The newsletter of
The Acoustical Society of America

ECHOES

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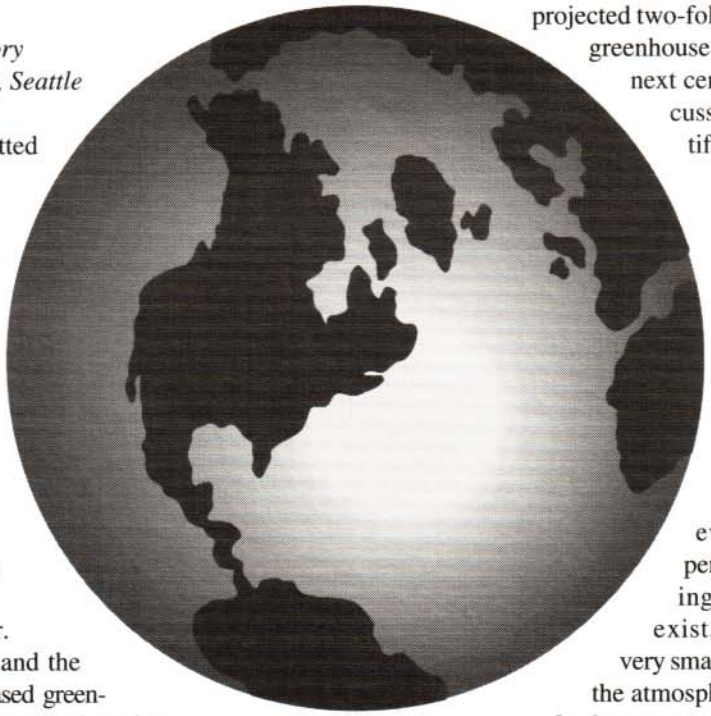
Measuring global warming through ocean acoustics: The Heard Island experiment

by Robert C. Spindel
Applied Physics Laboratory
University of Washington, Seattle



Sound signals transmitted halfway around the world beneath the sea show promise of measuring global warming. In a brief experiment conducted in late January and early February of 1991, scientists from a variety of U.S. and international universities and institutions successfully tested the idea of using transmissions of underwater sound as a global ocean thermometer.

Warming of the earth and the oceans as a result of increased greenhouse gases in the upper atmosphere is a subject of much concern, study, and debate. The possible effects of sea level and temperature change due to a projected two-fold increase in CO_2 and other greenhouse gases by the middle of the next century have been widely discussed in the popular and scientific literatures.

Unfortunately, the projections are uncertain because they are based on numerical models of atmospheric and oceanic responses to the greenhouse effect that lack good input data, especially warming (or cooling) rates. Indeed, definitive experimental evidence of long-term temperature change, either warming or cooling, does not yet exist. The problem is that the very small predicted annual change in the atmosphere, only a few hundredths of a degree per year, is nearly impossible to discern in the presence of normal annual temperature variations that are thousands of times greater.

The one hundred year temperature record is not clear-cut. Measurements compiled since about 1850 are the basis for much of our current speculations. They do suggest a rise of about one-half degree centigrade, but the fluctuations are so great that the trend is not considered to be statistically significant. Scientists are not confident that it really exists. Further, most of the data were taken in the Northern hemisphere, near cities which act as heat sources, and therefore is not a true global average. It could take many decades of averaging temperature readings from all over the globe to detect a warming trend with confidence.

Continued on page 4

A Look Inside...

Miscellaneous soundings

We Hear That . . .

Well known architectural acoustician **Cyril Harris** has become president of the New York Academy of Sciences.

At the plenary session of the Houston meeting, the Dennis Klatt award was presented to its first recipient, **Ying Yong Qi**. The award, honoring the late Dennis Klatt, was jointly commissioned by members of ASA and the American Speech and Hearing Foundation.

Avery Fisher Hall, the home of the New York Philharmonic, has engaged **Russell Johnson** to make recommendations for improving the sound musicians hear on stage. Evidently, musicians on the extreme left and right sides of the stage have considerable difficulty hearing each other. Plans are to be submitted in the spring, and modifications to the hall are scheduled for late summer.

David M. F. Chapman, an ASA Fellow, has been elected president of the Canadian Acoustical Association. The Association will host Acoustics Week in Canada, scheduled for October of 1992 in Vancouver.

The **National Council of Acoustical Consultants** is surveying members for best acoustical consulting projects in celebration of its 30th anniversary this year.

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Newsletter of the Acoustical Society of America

The Acoustical Society of America was organized in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications. This newsletter is provided as a free benefit of membership to Acoustical Society members.

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Woodbury, NY 11797

Last call for applications for Physical Acoustics Summer School

A special week for those interested in physical acoustics will start on June 24 at the Asilomar Conference Center in Pacific Grove, California.

Applications must received early in February!

Look for details on the last page of recent issues of *JASA*.

Letter to the editor:

Dear Editor:

I very much enjoyed reading the most recent issue of *Echoes,* especially Bill Cavanaugh's interview with Leo Beranek and Charles Schmid's "Opinion" article on the Acoustical Society "of America." Did you know that G.R. Anderson, one of the six members of the Society's first Executive Council in 1929, was at the University of Toronto? So the Society's connections with Canada go back to its very beginning. There were two other Charter Members from Canada, and one each from Australia, France, and Japan.

Tony Embleton
Nobleton, Ontario

ANSI approves dosimeter standard

The American National Standards Institute's Board of Standards Review recently approved the "Specification for Personal Noise Dosimeters" ANSI S1.25 1991. This standard is a revision of an earlier version, which was limited to noise environments that were predominantly non-impulsive. The new standard removes this constraint. It provides for three exchange rates: 3 dB, 4 dB, and 5 dB per doubling of exposure time. The standard specifies tolerances for the entire instrument, including frequency response, exponential averaging (employing SLOW and FAST), threshold, dynamic range, and other characteristics. It was developed by a working group chaired by John Earshen, under the auspices of S-1, Acoustics.

The Heard Island experiment

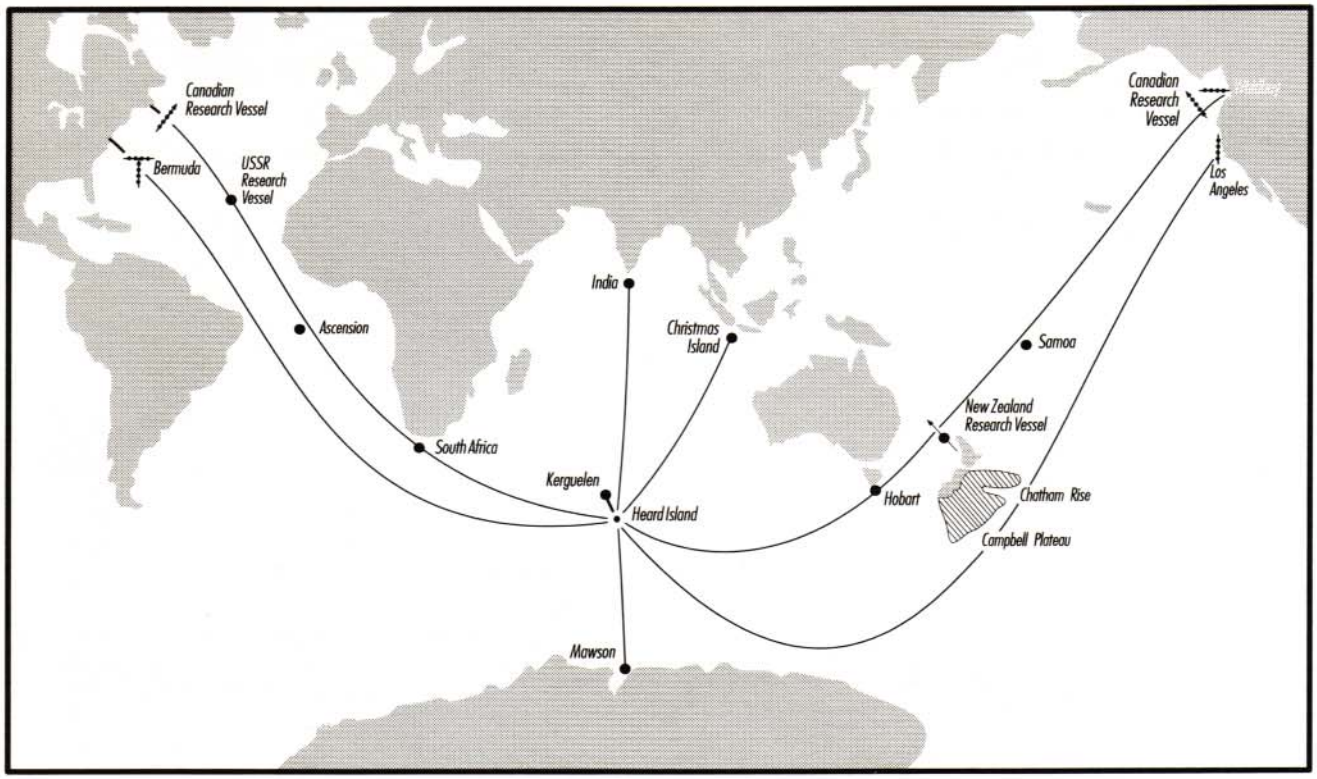
HEARD ISLAND EXPERIMENT — from page 1

Since sound travels faster in warm than in cold water, a gradual rise in ocean temperature would be detected as a slight decrease in the amount of time it takes for a signal to travel between two points. Over long ocean paths, the very slight annual warming, which is expected to be only a few thousandths of a degree at a depth of 1000 meters, would actually result in several tenths of a second change in travel time, an easily measured number. Acoustic transmissions have an added advantage in that the total travel time is related to the average sound speed along the path, and therefore the average temperature along the path. This is equivalent to having many thermometers distributed along the way. Thus a few dozen paths, monitored for about ten years, should provide a sufficiently large global average temperature measurement to reveal a trend if one exists.

The Heard Island experiment represented a feasibility test for such a ten-year experiment. It was designed to determine whether acoustic signals could be sent over long ocean paths and be received with good clarity and intensity, and also to determine whether a long-term program could be conducted without harming marine life. Low-pitched tones centered at 57 Hz were sent from a ship stationed near Heard Island in the Southern Indian Ocean, an Australian territory whose discovery in 1853 is credited to an American merchant, Captain Heard.

Transmitters were suspended beneath the ship at a depth of 200 meters, the axis of the deep sound channel at the latitude of Heard Island. This oceanic feature exists almost worldwide, and insures the efficient transmission of sound over long distances in the sea. It arises as a result of refraction in the vertical plane; sound speed is high near the surface where the water is warm, decreases with depth as a result of cooling, and increases again as the growing effect of pressure increases water density. The sound speed minimum formed in this manner constitutes a duct for sound propagation.

In response to the Heard Island transmissions, strong



Heard Island Feasibility Test

This map shows the acoustic paths from Heard Island to various receiving sites. The underwater sound paths appear as curved lines on this Mercator projection. Most receivers were simple hydrophones, indicated by single dots. Some, for example those at Bermuda and Whidbey Island, were more elaborate arrays of hydrophones, indicated by a series of small dots. Ships that lowered hydrophones into the water, or towed horizontal arrays, are represented by arrows indicating their direction of motion.

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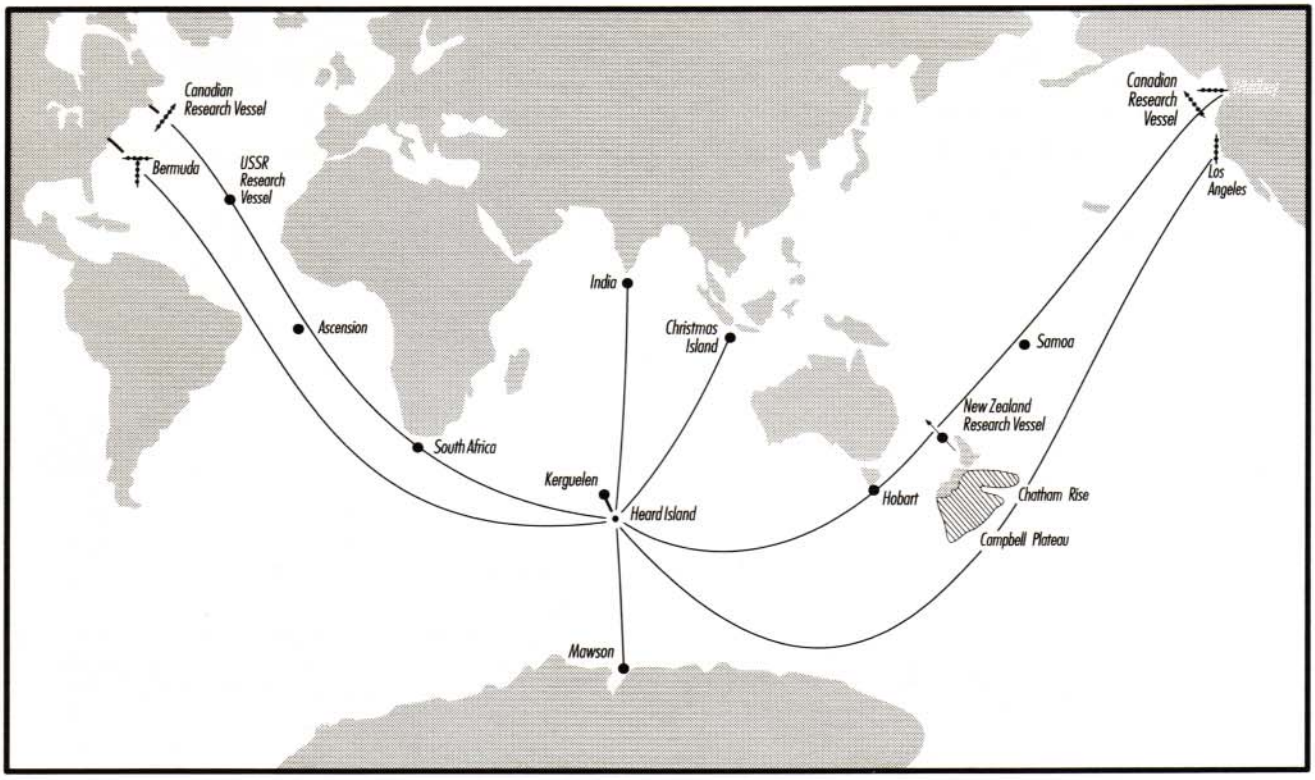

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signals were received in the Atlantic, Pacific, Indian, and Antarctic Oceans at distances up to 16,000 km. An associated marine mammal observation program saw no major changes in the behavior of nearby whales and seals.

The scientific team was led by Walter Munk of the Scripps Institution of Oceanography, Andrew Forbes of the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia, Theodore Birdsall of the University of Michigan, Arthur Baggeroer of MIT, and myself. In addition, listening sites were operated by scientists from the National Oceanic and Atmospheric Administration, Science Applications International Corporation, the Monterey Bay Aquarium Research Institute, and the Naval Postgraduate School.

The international team included scientists from Canada, France, India, Japan, New Zealand, South Africa, Australia, the Soviet Union, and the U.S. Funding for the experiment was provided by the National Science Foundation, the Office of Naval Research, the Department of Energy, and the National Oceanic and Atmospheric Administration in the U.S., and by CSIRO in Australia.

Plans are now underway to define the configuration of transmitters and receivers for a ten-year global monitoring experiment.

Robert C. Spindel

This article was based on a presentation given at a special session on the Heard Island Feasibility Experiment at the fall meeting in Houston.

Dr. Spindel is director of the Applied Physics Laboratory at the University of Washington in Seattle. Previously, he was head of the Ocean Engineering Department at Woods Hole. He received his undergraduate degree from Cooper Union, and three graduate degrees from Yale. A Fellow of the Acoustical Society, he was awarded the A. B. Wood Medal and Prize in 1981. He is also current President of the Marine Technology Society.

Archives in Physical Acoustics announced

John Kopec, who chairs ASA's administrative committee on Archives and History, has announced the establishment of the ASA Archives in Physical Acoustics at the National Center for Physical Acoustics of the University of Mississippi. The Center will provide for the storage and care of all documents in this field of acoustics submitted to the ASA. Lawrence Crum, the Center's interim director will serve as curator. These documents will be available to scholars and researchers in physical acoustics and its history. The Center's new $10 million building has a library and over 800 square feet of usable storage space for this purpose.

Archives in architectural acoustics have already been established at the Riverbank Acoustical Laboratory Museum in Geneva, Illinois. The Committee on Archives and History is seeking sites for each of ASA's technical areas so that important scientific papers and archival materials may be preserved and made available for future generations of acoustical scientists and historians. For further information on the archives programs contact John Kopec at (708)232-0104.

Acoustical Oceanography becomes a full TC

At the recent ASA meeting in Houston the Executive Committee passed a motion transforming the Acoustical Oceanography Technical Specialty Group into a full Technical Committee. More that 2 percent of the Society's members have given Acoustical Oceanography as their first choice of acoustical interests, which is the criterion on which the transformation is based.

In another development at the Houston meeting, a Coordinating Council on Ocean Acoustics Research was formed. This group, which has also been called the "Oceans Council," consists of chairmen or alternates from the five ASA technical areas with interests in different aspects of ocean acoustics: Acoustical Oceanography (ocean parameters and processes), Animal Bioacoustics (ocean animals), Engineering Acoustics (ocean transducers), Physical Acoustics (small-scale ocean physical processes), and Underwater Acoustics (ocean propagation).

The purpose of the Oceans Council is to coordinate the scheduling of sessions and of papers within sessions so as to minimize conflicts, although each technical committee retains the freedom to chart its own course.

ASA student membership

On the benefits of being a student

Students are some of the most valuable members of any organization. Before long they graduate and begin paying higher dues about the same time as their taxes increase. But more importantly, they begin to contribute scholarly research, work on committees, develop standards, hold office, and eventually take the places of their professors and mentors and become luminaries in their own right. It's only common sense that the organization should nurture these young members and provide them with special benefits. ASA has done just that, but not all members are aware of these benefits.

Certain benefits have always been available. Students can join at a reduced membership rate (currently only $22 per year) and register free for spring and fall meetings. They can also meet new people and connect names with faces. In fact, the Technical Committee on Speech hosts a reception at each ASA meeting on Tuesday from about 5 to 6 pm, at which students can meet well-known senior professionals in speech in an informal and friendly atmosphere.

Students are encouraged to present papers and posters. Because ASA meets twice a year and has many concurrent sessions, there is usually plenty of room for students to participate. Poster sessions provide a particularly good opportunity for students to present their research and to obtain feedback from interested observers.

Over recent years, ASA members have been asked to contribute $10 over their dues to a student travel fund, and about 36 percent of the members do. About 20 to 30 students apply for travel funds each meeting, and most of them receive some assistance. Awards defray expenses for the most economical kind of transportation (usually car or van pool), and consequently are most often given to students who are located closest to the meeting site.

Recently, certain technical committees (TCs) have instituted award programs for the best papers or presentations by students. These TCs include Speech Communication, Noise, Engineering Acoustics, and Structural Acoustics and Vibration, with awards ranging from $100 to $300. So far, only the Speech and Structural Acoustics TCs have actually presented awards.

The Speech Communication committee selects its recipients at one meeting and presents the award at the following meeting. Winners selected at the San Diego meeting and announced in Baltimore were Yoko Hasegawa and Geetha Krishnan. Selected in Baltimore and announced in Houston were Mazin G. Rahim and Melanie M. Campbell. Two more students were selected in Houston and their awards will be presented in May at the Salt Lake City meeting.

Structural Acoustics and Vibration gave four prizes for written and oral presentations at the Baltimore meeting. Tied for first place were Tei-Tai Chen and Thomas Howarth. Second place winners were Yi Gu and Christiaan Kauffmann. At the Houston meeting, Alain Berry received first place and Jeffrey Vipperman received the second place prize.

The Noise TC will give up to four awards per meeting to young professionals (not necessarily students) for outstanding papers in noise, and the Engineering Acoustics TC will begin its awards program at the Salt Lake City meeting. Interested applicants should see the pertinent sections of the Call For Papers preceding each meeting.

Another advantage is the ASA books program, where students can obtain classic works and even textbooks for as little as $20. In addition, the ASA membership directory can come in handy for students as well as other members. There is no reason why students cannot look up the name of the researcher whose work is being studied, call and ask a burning question, and get an answer! Also, of interest to certain foreign students is the fact that the Executive Council recently passed a resolution enabling acousticians from soft currency countries to get one year's membership free (including the journal) upon application.

It is plain to see that ASA values its student members. May they reap as many benefits as possible, and may they stay with the Society long enough to receive their 50-year awards!

Government Ethics Office retreats from proposed regulations

The last issue of *Echoes* (Vol. 1, No. 3) ran an article about proposed standards issued by the Office of Government Ethics that would curb the participation of federal employees in certain professional society activities. It now appears that scientific and other professional societies were successful in their attempts to convince the Office of Government Ethics to revisit these regulations.

In an October 22 hearing before the House Post Office and Civil Service Subcommittee on Human Resources, the Government Ethics Office's director Steven Potts stated that his staff had received over 1000 responses, and that they had vastly underestimated the impact of the proposal. "It was not our intention to unduly inhibit participation by federal employees in professional societies," he said, and "it appears that on the questions of associations, we have not spoken with the clarity we intended."

Potts said that the Office of Government Ethics will either issue another version of this section for public comment, or repropose the entire set of regulations.

Coming Attractions: Salt Lake City meeting

The May meeting in Salt Lake City promises some stimulating technical sessions as well as some non-technical tours geared to delight both the visual and the auditory senses.

Technical sessions

Short Course — Preceding the technical program will be a short course on Structural Acoustics, which will take place on Sunday and Monday, May 10 and 11. This is the first in a series of short courses sponsored by ASA to be held in conjunction with the semi-annual meetings. The Salt Lake City course is designed for engineers and scientists concerned with the problem of fluid structure interaction and the subsequent acoustic radiation into the fluid. The instructor is David Feit, coauthor with Miguel Junger of "Sound, Structures, and Their Interaction," which is the standard reference in the field. For information about the program content, call Mauro Pierucci (619)594-6079. To register, call Elaine Moran at ASA headquarters (516)576-2360.

Tutorial — On Monday evening, May 11, there will be a tutorial lecture entitled "Digital Audio," presented by Thomas Stockham of the University of Utah.

Memorial Sessions — During the meeting, there will be two sessions in honor of well known acousticians, recently deceased. A session honoring the late Eugene Skudrzyk has been organized by Sabih Hayek. About eight of Professor Skudrzyk's former doctoral students will give talks on the research they are currently conducting in acoustics. A wide variety of topics can be expected since some students graduated about 20 to 25 years ago, and others much more recently.

A memorial session honoring the late Eberhard Zwicker will feature Professor Ernst Terhardt and Dr. Hugo Fastl, guest speakers from Germany. As a lead-off speaker, Tilmann Zwicker, Eberhard Zwicker's son, will give personal notes on his father's life and scientific activities. Several other invited papers will be given by prominent scientists, describing their own work and how it relates to the work of Professor Zwicker. The session has been organized by Soren Buus.

The Distinguished Lecture will be held in conjunction with the plenary session in the Salt Lake City Symphony Hall. The speaker is Prof. Juergen Meyer of the Physikalish-Technische Bundesanstalt in Braunschweig, Germany. Professor Meyer is internationally recognized for his scientific research and publications on the acoustics of orchestral instruments, and is also an accomplished performer and conductor. He will give an introductory exposition, followed by examples performed by the Weber State University Symphony Orchestra. The musical examples will be taken from Carl Maria von Weber's Der Freischuetz, and the program will conclude with a complete performance of the overture.

Film — During the week there will be several presentations of a 30-minute film documenting the life of Harvey Fletcher, ASA's first president and a resident of Salt Lake City. Interested viewers can look on the bulletin board for information on the location and showing times.

Musical Acoustics Workshop — Following the meeting, Paul Palmer and Tom Rossing have organized a workshop on musical acoustics for teachers, which will take place on Friday afternoon the 15th and all day Saturday the 16th. Teachers are invited not only from colleges and high schools, but also from elementary schools. The instructors will demonstrate the teaching of science through musical acoustics using simple, inexpensive equipment. For information call Dr. Palmer (801)378-2230 or Prof. Rossing (815)753-6493.

Tours

Technical Tour — An all-day technical tour has been arranged for those interested in musical acoustics on Tuesday, May 12th. Among the visits will be the Violin Makers School of America, the Bigelow Organ Company (builders of tracker organs), and the Brigham Young University Carillon.

Day-trips during the meeting will include a Salt Lake City tour, and a trip to Park City, a former mining town and now a famous ski resort. There will also be a "supper and song" evening, featuring dinner at Lion House, the restored home of Brigham Young, and attendance at the weekly rehearsal of the Mormon Tabernacle Choir.

Post-Meeting Tour — A marvelous $2\frac{1}{2}$ day tour for May 15-17 has been arranged to some of the nation's most scenic places. After a drive through the Wasatch Mountains, the tour will overnight at the Peppermill Resort in Mesquite, Nevada, where guests can choose among six outdoor swimming pools and enjoy a buffet dinner. The next day the tour will visit Zion National Park and Bryce Canyon, accompanied by a geologist from an area university. On the third day, back in Salt Lake City, the tour will attend the CBS Radio broadcast of the Mormon Tabernacle Choir. Since space may be limited, interested parties should sign up early. For information, call Carefree Tours (800)658-8758 or Charlene Strong (801)377-0552.

Miscellaneous soundings

Speech newsletter available

ESCA, the European Speech Communication Association describes itself as a non-profit organization for promoting speech communication science and technology in a European context. Membership information can be obtained by contacting the Secretariat, BP7, B-1040 Bruxelles 40, Belgium. NESCA, the ESCA newsletter, contains information about recent articles, books, and theses, news about member groups, laboratories, and meetings, etc. For information about the newsletter, contact Maxine Eskenazi, LIMSI-CNRS, BP 133, 91403 Orsay Cedex, France.

Kudos for Russell Johnson

Critics have called it a remarkable gift, a virtuoso among concert rooms, the best concert hall in England, and assuredly among the world's best. They refer to the new concert hall of the City of Birmingham Symphony Orchestra, completed in the summer of 1991. The hall's acoustics were designed by Russell Johnson, chairman of Artec, whose previous notable success was the acoustics of the Morton Meyerson Symphony Center in Dallas. Simon Rattle, music director of the Birmingham orchestra maintains that this extraordinary hall has changed his whole approach to music.

According to Max Loppert of the Financial Times, *"The sound of the orchestra seemed to possess ideal space, depth, intimacy, and clarity across a wide range of pitches and dynamics; . . . and this is the true miracle — it reached me as a physical presence naturally proportioned and positioned, with no lacks, gaps, artificial 'gramophonic' adjustments, or internal imbalances."*

HCC 92 in Cincinnati

An international conference, "Hearing Conservation Conference 1992", will be held in Cincinnati, OH on April 1-4, jointly sponsored by the National Hearing Conservation Association, the National Institute for Occupational Safety and Health, and the University of Kentucky. The program includes seminars on noise control and hearing loss litigation, forums on employee education and the definition of noise-induced hearing loss, and film presentations, as well as lectures and posters on such topics as hearing protection, audiometric methods, recreational noise, and OSHA regulations. Proceedings will be available at the time of the conference. For further information, contact Elizabeth Haden (606)257-3972 or Michele Johnson (515)266-2189.

Room sharing for ASA meetings

Nowadays the price of a single and double room is usually the same. For those who want to cut their lodging costs in half, ASA's office will be preparing a list of people who want to share rooms at the semi-annual meetings. Anyone interested can send in his or her name, address, and phone number, and should identify gender and smoking preferences. The list will be available only to those whose names are on the list. Participating individuals will then make their own hotel arrangements. Send information by March 1st for the May meeting to: Room Sharing, ASA, 500 Sunnyside Blvd., Woodbury, NY 11797.

ASA'S NEW PHONE NUMBERS
(516) 576-2360 or (516) 576-2359

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