ECHOES

The newsletter of the Acoustical Society of America — Volume 1, Number 2, Summer 1991

Some thoughts on nonlinear acoustics

Robert Beyer

Throughout most of the history of acoustics, we have clung to the notion that the governing equations of motion for sound are linear equations, which means that all changes in the pressure that take place will be simply proportional to the changes in the density, and that the velocity at which any disturbance propagates through the medium will be independent of the intensity of that disturbance. And, for the most part, these are very reasonable conditions. But there are cases where such approximations can no longer be made. Such instances form the basis of nonlinear acoustics.

A simple example of nonlinear wave propagation is that of a water wave rolling onto a sloping beach (surf). Here the particles of water that have been displaced most from their rest positions travel more rapidly than the rest, and the crests of the waves overtake the troughs, producing the breaking of the surf as it approaches the beach. A similar phenomenon occurs in the passage of a projectile through a fluid medium at speeds in excess of the velocity of the wave in that medium. Here a wave of very steep front—the shock wave—is developed in air. This is the same phenomenon as that of the bow wave in boating and the sonic boom in aircraft.

If we have an initial wave that is purely a sine wave of a single frequency, and if the intensity of the sound is sufficiently high, then the shape of the wave gradually distorts from sinusoidal to something like a sawtooth. Another way of describing this is to say that the harmonics of the original wave are produced.

If two high-intensity waves of different frequencies travel in the same direction ("collinearly"), then one observes the production of components that are the sum and the difference of the original pair of frequencies. This will occur with sound waves in air or in water.

A very similar phenomenon was observed two centuries ago by the Italian violinist Tartini, namely, if two different pitches are sounded intensely on a violin at the same time, one can hear the pitch which is the difference frequency. This phenomenon is not due to beating but to the nonlinearity of the surface waves set up in the fluid in the cochlea of the inner ear.

In underwater sound propagation, the development of the difference frequency has been put to use in the form of sonar, called parametric array sonar, which can be used both for transmitting and receiving signals, and which has useful characteristics in a number of instances, especially in studying objects on the bottom in shallow waters.

There are many applications of the ideas of nonlinear acoustics. There is a steady force in the medium accompanying the passage of the sound wave that is due to nonlinearity, and that can be used to levitate small objects. This can serve to provide a support-free milieu for small objects in industrial processes. The phenomenon of shock waves can be controlled to smash kidney stones, using a focused beam of such shock waves (lithotripsy).

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A Look Inside...

"We hear that . . ."

The new officers of the Society are **Herman Medwin,** President-Elect, **Jiri Tichy,** Vice-President Elect, and **Dave Bradley** and **Sabih Hayek,** Executive Council.

There were 1,112 acousticians in attendance at the 121st meeting in Baltimore, just short of the 1,210 who registered at the 120th meeting in San Diego.

Bob Beyer's lecture on nonlinear acoustics was initially drowned out at the Omni Hotel in Baltimore by about 400 people singing soul music in the adjacent meeting room. No one had the heart to go in and ask them to stop for the sake of nonlinear acoustics, so Bob wisely delayed his lecture for a half hour for their meeting to come to an end. **John Gilheany**, chair of the Baltimore meeting, said never before has anyone arranged for a gospel choir of 400 as an introduction for a tutorial lecture.

Dave Klepper's arrangements to hear the Baltimore Symphony Orchestra rehearse at Meyerhoff Hall in Baltimore was a real treat for the approximately 200 acousticians and guests who attended. The program included Peter Serkin playing a Mozart piano concerto.

Friday's session on glass musical acoustical instruments, chaired by **Tom Rossing**, was a tour de force which was delightfuly highlighted by **Jamey Turner's** performance on the glass harp.

Lynn Phillips, who works for the ASA in Woodbury, became the mother of a baby boy, Kyle John, on Mother's Day. She will be returning to the ASA later this summer.

Dan Martin, ASA's editor-in-chief, had quite a few half-century anniversaries. The day before his 50-year ASA certificate arrived in the mail, he celebrated the 50th anniversaries of his doctorate from the University of Illinois and his marriage to his wife **Martha.** ■

ECHOES

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 all Acoustical Society members.

Ad hoc editors . . . . . Charles Schmid & Alice Suter
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Phone inquiries should be directed to 516-349-7800, facsimile transmissions to 516-349-7669. Article submissions and correspondence should be directed to: *Echoes* Editor, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY, 11797.

Letters

Dear Editors:

I enthusiastically welcome the debut of *Echoes* and urge that it be continued. To me, as a scientist retired from active participation in acoustical research, *Echoes* fills a need I long felt for a publication that succinctly summarizes new developments in acoustics and keeps me apprised of the activities of the Society and my former colleagues. I would think too that those still active in their fields would welcome the information, technical summaries of other fields, general news etc.

I really have no criticism to offer. I think the format is "lively" and pleasing (the airplane on the front page is a nice touch) and the contents are a good mix of technical information, and Society and personal news (I especially welcome the personal news).

As a member of the Society for 48 years (now Emeritus) I strongly urge the continuance of this publication.

William S. Cramer

Dear Readers:

We wish to thank the 90 ASA members who responded to the questionnaire in our premiere issue of *Echoes*. Eighty of you were in favor of continuing the newsletter, while 10 were not in favor.

Those advocating termination cited costs and ease of placing the newsletter material in JASA. Those in favor felt that "*Echoes* opens the way for new features not in JASA," complimented the "great graphic design" and thought that it was an effective means of keeping abreast of current events and topics in acoustics.

Many suggestions were offered, and we hope to use a lot of them in future issues. The Executive Council has authorized a one-year trial period of *Echoes* (four issues).

Some people liked the red color used for the first issue, while a few were bothered by it. As one person pointed out, you either like red or you don't. So in the true spirit of the scientific method, we decided to try a more subdued ink color for this newsletter, and get your reaction. Let us know how you like this color; but, more importantly, keep telling us how you feel about the content, or send us information for publication.

Our third issue of *Echoes* will be coming out before the Houston meeting.

Alice Suter and Charles Schmid
Ad-hoc editors for *Echoes*

Send your comments to:

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Acoustical standards in the making

Next year is the 60th anniversary of the Acoustical Society of America's standards program. Despite its longevity and activity at ASA meetings, surprisingly few ASA members know very much about the program unless they are directly involved in standards activities.

Although standards have an impact on nearly every aspect of acoustics, it is easy to take them for granted. We automatically assume that a sound pressure level of 50 dB means the same thing to the person calculating the Articulation Index as it does to the person designing the concert hall. We are able to do this thanks to a standard known as ANSI S1.1-1960 (R1976), American National Standard for Acoustical Terminology, which is currently being revised and updated.

Moreover, if we read about someone's experiment, we usually assume that the sound level meter and microphone were operating within certain specifications, and probably skip over the term appearing in the instrumentation section, namely ANSI S1.4-1983 (American National Standard Specification for Sound Level Meters). This standard, however, is extremely important for the interpretation and comparison of results.

Ken Eldred

Avril Brenig

Ken Eldred has been Standards Director since 1987, and a member of ASA's Committee on Standards (ASACOS) since 1982. Ken is a Fellow of the ASA and a graduate of MIT. He presently heads his own consulting company located in Cambridge, Massachusetts.

Avril Brenig has been Standards Manager since 1975. She and her staff are located in the office of the Standards Secretariat in the AIP building in Manhattan. She is a member of the ANSI Organizational Council, and an associate editor for JASA. She has a Sc.D in public health from Columbia University.

ASA is the natural home for such standards because this is where the acoustical expertise lies. By scheduling the standards committee and working group meetings in conjunction with ASA's regularly scheduled meetings, ASA members have the opportunity to contribute on a regular basis and to stay informed. Through participation in standards activities, acousticians can influence the codification of product specifications and measurement procedures to ensure accuracy and compatibility with accepted practices in acoustics.

Standards activities also provide the means by which acoustical professionals in the United States can have an influence on international activities. Unfortunately, though, the U.S. has fallen behind the fast-paced European Community in international standards activities over the past decade as Europeans gear up for EC 1992.

A little history

ASA's standards program was initiated in 1932, shortly after the Society was founded. The American Standards Association (which later became the American National Standards Institute—ANSI), had asked ASA to initiate the standardization of acoustical measurement and terminology. In response, ASA put together a new committee with the designation Z24, consisting of four subcommittees in different areas of acoustics.

In 1942, ASA extended the scope of the Z24 committee to include vibration, and by 1954 the committee had grown so large that it was divided into three new committees: S1 Acoustics, S2 Mechanical Shock and Vibration, and S3 Bioacoustics. In 1981, a fourth committee, S12 Noise, was added.

ASA is the most active of the 27 organizations developing standards in acoustics, all of which operate under ANSI's umbrella. In all, ASA has been responsible for developing more than 85 out of the approximately 100 American standards in acoustics.

Here are a few examples of the standards proceeding from the four "S" committees: Those developed by S1 include performance characteristics of sound level meters and dosimeters, and standards for calibrating and making measurements with these instruments. Recommendations for specifying the measurement and evalua-

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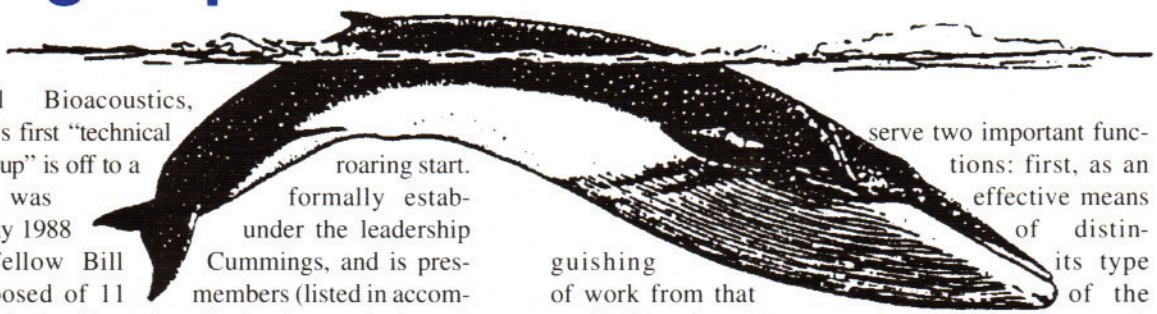
ASA group "talks to the animals"



Animal Bioacoustics, ASA's first "technical specialty group" is off to a roaring start. The group was formally established in May 1988 under the leadership of ASA Fellow Bill Cummings, and is presently composed of 11 members (listed in accompanying sidebar) with various kinds of expertise in animal acoustics. During its first three years the group sponsored or co-sponsored seven special sessions on animal bioacoustics, with a total of 60 papers.

The concept of the technical specialty group (TSG) was first proposed by Herman Medwin at the fall '86 meeting in Miami, and subsequently was adopted by the Executive Council. The function of these groups is to provide a venue for ASA members who share a common interest in a discipline not yet represented by a full-fledged technical committee.

The TSG functions like a technical committee, with the following exceptions: (1) the chairman is an ex-officio member of the Technical Council, without voting privilege; (2) the chairman is appointed rather than elected to office; and (3) a TSG cannot generate ASA awards.

ASA's other TSG, Acoustical Oceanography, is chaired by Herman Medwin, currently ASA's president elect. Medwin has requested full technical committee status for his TSG, and that action is now under consideration by the Technical and Executive councils (see related article on page 7).

Members of the Animal Bioacoustics TSG have felt a need for such a group long before TSGs were an option. They believed they were not adequately represented by an ASA committee, so they had to piggy-back on established technical committees, most of which were already overloaded with projects and paper sessions. In the past, JASA papers on animal bioacoustics were often categorized under psychological or physiological acoustics, noise, underwater sound, or bioacoustics, with no section devoted specifically to animal bioacoustics. Evidently, the current "bioacoustics" classification was intended to cover research in medical ultrasound, such as the work undertaken by Floyd Dunn and his colleagues.

According to the TSG's chairman Bill Cummings, "Floyd Dunn has graciously volunteered to shepherd the animal papers for over 20 years. But the opinion among animal bioacousticians has increasingly favored some form of unique status in JASA and within the Society. This group believes that such an accommodation would serve two important functions: first, as an effective means of distinguishing its type of work from that of the medically oriented group, and second, as a powerful attraction for the 100 or so animal bioacousticians who are not ASA members and who do not publish in JASA."

Some 32 papers on animal bioacoustics were printed in JASA last year. Cummings and his colleagues are working with JASA's editor-in-chief Dan Martin to review the suitability of current paper classification subjects (PACS) related to animal bioacoustics. In addition, several of the committee members are assembling a chapter on animal bioacoustics for the upcoming *Handbook of Acoustics*, edited by Malcolm Crocker for publication by John Wiley and Sons.

A number of intriguing topics have appeared in special sessions organized by this TSG. For example, in Baltimore we learned that the praying mantis wears his "ears" on his belly; in St. Louis we heard that acoustic flea collars were totally ineffective on cats; and did you know that diseased trees actually make sounds which attract insects

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Members of the Animal Bioacoustics Technical Specialty Group and their areas of specialization

William Cummings, chairman, marine animal sound
Richard Fay, vice chairman, animal hearing
Whitlow Au, marine mammal biosonar
Christopher Clark, bioacoustic population enumeration
Orest Diachok, sound propagation, acoustical standards and measurements
Timothy Forrest, insect bioacoustics, agro-acoustics
Marc Hauser, non-human primates
D. V. Holliday, high frequency man-made sonar applications
Brooke Farquhar, high frequency invertebrate and vertebrate assessments
Arthur Popper, animal hearing modalities
Sam Ridgway, marine mammal hearing, neural and physiological bioacoustics

ASA standards program

STANDARDS—from page 3

tion of vibration in machines, motor vehicles, and ships have been developed by the S2 committee. The S3 committee has developed standard methods of measuring the performance of hearing aids, as well as performance specifications for audiometers and the conduct of audiometric testing. S12 has published standards on measuring impulse noise, determining the insertion loss of outdoor noise barriers, and measuring the noise emitted from computers and business machines.

How the ASA standards program operates

In the initial years, the ASA contracted with ANSI for the administration of its standards program. But in 1969 the society decided to perform this function in-house.

This is how the standards activity operates: Each of the "S" committees (S1,S2,S3,S12) is composed of organizational members who must have, according to ANSI's rules, a "direct and material interest" in the scope of the committee. There are also individual members, who are experts in the committee's area. The "S" committee chairs establish working groups to develop new or revised standards, and select their chairs, who, in turn, select the members of their groups.

"The U.S. has fallen behind the fast-paced European Community in international standards activities over the past decade as Europeans gear up for EC 1992."

All members of the "S" committees and working groups serve on a voluntary basis. They do not have to be ASA members (although they usually are), and their deliberations are open to the public. At this time there are approximately 100 working groups operating simultaneously. ASA's Committee on Standards (ASACOS) encourages interested professionals to develop ideas for new standards and to serve on working groups.

ASACOS is responsible for the leadership and direction of the standards program, and is chaired by the ASA standards director, a position currently held by Ken Eldred. The day-to-day administration is performed by the standards manager, Avril Brenig, who manages the activities of all four committees and 100 working groups, schedules meetings, helps settle disputes, initiates and maintains liaison with government agencies (some of which provide financial support to the standards program), provides the secretariat for an international standards committee, and is responsible for the publication and sale of standards.

International standards

Worldwide standardization for acoustics is performed by three technical committees sponsored by the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO). Two of these committees are administered by the Dansk Standardiseringsraad in Copenhagen, and the third is administered by the ASA on behalf of ANSI.

Each of the four ASA "S" committees serves as a technical advisory group for its international counterpart. In this way, ASA members are able to interact with representatives of other nations and promote U.S. interests in international standards. Unfortunately, the U.S. is at a disadvantage because most Europeans and other ISO and IEC members receive government sponsorship for their work, whereas American representatives must look to their companies, or (in rare cases) to their federal agencies for financial support, or pay their own travel and expenses.

Process of developing standards

ASA follows procedures prescribed by ANSI for developing and voting on its standards. Ideas for new standards can come from a number of sources: (1) an "S" committee member or chair; (2) a government agency; (3) an interested ASA member; or (4) any member of the public.

Sometimes the ideas originate in an international standard, which is then taken up by a U.S. working group. This was the case with the standard, Audible Emergency Evacuation Signals, developed by an ISO working group chaired by ASA member Milt Whitcomb. The U.S. counterpart, S3.41 1990, has just been published.

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Press luncheon held at Baltimore

ASA's Committee on Public Relations, with the help of Phil Schewe from AIP's Public Information Department, held its first press luncheon on April 30th at the Baltimore meeting. Four reporters showed up to hear four ASA members speak.

President Alan Powell gave an introduction to the field of acoustics. He was followed by Tom Rossing, who spoke on glass musical instruments; John Wesler, who described new airport noise legislation; and Aubrey Anderson, who told about flammable ice on the sea floor.

The May 11th issue of *Science News* contained two articles—"Sounding out burning snowballs" and "Wine glasses and ringing bells"—by Ivars Peterson, who attended the press luncheon. In the same issue, Peterson also interviewed Seth Putterman on sonoluminescense and Ken Suslick on sonochemistry. Papers on these topics were presented at Baltimore in a session chaired by Larry Crum. ■

ANIMAL BIOACOUSTICS — from page 4

wishing to take advantage of the tree's weakened condition? You would if you had attended the special session at the Syracuse meeting. One committee member is investigating an acoustical means for detecting the feared Mediterranean fruitfly.

Most recently, Argentinean scientists requested information from the Animal Bioacoustics TSG about sounds which may be offensive to killer bees. Also, NPR recently covered a bowhead whale acoustical census undertaken by TSG member Chris Clark and Bill Ellison for the Alaskan Eskimos.

Special sessions on various topics of animal bioacoustics are being planned for the Houston, Salt Lake City, New Orleans, and Ottawa meetings. Among the featured subjects are animal bioacoustic modalities and applications, insect acoustical signals and their reception, bioacoustics signal processing, non-human primate communications, and the effects of noise on animals.

Although the TSG's 11 members boast a variety of skills, the committee's vice chairman Dick Fay has called for representatives in the areas of bioacoustic signal processing as well as bat sonar, avian, canine, large mammal, reptile, and amphibian bioacoustics.

Committee membership is open for specialists in animal bioacoustics who are willing to assume responsibility for occasional consultation, ad hoc committee work, or organizing and leading special sessions.

A TSG's initial term is three years, after which the chairman may request an extension for another three years. At the Baltimore meeting the Executive Council granted Animal Bioacoustics a three-year extension. It is no surprise that the group has discussed plans to request full technical committee status. But Bill Cummings reported to the Technical Council in Baltimore that his members prefer to function as a strong and viable group rather than to chance full technical status right now.

This young and energetic group is a good example of how the TSG process can work to benefit its members and the Society. Its interesting sessions have attracted sizeable audiences, including members of the press, and one of them earned the designation "most novel session" by then ASA president Harvey Hubbard. It looks like we'll continue to hear from the Animal Bioacoustics group. ■

Animal bioacousticians concerned that underwater blasts may disturb whales

The May 17th issue of *Science* contained a two-page article entitled, "Was Underwater Shot Harmful to the Whales?" The article discusses the potential divergence in goals between the acoustical oceanographers attempting to measure global warming by measuring sounds transmitted over long distances, and the animal bioacousticians who are concerned the noise is upsetting the whales. A special session at the Houston meeting will probably cover this subject. Entitled "The Heard Island Feasibility Experiment," it will be jointly sponsored by Underwater Acoustics, Acoustical Oceanography and Animal Bioacoustics. ■

ASA meeting venue switched from Memphis to New Orleans

The fall 1992 meeting of the Acoustical Society of America will be held at the Fairmont Hotel in New Orleans. This meeting was originally slated to be held in Memphis, but changed because the chair of the local organizing committee moved from the Memphis area to New Orleans.

The new dates for the New Orleans meeting are Saturday, October 31st through Wednesday, November 4th. Thus the meeting will convene over a weekend, rather than the traditional Monday through Friday.

The primary technical sessions, which are usually held over the four weekdays from Tuesday through Friday, will instead be Sunday through Wednesday. For those of you used to the usual routine, remind yourself this is merely a linear translation and is not a permanent change. A weekend offers lower hotel rates, and a Saturday night stayover probably means much lower air fares.

This week also spans Halloween and Election Day, which for 1992 includes presidential ballots. Previous ASA meetings have been held during national elections, and the simple remedy is to cast a mail ballot. The late fall is an ideal time to visit New Orleans, and the Fairmont Hotel is located near the Latin Quarter.

Mark your calendar with this new location and dates for the 1992 fall meeting. ■

Example ASA Standards

Here are three recent standards, and one presently being studied:

ANSI S2.47–1990 Vibration of Buildings—Guidelines for the Measurements of Vibrations and Evaluation of their Effects on Buildings

ANSI S3.36-1985(R 1990) Specification for a Manikin for Simulated *in situ* Airborne Acoustic Measurements

S12.10–1985(R1990) Measurement and Designation of Noise Emitted by Computer and Business Equipment

ISO/TC 108 New standardization in the field of condition monitoring and diagnostics of machines (study now underway)

A catalog listing some 85 ASA standards may be obtained by calling Avril Brenig at (212) 661-9404 ext. 562. In addition, the *Standards Program Directory* is available, listing Standards Committee and Working Group members.

STANDARDS—from page 5

The working group drafts its standard or recommendation and then must achieve consensus within its own membership. Next the new document is put to a vote in its parent "S" committee. The standard is balloted, revised, and reballoted until the vast majority of negative votes have been reconciled, or on occasion, determined to be irreconcilable. (Consensus does not imply unanimity, but every effort is made to satisfy all parties involved.)

At this point the standard is approved as an American National Standard by the ANSI Board of Standards Review, which ensures that due process requirements were met and consensus was achieved. Anyone who is still dissatisfied may appeal to ANSI or to ASACOS, but these kinds of appeals are rare.

As a result of the procedure described above, each of these standards represents considerable work and deliberation on the part of its working group members, often taking many years to complete.

The advent of European unity

The year 1992 will be an important one for standards. The European Community is racing toward its goal of putting the single European market into effect, and trade barriers will go down like the Berlin Wall. In the process, the EC is hard at work to standardize a multitude of procedures and specifications for equipment.

But trade barriers may go up between the U.S. and the EC if the U.S. doesn't take an active part in international standardization. American manufacturers may be shut out of certain exports or may have to make duplicate products, with one product meeting the U.S. standard and the other meeting the EC's. Or maybe the current U.S. involvement will prove to be sufficient. We will soon see. ■

Request by Acoustical Oceanography to become a technical committee delayed until Houston meeting

The Executive Council decided to wait until November to decide upon the request by the Technical Specialty Group (TSG) on Acoustical Oceanography(AO) to become a technical committee.

As of April when the Executive Council met in Baltimore, 90 of the 3700 survey returns indicated a primary interest in AO. This represents 2.4% of the returns, but only 1.3% of the total ASA membership (6700). Hence, as of the Baltimore meeting, the number of members choosing AO as a primary field didn't satisfy the 2% requirement to become a technical committee given in the Technical Council's standing rules.

It turns out that this is the first application of the 2% rule, which has resulted in discussions concerning this requirement. It is also interesting to note that 8.9% of those responding gave AO as their second choice.

Based on feedback from the ten technical committee meetings in Baltimore, the Technical Council has offered various suggestions to the Executive Council concerning Acoustical Oceanography becoming a technical committee. The Technical Council also expressed a desire to clarify the standing rules. This prompted President Eric Ungar, with the consensus of the Executive Council, to set up an ad hoc committee under Vice President Robert Apfel to look into means to improve the wording and order of the ASA rules. ■

NONLINEAR ACOUSTICS—from page 1

Other applications include surface-wave devices on solids, useful in electronic control systems, characterization of biological tissues in terms of the nonlinear parameters, and the studies of fish schools in shallow waters, using the parametric array sonar. ■

This introduction to nonlinear acoustics was written as a "lay language" summary of the tutorial lecture presented by Bob Beyer on Monday evening, April 29th, at the 121st ASA Meeting at Baltimore.

Bob is Treasurer of the Society, a position he has held since 1974. Bob also served as President of the Society in 1968-69, received the Distinguished Service Citation in 1978, and received the Gold Medal in 1984.

Results of ASA census

Profile of the acoustics community in the United States and Canada

The ASA recently has completed a survey to estimate the size of the population of the acoustics community in the United States and Canada and the distribution of this community by subfields of acoustics, geography, and category of employment (education, government, industry, not-for-profit, and consulting). The primary motivation for the survey was to obtain reliable data which could be used by the ASA for its long-range planning.

The basic method for conducting the survey or census was to identify organizations (e.g. schools, companies, government labs and offices, and consulting groups) which were known to have some involvement in acoustics. Then an individual at each location was requested to complete a brief survey form listing the number of professionals, graduate and undergraduate students, and technicians at his or her place of employment who were involved in acoustics work.

Requests for surveys were sent to about 4500 organizations including approximately 500 universities and colleges, 325 government labs and offices, 3000 companies, 75 not-for-profit entities, and 600 consulting groups. Responses were received from about 2000 organizations, or 45%. Response percentages were high for government, not-for-profit, and consulting groups, fair for educational institutions, and low for industry.

It is believed that most organizations which employ large numbers of acousticians were surveyed. Little effort was made to survey the large number of acousticians involved in clinical practice, such as speech pathologists (45,000) and audiologists (7500), since good census data on these sub-fields were already available.

The ASA survey counted nearly 10,000 professional acousticians, with about 44% being in industry, 18% in education, 26% in government, 3% in not-for-profit, and 9% in consulting. The survey counted nearly 2000 graduate students, 800 undergraduates, and 2500 technicians. Geographically, over 50% of the professional acousticians counted live in seven states, with the largest number (13%) being in California.

For census purposes, the broad field of acoustics was divided into 21 sub-fields. Survey responses indicate that the highest populations are in underwater acoustics (science, engineering, and some in transducers and signal processing) and the combined sub-fields of psychological and physiological acoustics, speech, and audiology. Noise control and architectural acoustics, structural acoustics, and vibration also have large populations.

"It appears that a well-organized and executed membership drive could double the size of the Society."

Of the 4500 organizations queried in the survey, 39% are known to employ at least one ASA member, ranging from 75-87% for educational institutions, consulting groups, and not-for-profit entities, to a low of 22% for industry.

Analysis of subfield data indicates that the ASA is well represented in some subfields and poorly represented in others. It appears that a well-organized and executed membership drive could double the size of the Society.

A detailed report of the survey results was distributed to the ASA Executive Council at the Baltimore meeting and a condensed version will be published in the News section of JASA later this year.

Chester McKinney chairs ASA's ad hoc Census Committee. He was assisted by committee members Burt Hurdle and Joe Blue, and by ASA office manager Elaine Moran and other staff members at Woodbury. ■

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