum depicting Russian history; banquet of Russian delicacies and wines; Conference Chair Nickolay Ivanov thanks Marianna Sankiewicz, former AES Europe Central Region vice president, for efforts that laid groundwork for St. Petersburg conference.

PALACE BANQUET

Sunday evening was the social highlight of the conference, when delegates were treated to a regal banquet and entertainment at the Beloselskiy-Belozerskiy Palace. Getting off the buses on Nevskiy Prospekt at the Anichkov Bridge over the Fontanka Canal, delegates found themselves in front of a massive building covered in green scaffolding; they were not sure they were at the correct location. Like many buildings throughout St. Petersburg, the exterior of the palace is undergoing renovations before the city's tricentennial celebrations next year. The interior of the palace has already been completely restored to its original beauty. Once inside, three ladies in imperial-period dress escorted the visitors up a grand gold staircase, covered with red velvet carpeting, to the second tier where a large mirrored room had been prepared with tables and glasses of Russian vodka and champagne. Music filled the room, provided by a trio of flute, violin, and cello.

Following the champagne reception, the guests were taken in smaller groups through the several rooms of the wax museum which now occupies sections of the palace. These exhibits trace the history of Russia and its rulers from the early Czarist period, through the Russian Revolution and the Soviet years, to the present day. The guides for this tour were very articulate and knowledgeable and provided guests with a thorough explanation of the personalities and conflicts of Russian history.

A magnificent Russian banquet followed, with several courses of meats, vegetables, fish, and desserts served by costumed waiters in an elegant dining hall. During the banquet special recognition was given to Marianna Sankiewicz, former AES Europe Central Region vice president, for efforts that laid the groundwork for the conference. After the banquet delegates assumed the evening was over, but the conference committee had a final surprise. Guests were escorted to another extravagant grand ballroom, where costumed dancers took most of the guests for a waltz on the dance floor. Although many of the golden-eared delegates have two left feet, everyone found the dancing exhilarating.

DAY 3

On the final day of the conference the first of two sessions, *Architectural Acoustics, Part 2*, offered several more case studies of halls under development or in the process of restoration or improvement. The most unusual of these was presented by Maria Ribeiro of Porto, Portugal. She was in the midst of a project to convert a multipurpose cinema the-

Clockwise from above: "Za zdorovie (To health)," from left, Jan Voetmann, Thomas Lagö, Arkady Gloukhov, and David Scheirman offer toast; trio of flute, violin, and cello provide music; after banquet Russian dancers waltzed with delegates.

ater into a music performance hall while maintaining its ability to serve as a cinema theater. She accepted this challenge despite being given a very tight budget. She was further restricted by the existing architectural features of the building and the fact that there was considerable noise from the heating and cooling system. Delegates commented that such challenges are all too common to everyone in the field. This session brought out the best collaborative instincts of the delegates, as several of the veteran acoustical consultants and designers offered her assistance in facing what all in the room agreed to be a fairly insurmountable task. This session truly became a community of colleagues and friends, and that is what the Audio Engineering Society really is about.

The final session of the conference was *Linear and Nonlinear Signal Processing Techniques*. Mark Avis of the University of Salford, Greater Manchester, UK, presented "Q-Factor Modification for Low-Frequency Room Modes." He discussed a method for deriving a simple central filter to correct low-frequency, spatial, and temporal problems in listening rooms. He stated that the total soundfield of a room can be considered as the sum of all modal responses in the room and that by appropriate manipulation the user can set the soundfield to match a defined set of criteria.

At the conference closing Nickolay Ivanov and Irina Aldoshina expressed their gratitude to the more than 100 delegates from 22 countries who attended and to the authors of the 58 papers. The final remarks were given by AES President Garry Margolis who thanked the conference organizers for their many months of hard work in preparing the first AES conference in the former Soviet Union.

Many delegates were able to schedule extra time before or after the conference to visit St. Petersburg's great museums, its grand churches, and its famous music and dance venues. Two technical tours gave delegates an up-close look at the Ice Palace, the most modern concert venue in Russia, and the Old Musical Instruments Museum at the Count Scheremetev Palace. Numerous delegates praised the opportunity to meet and exchange ideas with talented Russian colleagues who were isolated from the global audio community during the Cold War years. All who attended undoubtedly hope that they can return another time to the city that Peter founded almost 300 years ago.

A CD-ROM and a printed version of The Proceedings of the AES 21st International Conference *are available for order on www.aes.org, or from any AES office.*