The newsletter of
The Acoustical Society of America

ECHOES

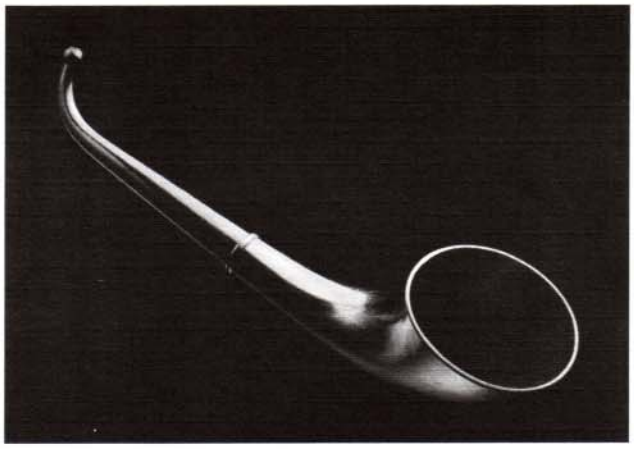
Volume 4, Number 3
Autumn 1994

Hearing Aids: Today and Tomorrow

by Sigfrid D. Soli

OVER 28 MILLION Americans have hearing impairments severe enough to cause a communication handicap. While hearing aids are the best means of treatment for the vast majority of these people, only about 5 million of them own hearing aids, and fewer than 2 million new hearing aids are sold annually. Market surveys of hearing aid owners have found that only slightly more than half (58%) of these people are satisfied with their aids.

These statistics present both a challenge and a puzzle to the scientists and engineers who conduct hearing aid research and development. Through their work in recent years, hearing aid technology has advanced to new levels of sophistication and miniaturization. Contemporary hearing aids have higher fidelity and more precisely controlled gain and frequency response than ever before. Some aids can be programmed with multiple responses which the user can select at any time, while others incorporate complex amplitude compression techniques to ensure that the sound from the hearing aid is not uncomfortably loud. Hearing aids have also been miniaturized to fit completely in the ear canal, making them almost invisible to the casual observer.



Early hearing aids, such as this ear trumpet, were used in the 1800s before the advent of electronic aids. These passive mechanical devices provide up to 10 or 15 dB of gain at frequencies above 1000 Hz, depending on the diameter and length of the bore.

Hearing in noisy and reverberant environments

The limited use and satisfaction of hearing aids may relate in part to the wider range of functions that hearing aids must serve with today's lifestyles. Ironically, the technological advances in miniaturization and flexibility may actually have contributed to this situation. As hearing aids have become smaller and less conspicuous, more hearing-impaired individuals use their aids in a wider range of situations where speech communication is important. These situations commonly include work and social settings with groups of people talking, as well as other types of noisy or reverberant environments, such as churches, restaurants, sporting events, and public performance spaces. The use of hearing aids in most of these settings would have been unthinkable in the days of large body-worn or hand-carried devices with wires connecting the device to the output transducer in the ear.

The acoustical environments in the settings where people now want to wear their hearing aids differ fundamentally from the traditional setting of the quiet home. These environments often include a competing noise with about the same spectrum and sound pressure level as the signal of interest. This is especially true when the signal of interest is the speech of one of several people who are talking, and all of the people are talking at about the same sound level. In these situations, the hearing aid will amplify both the desired and the undesired competing sounds without changing their signal-to-noise ratio (S/N). For the individual with sensorineural hearing loss, the most common type of hearing loss, the ability to communicate in these situations may not be much improved by using hearing aids. Individuals with sensorineural hearing loss usually require a better S/N for speech communication than do individuals with normal hearing. For example, the hearing aid

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We hear that . . .

The National Council of Acoustical Consultants (NCAC) has elected **Dennis Paoletti,** president and principal of Paoletti Associates, Inc., to be its new president.

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The George W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology has appointed **Peter H. Rogers** as Professor to the Rae and Frank H. Neely Chair in Mechanical Engineering.

***

ASA Vice-President **Lawrence R. Rabiner** of AT&T Bell Laboratories will speak on "Science and Technology of Speech Processing" at the after-dinner session of 1994 Meeting of American Institute of Physics Corporate Associates, October 24.

***

During their recent semi-annual meeting in Pittsburgh, American National Standards Institute working groups S3.48 and S3.80 presented a plaque to **Samuel F. Lybarger,** recognizing his years of contribution to ANSI's hearing aid activities.

***

ASA members recently appointed to the Advisory Council of the National Deafness and Other Communication Disorders were: **Eric D. Young** of the Johns Hopkins University School of Medicine, **Joanne L. Miller** of Northeastern University, and **Arlene E. Carney** of Boys Town National Institute.

ECHOES

Newsletter of the Acoustical Society of America
Provided as a benefit of membership to ASA members

The Acoustical Society of America was organized in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications.

Echoes Editor ..... Alice Suter
Publication Design ..... Linden Communications
Printing ..... Custom Printing
ASA Editor-in-Chief ..... Daniel Martin

Phone inquires: 516-576-2360. Article submissions and correspondence should be directed to *Echoes* Editor, Acoustical Society of America, 500 Sunnyside Boulevard, Woodbury, NY 11797.

Austin Meeting highlights

Mexican visitors to enhance meeting

At this time, at least twelve scientists from Mexico plan to attend the Austin meeting, nine of whom will present papers. ASA's friendship with Mexican acousticians was strengthened about a year ago when Ilene Busch-Vishniac, Tom Rossing, and George Wong were invited to give presentations to the Sociedad Mexicana de Acustica in Mexico City. More recently, the Instituto Mexicano de Acustica hosted its first Congreso Mexicano de Acustica in Monterrey, September 22-23. Among the presenters were several ASA members, including Mahlon Burkhard, John Duda, and Christopher Jaffe. In addition, Jiri Tichi, ASA President, and Tom Muir, Technical Chair for the Austin meeting, represented the ASA.

Mexican acousticians will present papers at ASA's meeting in engineering acoustics, noise, architectural acoustics, and musical acoustics. Among the presenters are Fernando Elizondo, organizer of the Monterrey conference, and Juan Antonio Ortiz Garcia, President of Sociedad Mexicana de Acustica, both of whom will present papers in noise sessions. Ilene Busch-Vishniac has been acting as ASA's informal liaison, faxing copies of the Call for Papers to her Mexican colleagues and helping them find housing in Austin.

ASTM E33 Committee to meet

The American Society for Testing and Materials (ASTM) Committee on Environmental Acoustics, E33, will meet all day Sunday and Monday, November 27 and 28, prior to the Austin meeting of the ASA. Up to 80 people are expected to attend Task Group meetings on Sunday and meetings of subcommittees and the main committee on Monday to work on new and existing ASTM standards.

Free hearing tests

Once again, free on-site audiometric tests will be provided to Austin meeting attendees and their guests. Testing requires about ten minutes and will be available on Wednesday, November 30 and Thursday December 1 from 9:00 am to 3:30 pm. Interested persons should sign up when they register at the meeting.

This service is jointly sponsored by the technical committees on Noise and Psychological and Physiological Acoustics. Test equipment and personnel are provided courtesy of the University of Texas Speech and Hearing Center and the test booths by Acoustic Systems, Inc. of Austin.

Musicians wanted

Two ASA members have, simultaneously and independently, decided to request expressions of interest by other ASA members in the making of music. Julian Hook believes that the many accomplished musicians among the ASA membership might put together a chamber music concert to play at future ASA meetings, possibly in conjunction with the Plenary Session in the Circle Theatre at the 1996 Indianapolis meeting. His idea was received favorably at the meeting of the Technical Committee on Musical Acoustics in Cambridge. Anyone interested should write to him at:

600 South Dearborn, Apt. 1512
Chicago, IL 60605
Or call (312) 922-5074.

ASA's President-Elect Bob Apfel has in mind the "Acoustical Society of America Ensemble," an informal singing group of anywhere from 12 to 50 members. The group would choose short pieces from the choral repertoire and practice at ASA meetings, with the intent of performing occasionally at ASA events. A piano accompanist is also being sought. For a questionnaire, prospective ensemblers should contact Bob at:

Yale University
New Haven, CT 06520-8286
Phone (203) 432-4346
Fax (203) 432-7654

Executive Council approves new Technical Specialty Group

Technical Specialty Group (TSG) status is accorded new groups that are not sufficiently large or well established to become full-fledged Technical Committees (TCs). Not long ago the TSG on Acoustical Oceanography became a full TC, leaving Animal Bioacoustics as ASA's only TSG. Now a new group has joined its ranks, the TSG on Signal Processing in Acoustics.

Stan Ehrlich, former ASA Vice President, initiated action on the new TSG. Its objectives, prepared by David Havelock, are:

(1) To foster a forum for interdisciplinary interaction in signal processing for acoustics;
(2) To promote and organize initiatives in signal processing among the TCs;
(3) To provide a contact point for inquiries, recommendations and information in this area both within and outside the ASA; and
(4) To provide a forum for the discussion of policy, planning, and organizational issues relevant to signal processing in acoustics within the ASA.

Jim Bartram, formerly Associate Editor for papers pertaining to signal processing, was elected the TSG's interim Chair.

Teaching noise control

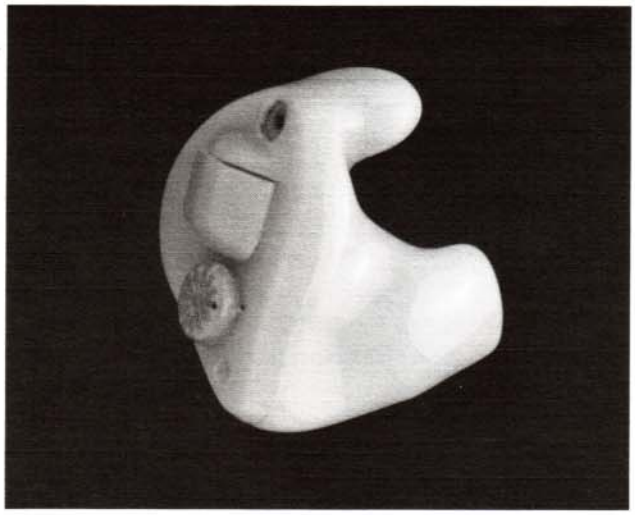
Teaching particular concepts and skills is a special challenge in the field of noise control, where there is often a wide gap between the fundamental concepts learned in a classroom and the skills used by practitioners. We have recently revised a course in noise control at The University of Texas at Austin with a novel approach to bridge this gap. The course contains a major project which the entire class performs during the semester. Last fall's project was to evaluate the efficacy of soundproofing at the Ridgetop Elementary School, a public school located directly under the flight path of Austin's Mueller Airport.

The new course includes undergraduate and graduate students from the mechanical, electrical, and architectural engineering degree programs. The project is discussed during the introductory course lecture and the class is divided into teams once the enrollment is stable. Each team incorporates a mix of undergraduate and graduate students from the various degree programs. The teams make measurements several times during the semester, and we publish the results and discuss the causes of any discrepancies.

At the end of the semester each team is responsible for writing up a specific section of the report, based on the data collected by the entire class. Then, as the class instructor, I assemble these sections into a final report and formally present it to the appropriate agency or person, such as the principal of Ridgetop Elementary School. In an earlier project, a student accompanied me to the high school we had studied and, in addition to discussing the project, we presented demonstrations in acoustics. We also gave the school two hand-held sound level meters.

Thanks to the generosity of the General Motors Corporation, the new noise control course has a modest endowment. These funds are being used to buy instrumentation to support the project and to send students to ASA meetings to present the results. Brandon Scott, a senior in the Electrical and Computer Engineering Department, delivered a paper on the Ridgetop project at ASA's meeting in Cambridge. He described the school's sound proofing as very effective, much to the delight of the school's acoustical consultants who happened to be in attendance. Brandon's feeling was that the project greatly improved the class and that the students appreciated the opportunity to help the community as well as to learn hands-on techniques. He did note a number of logistical problems, such as the eagerness of the children to hold the sound level meters and the restricted availability of the equipment—some students would want to use it while other students had it. At least one consultant attending the talk in Cambridge commented that these problems made it clear that the experience was a very realistic one!

Ilene Busch-Vishniac
Dept. Mechanical Engineering
University of Texas, Austin



Contemporary hearing aids, such as this in-the-ear device, are custom built to fit the shape of an individual's ear canal and external ear. These battery-powered devices contain a microphone, amplifier, filter(s), and an output transducer, providing up to 30 dB of frequency-dependent gain. Maximum gain is often limited by the occurrence of acoustic feedback.

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wearer with a moderate hearing loss of 40 dB between 500 Hz and 2000 Hz may need a S/N that is 3-4 dB more favorable than those with normal hearing for a comparable level of speech recognition. Thus, amplifying both the signal and noise without improving the S/N is unlikely to restore normal speech communication in these situations.

New directions in hearing aid research

A number of different research efforts are directed toward this problem. All have as a common goal the improvement of hearing in noise. Achieving this goal with a practical, robust, and cosmetically acceptable hearing aid requires innovative effort on several fronts. New algorithms need to be developed. In many of the acoustical environments that are difficult for the hearing aid user, the desired signal (usually speech) and the competing noise(s) are broadband and complex with similar but variable spectral, temporal, and spatial properties. These similarities may make it difficult for existing algorithms to reduce or cancel the noise without also canceling or distorting the desired signal. The task also requires new signal processing circuits that can implement complex algorithms in real time while minimizing power and size. A typical integrated circuit for a hearing aid is a few hundred mils on a side, operates on a 1.2 volt battery, and consumes only a few milliwatts of power.

Current hearing aid research efforts directed toward the improvement of communication in noisy environments fall into three main categories. In the first category are the efforts that exploit differences in the spatial or directional properties of the signal and noise. In non-reverberant environments where the signal and the noise sources originate from different directions or where the noise is diffuse, directional microphones or arrays of microphones can improve the S/N. For example, researchers in the Netherlands have built a prototype array for use with hearing aids that can improve thresholds for speech intelligibility by up to 6 dB in diffuse, non-reverberant noise. Performance degrades significantly, however, in reverberant environments, especially when the hearing aid user and the speech source are separated by more than the critical distance. Researchers from several universities, including MIT, Stanford, UCLA, and Göttingen, are currently developing new algorithms and arrays.

The second category of hearing aid research focuses on enhancing the speech signal to improve communication in noisy environments. As an example, researchers at Cambridge University have developed an algorithm that narrows and sharpens the spectral peaks in speech to offset the effects of poor frequency resolution that occur with sensorineural hearing loss. These methods have achieved only limited success to date, although the research is still in its early stages. Speech enhancement also refers to methods of removing noise from the speech signal using estimates of the statistical properties of the speech and noise derived from the input. For example, new enhancement algorithms based on wavelets and other novel transforms are being tested at George Mason University for hearing aid applications.

The third category of research concerns several issues related to the wideband fidelity of hearing aid devices. Articulation theory has shown that the audible level and bandwidth of speech affects its intelligibility in noise. Thus, the goal of this research is to reduce or eliminate noise, distortion, feedback, and other effects caused by the device itself that can influence audibility, bandwidth, and fidelity. Researchers in the hearing aid industry have developed advanced methods of amplitude compression, as well as wide bandwidth, low distortion circuits and transducers. Methods of acoustic feedback cancellation are also being developed by researchers at CUNY, University of Minnesota, and UCLA.

Our work at the House Ear Institute on the development of a binaural hearing aid also falls under this third general category of research. Because binaural directional hearing can improve speech intelligibility in noisy environments, both the magnitude and phase response of the experimental hearing aid are adjusted on the user to ensure that the interaural time and level differences needed for binaural directional hearing are present at audible levels.

Federal support for hearing aid research

The need for more effective hearing aids, especially devices that can improve communication in noisy environments, has recently received significant attention by the U.S. government. In August of 1992, the National Institute on Deafness and Other Communication Disorders (NIDCD) and the Veterans Administration (VA) signed a 10-year agreement on hearing aid research collaboration. The agreement established a program consisting of several parts: First, the NIDCD scheduled a series of program announcements list-

ing funding priorities, then issued a request for contract proposals entitled "Hearing Aid Device Development." Next, NIDCD and the VA are planning a series of clinical trials to evaluate new and existing hearing aid technologies. Finally, the two agencies will sponsor a national hearing aid research forum which will be held in 1995. NIDCD has formed an ad hoc advisory committee on hearing aid research and development consisting of Louis Braida, MIT, Judy Dubno, Medical University of South Carolina, George Gates, University of Washington, Harry Levitt, CUNY, Janet Rutledge, Northwestern University, Sigfrid Soli, House Ear Institute, and Blake Wilson, Research Triangle Institute.

The future for hearing aids

Although improvement of hearing aid performance in noisy environments presents substantial challenges, the extent and quality of research now directed toward this problem, together with increased federal support for this research, are promising signs of the future for hearing aids. The incidence of hearing impairment throughout the world indicates that these improvements can have an important impact on the communication abilities of the public.

The author, Sigfrid Soli (left), and Michael Nilsson (right), along with other researchers at the House Ear Institute, are performing research and development on a binaural hearing aid system. The prototype portable processor shown above is used for field tests. The arc in the foreground is used for tests of sound localization.

Sigfrid D. Soli, Ph.D., is Acting Director of Research at the House Ear Institute and Director of its Hearing Aid Research Laboratory. He is an ASA Fellow and currently Chair of the Technical Committee on Speech Communication.

"What it was" . . . the Microphone Hummer

There were many responses to the "What is it?" article appearing in the Winter 1994 issue of *Echoes.* The article included a picture of a "Campbell Microphone Hummer," donated to ASA's Museum of Architectural Acoustics at Riverbank by the Physics Department of Bowdoin College. Unfortunately, the device came with no instructions. In "What is it?" my purpose was not only to obtain an answer regarding the Hummer, but also to support the activities of the ASA Committee on Archives & History through reader participation. The article resulted in success on both counts.

At first, the letters and telephone calls produced quite a variety of explanations for the Hummer's functions. Fortunately, correspondence from ASA member W. Jack Cunningham, Professor Emeritus of Electrical Engineering at Yale University, gave the type of answer I had hoped for. Professor Cunningham reminisced about his college days when he used a similar device, and mentioned that the Riverbank photo did not show all the Hummer's components. He provided a copy of pages from *Measurements of Inductance, Capacitance and Frequency* by **A. Campbell** and E.C. Childs (D. Van Nostrand, 1935, pp. 16-23). These pages showed pictures of the Campbell Hummer and other similar devices. The pictures and text showed that Riverbank's Campbell Hummer is indeed incomplete. This explains why drawing a schematic of the existing circuit provides no answers other than the fact that one coil would be energized if a battery were connected. What was missing was a small steel bar resting on two posts and a jumper wire.

Briefly, the answer to "What is it?" is this: A microphone hummer is a device that provides a constant frequency and a "tolerably pure" wave form from a **dc** (battery) source. The Campbell Hummer, circa 1906, provided frequencies (n) from 1000 to 5000 cps (now Hz) by adjusting the length (L) of a 25 mm diameter steel bar (vibrator) that set on two nodal points and operated by electromagnets. The formula Campbell's Hummer applied was $L=1075/n^{0.5}$. Since a microphone's mica diaphragm has a natural frequency, the microphone in this application is used as a pulsating current source that kept the magnets properly polarized, thus the name "**microphone** hummer."

Two other individual explanations came very close, but Professor Cunningham was declared the winner on the basis of providing a document, written by its inventor, that showed the Hummer and explained exactly what it did. Congratulations, Professor. One authentic Riverbank tuning fork is heading your way, signifying that your response was perfectly "in tune" with our needs.

—John W. Kopec, Curator
ASA Museum of Architectural Acoustics at Riverbank

Design for acoustical accessibility

Three ASA technical committees are putting together a special session on acoustical accessibility of public facilities for persons with hearing and vision disabilities. The intent is to discuss potential solutions to the problems experienced by these people in attempting to communicate in public spaces, such as restaurants, offices, schools, and theaters. The session is being jointly sponsored by the committees on Architectural Acoustics, Noise, and Speech Communication and will take place at ASA's spring meeting in Washington, DC, May 30 through June 3, 1995.

The enactment of the Americans with Disabilities Act (ADA) has generated considerable interest in the rights of people with hearing and vision impairments, but because explicit standards are few, architects and space designers must seek guidance through examples of considerate design.

You might ask what is meant by "considerate design," so here are some examples:

Restaurants can "show consideration" by providing quiet zones for sit-down diners. Not everyone wants a din with their dinner. Three-sided partial-height barriers with sound absorbing panels both inside and outside afford one way to do this. A series of these U-shaped cubicles laid out with staggered openings can provide quiet settings for intimate exchanges between diners. Communication with waiters is also improved. Restaurants can also change traffic patterns to reduce the clatter of dishes and other noises coming from the kitchen; for example, by providing L-shaped kitchen entrances lined with sound absorbing panels. Drive-through and fast-food restaurants can improve communication systems in a number of ways; by basing intercom selection on intelligibility ratings, by testing these devices periodically, and by training employees to speak clearly. (You don't have to be hearing- or vocally-impaired to appreciate this kind of consideration.)

Many churches and theaters already show consideration by providing assistive listening systems, hearing aid connections, and front-seat access to hearing-impaired people. Hotels and conference facilities need to do this as well. Meeting space providers also need to improve listening conditions by ensuring low noise transmission through operable partitions and by providing quiet audiovisual systems. (See feature article by Ewart Wetherill in the Winter 1994 issue of *Echoes*.) If meeting planners demand such considerations for their clients, meeting space providers are more likely to oblige.

Urban planners can reduce street noise in many ways. Noise caused by the "canyon effect" (reverberant sound buildup between buildings) can be reduced by eliminating parallel walls. This can be achieved by adding a slight tilt to building facades at the street level or by siting buildings in such a way that their walls are not parallel. Designating certain areas as traffic-free can create quiet and delightful urban malls that are inviting to all people.

Car makers market quiet interiors to their customers while disregarding exterior noises. Quieter automobile exhaust systems are practical and represent "considerate design" from which all would benefit.

This list of ideas is meant to be evocative rather than exhaustive. Perhaps it will stimulate further interest for the special session planned for ASA's 1995 meeting in Washington, DC. The session aims to provide a forum for acousticians, audiologists, and government officials to exchange ideas and share experiences. For this purpose, papers are being sought on the following subjects:

- Design criteria for acoustical accessibility.
- Case studies involving acoustical accessibility in public spaces.
- Experience with acoustical accessibility (and non-accessibility) by people with hearing or vision impairments.
- Good and bad examples of design for acoustical accessibility.
- Communicating acoustical accessibility to architects, designers, and space planners.

Written abstracts for oral presentations of about 12 to 15 minutes are due in January, 1995. ASA members will receive a Call for Papers in December. Non-members should call the ASA Woodbury office for instructions on submitting papers (516)576-2360. Opportunities exist for a few invited papers of about 25 minutes duration, and a panel discussion is also planned. For further information contact David Lubman, 14301 Middletown Lane, Westminster, CA 92683. Voice (714)898-9099, fax (714)373-3050, EMail:Compuserve 71170,3306, Prodigy NNMR93A.

—David Lubman

Recycling JASA

Any ASA member who is moving or retiring: Would you like to donate back copies of *The Journal* to a deserving newer member? ASA newer members: Would you like to receive back copies of *The Journal?*

Interested parties should contact Elaine Moran at the ASA Woodbury office (516)576-2360, who keeps a list of potential donors and recipients and tries to pair them according to geographical proximity. Each pair will make its own arrangements for shipping and postage.

FICAN meeting draws interest, frustration

The first public session of the Federal Interagency Committee on Aviation Noise (FICAN) engendered hope, interest, and sometimes frustration on the part of the audience. The meeting was chaired by Tom Connor of the Federal Aviation Administration's (FAA) Office of Environment and Energy, who repeatedly emphasized FICAN's limited role in anything beyond research and technology. In his role, Connor was unable to respond to numerous questions from the audience involving policy considerations. According to *Airport Noise Report,* Connor has stated that the FICAN members were impressed by three points resulting from the meeting: (1) The need to get a better handle on what noise metrics to use and when to use them; (2) The need to study noise impact from general aviation and commuter propeller operations; and (3) The possible need to broaden the FICAN membership to include a representative of a federal agency, such as the National Institutes of Health, that has expertise in human physiological and psychological processes.

ASA was represented at the meeting by Daniel Johnson, former Chair of the Technical Committee on Noise. He addressed FICAN briefly on the importance of standards as a practical outcome of noise research, and on the benefits of coordinating with ASA's standards program.

FICAN has released a report that summarizes federal agency research in the area of aircraft noise. Examples of research projects include: a tri-national study coordinated by the U.S. Air Force (with Canada and the U.K.) to determine the feasibility of conducting a prospective field study of the effects of military aircraft noise on human health; a study by the FAA to develop an Enroute Aviation Noise Model; and efforts by NASA to develop an Airport Community Noise Impact Model, and to examine and validate the predictive capabilities of current noise exposure models at or below 60 dB DNL.

Further information on the FICAN meeting may be found in the Aug. 2 issue of *Airport Noise Report* and the Aug. 8 issue of *Noise Regulation Report.* The FICAN report on federal agency research may be obtained by calling Jim Littleton at the FAA in Washington, DC (202) 267-3579.

Acoustics in the News

The big acoustical newsmaker around the end of August was the mysterious sounds heard underwater at Point Lobos, California. Possible sources of the low-frequency, periodic bursts were submarines, a fish species known as "midshipmen," or perhaps even construction along the shoreline. James H. Miller of the Naval Postgraduate School (NPS) in Montery was in the process of investigating the puzzling sounds, but, in early September, the sounds ceased. The event made several California newspapers, as well as National Public Radio and some TV networks, including CNN, CBS, and "Hardcopy" on the Fox channel. (For further information contact Scott Kathey at (408)647-4251.)

The Boston Globe published numerous articles on Ozawa Hall, the new $10.7 million concert hall at Tanglewood, summer home of the Boston Symphony. Writers and critics have been enthusiastic about the new hall's interior design, with special praise for the acoustics, executed by the firm of R. Lawrence Kirkegaard Associates. (See *The Boston Globe* articles by Richard Dyer on June 10 and July 2, and three articles by Dyer on July 8; also an article by Jane Holtz Kay on July 1.)

More on musically related acoustics appeared in the British journal *Nature* (Vol. 370, Aug. 18) in an article entitled "Flutes to hyperinstruments" by Thomas D. Rossing. The article describes three sessions on musical acoustics at the recent ASA meeting in Cambridge: sessions on woodwinds, musical technology, and the hammered dulcimer. Also mentioned was the dialogue between performers, listeners, and instrument makers during the Tokyo String Quartet concert. In addition, the Cambridge meeting was described in some detail, with special emphasis on the Sabine Centennial, in an article in *Sound and Communications* by Neil Shaw.

The Sept. 3 issue of *Science News* (Vol. 146) carried "To Build a Better Violin" by Richard Lipkin, a thoughtful piece about the life and work of Carleen M. Hutchins. It describes Hutchins' long career researching the acoustics of stringed instruments and crafting some 400 violins, violas, and cellos.

Product noise evaluation received attention from science writer Jerry E. Bishop in an article in *The Wall Street Journal* entitled "Why Vacuum Cleaners Are Louder and Other Acoustic Mysteries," (Aug. 30 in the "Marketplace" section.) The article details the work of the RH Lyon Corp, headed by ASA Past-President Dick Lyon, in sound-quality engineering. Another article, this time in *The New York Times,* focuses on gas-powered leaf blowers and the attempts to ban their use in Westchester County. Once again, engineering advice from the RH Lyon Corp is being sought by the product manufacturer. (See the Sun. Aug. 14, "Pastimes" section.)

The Aug. 16 *New York Times* carried an article by Sandra Blakeslee entitled "New Clue to Cause of Dyslexia Seen in Mishearing of Fast Sounds." The article features the work

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of scientists from Rutgers and Harvard that suggests that the origin of dyslexia is in the medial geniculate nuclei, a station along the auditory pathway that is essential for comprehending sound. The left hemispheres of dyslexic brains appear to have fewer large nerve cells in this area, which may inhibit the comprehension of rapidly flowing auditory information. Also, the cover story of the Sunday Aug. 28 *New York Times Magazine* is a lengthy piece by Andrew Solomon on deafness, deaf culture, and the controversies surrounding methods of communication by deaf people.

The August issue of another popular magazine, *New Woman,* contains an article by Yvonne Dunleavy, "Is noise driving you crazy?" The article contains information on the effects of noise on hearing and health obtained from interviews with several ASA members, along with some practical preventive measures.

Two articles on acoustics appeared in recent issues of *Science.* "Time-Reversed Sound Waves Resonate Among Physicists" by James Glanz discusses a new device employing "time-reversal mirrors" (TMR) that can turn sound waves around in the time domain (Vol. 265, July 22). It may be used for such practical purposes as identifying kidney stones and finding defects in titanium alloys. TMR technology has also been developed by Darrell Jackson and his colleagues at the University of Washington to enhance underwater communication. The other *Science* article, "Real-Time Parallel Computation and Visualization of Ultrasonic Pulses in Solids" by R.S. Schechter, H.H. Chaskelis, R. B. Mignogna, and P.P. Delsanto reviews the use of massively parallel computers to simulate ultrasonic wave propagation (Vol. 265, Aug. 26).

The thermoacoustic refrigerator developed by Steven Garrett and colleagues at the Naval Postgraduate School continues to be of interest to the media, this time in the August issue of *IEEE Spectrum.* (See also *Echoes, Vol. 2,* Spring 1992; *J. Acoust. Soc. Am., Vol. 84,* p.1145; and *J. Acoust. Soc. Am., Vol. 91,* p. 512 (1992).)

The September issue of *Physics Today* carried two articles of interest to acousticians. First, "Sonoluminescence" by ASA's Vice President Elect Lawrence A. Crum appeared as a feature article. Also, the postponement of the Acoustic Thermometry of Ocean Climate (ATOC) project is discussed on p. 85.

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