

Agenda

TECHNICAL COMMITTEE ON ARCHITECTURAL ACOUSTICS (TCAA)

177th Meeting of the Acoustical Society of America
Louisville, KY

Tuesday, May 14, 2019

7:30 PM

French

Chair: **Eric Reuter**

Secretary: **Ana Jaramillo**

In Attendance: **94**

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Section One: Welcome and Acknowledgements

I. Welcome and Introductions

- Pass Attendance Sheet
- Attendees are encouraged to become TCAA members if they are not already.
- New attendees' introductions
- Please limit clapping to expedite this meeting
- Introduction to TCAA

II. Previous Minutes

- Approval of previous minutes
 - Previous minutes (Victoria).
 - Reminder: TCAA Meeting Agenda and Minutes are published on the TCAA website <http://tcaasa.org>
Bruce Olson moves, Ken Good seconds, approved.

III. Acknowledgements

- **Pavel Zahorik** (Meeting Chair)
- **Christian Stilp** (Technical Program Chair)
- **Shane Kanter & Ben Bridgewater** (TCAA TPOs)
- **Session Chairs:** Ken Good, Eric Reuter, Tony Hoover, Damian Doria, Brian Corry, Kirsten Hull, Ben Bridgewater, Shane Kanter, Bruce Olson, Ana Jaramillo, Ning Xiang, Lauri Savioja, Klaus Genuit, Brigitte Schulte-Fortkamp

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- **Presenters:** 64 papers presented in 7 special sessions
- **Sean Browne** (Webmaster)

Over 1000 attendees at this meeting.

IV. Congratulations!

- **Gold Medal – Bill Cavanaugh**

Be sure to attend the Plenary Session tomorrow, 3:30 in Grand Ballroom B.
(Encomium attached)

Tony Hoover said some words about Bill's contributions. The room gave a standing applause of recognition.

- **TCAA Elections**

- **Ana Jaramillo**, Chair
 - **David Woolworth**, Chair-Elect
- Good response to electronic ballot. About half of the membership voted.

- **ASA Elections**

- Diane Kewley-Port, President Elect (2019-2020)
- Stan Dosso, Vice President Elect (2019-2020)
- Bennett Brooks and Andrew Morrison, Executive Council (2019-2022)

- **TCAA Student Paper Award – Results from New Orleans**

- **1st Place: Matthew Neal**, Penn State
"The room impulse response in time, frequency, and space: mapping spatial energy using spherical array beamforming techniques"
- **2nd Place: Byeongho Jo**, KAIST
"Nonsingular EB-ESPRIT for the localization of early reflections in a room"

V. Chair's Report

1. In Memoriam:
 - a. **Angelo Campanella** 1929-2019
 - b. **Jiri Tichy** 1929-2019
2. TCAA membership update
 - a. In order to be a member of this committee, you must maintain your ASA membership. Several people have indicated interest in being committee members but are not ASA members.
 - b. Please update your email address on the sign-in sheet. If you are graduating in the next year, consider using a more permanent address.
3. JASA – Historical Articles
JASA would like us to select a handful of historically significant articles, and have

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short writeups submitted. We need a few volunteers to form a committee to take this on.

Greg Tocci, Tony Hoover and Ning Xiang volunteered.

4. Strategic Initiative
 - a. TC and EC summits were held over the winter
 - b. Four new areas of focus were identified:
 - A. Identification and Promotion of Emerging Scientific/Technical Areas
 - B. Better Engagement of Industry and Practitioners
 - C. Improved Communications and Public Relations
 - D. Member Engagement Outside of Meetings
 - c. Champions meeting Thursday 2:00 pm in Wilkinson Room
5. Comments on this meeting

Steve Pettyjohn: two similar sessions at the same time

Ric Doedens: Monday session stretched things one day, could have been shorter.

Eric Reuter: Conflicts with committee meetings don't make it possible

Ric Doedens: ASA should have a presentation format that works on even a bad projector

Robin Glosemeyer: Aspect ratio should be known

Bruce Olson: Program states a resolution that does not make sense and a VGA adaptor. Also screen was set just in front of the downlight!

Tony Hoover: Social was nice, lots of seats

Section Two: Committee and Subcommittee Reports

ASA Committee Reports

1. **Membership** (Tony Hoover)

Please check to be sure that you are a Full Member (not still an Associate or a Student). Fees are the same than for associate. You can check the ASA Directory: <https://acousticalsociety.org/asa-membership/>

If not yet a Full Member, application forms are on the ASA Website; you'll need two Sponsors/References that are Full Members or Fellows....and who should be quite easy to find here at this meeting.

<https://acousticalsociety.org/asa-membership/> => Download Application Form

Application for full membership will soon migrate to an online form, simplifying the process.

Continued good progress with Associates and former Students applying for Full Membership. Since Victoria BC/Fall 2018, there have been seven applicants who list AA as their primary TC (and 4 as secondary TC), which again leads all the other TCs.

2. **JASA & JASA-EL**

a. JASA Associate Editor (**Michael Vorländer, Brian Katz, Francesco Martellotta, Ning Xiang, Lauri Savioja, Frank Sgard**)

b. JASA Coordinating Editor (**Ning Xiang**)

c. JASA-EL Associate Editor (**Ning Xiang**)

Lauri Savioja: Special issue in auralization just came out.

Ning Xiang: JASA-EL gives the opportunity of fast publication and also to add media content.

3. **POMA - Proceedings of Meetings on Acoustics** (Lauren Ronsse)

Proceedings of Meetings on Acoustics (POMA) is an editor-reviewed, open-access, online journal published by the Acoustical Society of America (ASA). Articles originate as papers presented at semiannual ASA meetings or **at other cosponsored meetings**. Both researchers and practitioners are encouraged to submit manuscripts to POMA. **Authors are especially encouraged to use POMA for better archiving of special sessions presented at ASA meetings.**

4. **Women in Acoustics** (Lauren Ronsse)

Everyone is encouraged to attend the **Women in Acoustics luncheon** held at each meeting.

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WIA sponsored funding opportunities:

The **Young Investigator Travel Grant** is intended to help with travel costs associated with presenting a paper at the meetings. Young professionals who have completed their doctorate in the past five years are eligible to apply if they plan to present a paper at an ASA meeting, are not currently students, and have not previously received the award.

The **Dependent Care Subsidy** is intended to help with dependent care costs associated with attending an ASA meeting. Meeting attendees are eligible to apply if they plan to present a paper at an ASA meeting or hold a leadership position in ASA.

Please see the call for papers for more details on these opportunities for future meetings.

Leisa Nalls: Mentoring program was discussed and will be changing.

5. **College of Fellows** (Tony Hoover)

Undergraduate students' registration fees are \$25 for the Louisville meeting. CoF is urging Executive Council to continue this for future meetings, as part of investing in the future of ASA.

CoF donated its (discretionary) Acoustic Society Foundation funds (\$9,253) to ASA Early-Career Leadership (CAECL - Campaign for ASA Early Career Leadership).

<https://acousticalsociety.org/campaign-for-asa-early-career-leadership/>

There are still some final tasks regarding compiling, collating, and checking the list of all ASA Fellows before year 2000, going all the way back to 1941 (the first ASA Fellows), and including citations as available.

For the Louisville Society Luncheon and Lecture Hosted by CoF, Andy Cavatorta will present a lecture titled "Music, Machines, and Meaning", about the surprising history of music and technology, his own work, the pleasures and perils of working in unexplored spaces, and the importance of fake rules. Thanks to TCAA members who have volunteered to accompany the ticket-winning students to the Luncheon!

6. **Regional & Student Chapters** (Ken Good)

Chapters Meeting Wednesday, 7:00am

It is with great sadness we report the passing of Larry Royster in March. Larry was the founder of the North Carolina Chapter. Most notably, the Royster Competition is made possible by the generous support of Larry and Julia Royster. The Royster Competition is a chapter-run poster competition held once a year for a total of \$5000 in scholarships for student posters on the topic of Hearing Conservation and/or Noise Control.

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As you may recall the East, South East Asia Chapter has been added and has hit the ground running with a “Chartered / inauguration ceremony” and other planned activities.

In April, Student Chapters were challenged to organize “sound walks” to celebrate the International Noise Awareness Day.

Chapters are a great way to bring the National meeting home and engage folks who could or would not come to the national meeting. They are also great opportunities to coordinate with other organizations such as AIA, AES and more. As example the Philly Chapter recently hosted a joint meeting with the AES featuring AES Past President Alex Case.

7. **ASA Jam** (Tony Hoover)

Jimmy Can't Dance

119 S 7th St.

8-midnight

At long last, a set of documents has been compiled and provided to the Meetings Committee. These docs guide Jam planning and detail the technical riders for rental and setup of instruments, backline, audio, and lighting. Many thanks to Damian Doria and Eric Reuter for early versions, to local organizers over 10 years for interim refinements, and Bruce Olson and Matt Hildebrand for final revisions!

Louisville Jam will be at *Jimmy Can't Dance* (119 South 7th Street, approx. 8-minute walk from Galt House Hotel), Wednesday 15 May 2019, 8pm to Midnight. Many thanks to Pavel Zahorik (Louisville Meeting General Chair) for making the arrangements.

8. **Medals and Awards** (Ron Freiheit)

TCAA will be eligible for a **Silver Award** recipient in **2020**.

Nominations must be submitted no later than 5 weeks before next year's Spring Meeting (by the end of March 2020).

9. **Standards** (New rep needed)

Roger Logan: (rep for other TC) The Free 5 standards might be going away. We need more experts as the committee lost 4 recently.

New manager.

Bob: Modular instrument systems standard being developed. IEC. Check the video

Derek Knight: changing how they do standards. Looking for participation from consultants. HVAC related.

Eric Reuter: Speech Privacy S12.70 standard was published a few years ago. The committee is reactivated.

Nicholas Sylvestre-Williams : Chair of S12 WG18. Looking for people interested.

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10. **Student Council** (Matthew Neal)

Last meeting. Mallory Morgan is the incoming. 91 attended the orientation. 85 at the meet and greet. Student reception on Wednesday, sponsored by NCAC and College of Fellows.

Intro to TCs at the next meeting. Need volunteer.

SMMFL 90 matches.

11. **Panel on Public Policy** (Eric Reuter)

a. IEQ-GA

Eric attended the January meeting of the IEQ-GA (Indoor Environmental Quality – Global Alliance) on behalf of PoPP. Consensus of PoPP is that ASA should be a member of the alliance, and work will be done toward that goal.

b. Acoustics of Public Accommodations (Restaurant Acoustics)

Sessions on this topic continue – we have one Friday morning PoPP is working on if/how ASA should approach this issue (standard/whitepaper/etc.)

12. **Education** (Rep Needed)

13. **Tutorials, Short Courses, Hot Topics** (Eddie Lau)

14. **ASA Foundation Fund** (Carl Rosenberg)

15. **ASA Books Committee** (Robin Glosemeyer)

Anyone thinking of writing a book I'll put you in touch with Springer. Working on eliminating paper forms to order books.

If you come across errors on books stamped by ASA, let us know.

16. **Archives and History**

TCAA Subcommittee Reports

Speech Privacy (Ken Good)

Our fourth meeting will be Wednesday, 5:00pm.

Some significant work to date includes work around terminology: Subcategories have been defined within the broad term Speech Privacy to include "Speech Distraction, Confidential Speech, and Speech Security" we will be discussing the addition "Speech Disturbance". Ongoing work also includes work around minimum background sound requirements. We have a close collaboration with work related work at ASTM.

To become part of the team all are welcome to join us tomorrow and/or click follow this link <http://eepurl.com/c0TJ8j> to self-subscribe.

WG 44: (ASA/ANSI S12.70 Criteria for Evaluating Speech Privacy in Health Care Facilities) has met Tuesday May 14th and will again be meeting at the San Diego. We are considering changes to better complement and influence FGI Guidelines

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1. **AIA/CEU Course** (Ken Good)

This course continues to grow as a valuable outreach, educational & business development tool. By serving your local architecture firms and others providing an opportunity to build relationships and educate on the importance of acoustics in their design and planning.

To qualify as a presenter you must be: 1) A member of ASA, 2) a member of TCAA, and 3) have completed the presenter's course. A presenter's course was held at the Minneapolis meeting and was well attended.

Trying to have one every 3 meetings or so.

2. **Green Building Acoustics** (Eddie Lau)

3. **Concert Hall Research Group** (Robin Glosemeyer)

<https://acousticalsociety.org/chrg-2019-announcement/>

Concert Hall Research Group (CHRG) Summer Institute

Dates: Summer Institutes 29 July - 1 August 2019 in

Location: Experimental Media and Performing Arts Center (EMPAC)

at Rensselaer Polytechnic Institute campus (<http://empac.rpi.edu>) in Troy, NY

Applications Due: 17 May 2019

Notification: 31 May 2019

Payment: 28 June 2019

It's like summer camp for acousticians!

One application for professionals and one for students. There are scholarships and they include lodging and meals.

Topics: Spatial Sound, Diffusion, How we should address bad reviews on new halls

\$900/\$700

4. **Healthcare Acoustics Subcommittee** (Gary Madaras)

Nothing to report

5. **Classroom Acoustics** (Dave Woolworth)

Nothing to report

6. **Newman Student Award Fund Update** (Ian Hoffman, Bob Celmer, Michelle Vigeant)

Michelle Vigeant: Bob Celmer increased the number of donors. The Schultz Grant will happen again.

7. **Student Design Competition** (Dave Woolworth & Andy Miller)

Andy Miller: Felicia Doggert, Scott Havey, Ian Patrick, Jay Bliefnick were judges.

Newman Fund and Wenger foundation.

Winners were recognized.

Looking for people to step up to chair the competition.

Section Three: Old Business, New Business and Meeting Planning

I. Old Business

II. New Business

Michael Vorländer: International Year of Sound 2020. Supported by UNESCO. All initiatives can use the label international year of sound". Vic Sparrow is coordinating on ASA. Ideas will be requested. Opportunity for regional chapters.

III. Planning of Future Meetings

- **178th Meeting, San Diego – Hotel Del Coronado**
 - **Special Sessions - Abstracts Due July 8**
 1. Large Music Rehearsing Spaces (Brian Corry)
 2. Architectural Soundscapes (Gary Siebein)
 3. Sound transmission and impact noise in buildings (Matt Golden)
 4. Archaeoacoustics (David Lubman, Maryam Kolar)
 5. Assembly space renovations challenges (Joe Keefe)
 6. Computational acoustics for AA applications (Laura Brill)
 7. Speech perception for architectural privacy (Ken Good SC/PP)
 8. Sustainable Acoustics for smart cities (Eddie Lau, Andy Chung)

- **179th Meeting, Chicago May 11-15, 2020**
 - **Finalize Special Sessions**
 1. Session in Honor of Jiri Tichy (Vic Sparrow, Gary Elko) *confirmed*
 2. Recording and production spaces (Ron Eligator) *confirmed*
 3. Architectural Acoustics and Audio: Even Better Than the Real Thing (Hoover/Case) *confirmed*
 4. Court rooms and municipal buildings (Jessica Clements) *confirmed*
 5. A day in the life (Greg Miller) *confirmed*
 6. TCAA AIA CEU (Tony Hoover, Ken Good) *confirmed*
 7. Recent developments in classroom acoustics (David Lubman, Dave Woolworth)
 8. Healthcare (Jay Bliefnick)
 9. Microphones: from rockstars to rockets. Joint with EA (Sandy Guzman, Neil Shaw) (EA is first)
 10. Transportation Noise sources and their effect on buildings (Ben Markham) Joint with NS (NS is first)
 11. Excellence in Acoustics around the world (Brigitte Schulte-Fortkamp) (proposed by International Liaison, interdisciplinary)

- **180th Meeting, Cancun, Mexico: Fall 2020**
 - **Preliminary Special Sessions**

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1. Sound transmission and impact noise in buildings (Matt Golden)
2. Archaeoacoustics (David Lubman Maryam Kolar)
3. Stage acoustics (Greg Miller, Ian Hoffman)
4. Acoustics of Coupled Spaces (Michael Vorländer, Ning Xiang)

- **Future Meetings**, no action required:

181st Meeting, TBD: Spring 2021 (Likely Portland)

182nd Meeting, Sydney, Australia: Fall 2021

IV. Technical Initiatives – Reports and Renewals

- Note: Technical Initiatives are meant to inspire and support innovative ideas. Suggestions for appropriate investments in outreach, education, and other ASA activities are encouraged. TIs do not automatically roll over.
- **Discretionary Funds:**
 - \$5000 annually, can be used to assist Invited Speakers, Student Paper Awards – Temporary *increase to \$6000 for 2017*
 - AIA CEU ongoing
- **Submitted Technical Initiatives**
 1. **Music Education Facilities Book** - \$3000 (2019)
Laruen Ronsse
We are requesting these funds to offset design and printing costs associated with the upcoming publication, "Rooms for the Learned Musician: A 30-Year Retrospective on the Acoustics of Music Education Facilities." The book has initial approval from the ASA Books Committee and will be published by Springer.
Ken Good moves, Bruce Olson seconds.
Tony wonders if the cost is appropriate. Eric says that it's probably OK to be above the \$5000 limit, but TC will approve it on Friday.
Martin Lawless, David Bradley, Shane Kanter and Jon Webber are the editors.
Approved.

Tony speaks about how Eric stepped in without having served as secretary for 3 years and has done a great job.

Meeting Adjournment

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CITATION FOR WILLIAM J. CAVANAUGH

“ . . . for practical applications to building design and education in architectural acoustics, and for service to the Society.”

15 MAY 2019 • LOUISVILLE, KENTUCKY

Bill Cavanaugh has changed the world as we hear it. He has been at the forefront of a broad spectrum of research and consulting in architectural acoustics for over 60 years. His service to the Acoustical Society of America, to many related societies, and to the science and art of acoustics in general has been deep and pervasive. Although always eager to redirect credit to his colleagues, most of us know at least some of the roles he played that have helped to define the entire field of building acoustics.

William J. Cavanaugh and the Acoustical Society of America were both born in 1929—Bill in Boston. During World War II he attended The English High School, the first public high school in America, a prep school for students who had dreams of attending nearby Massachusetts Institute of Technology (MIT). Although Bill was too young to serve, during WWII, he told his father that he wanted to join the Army Corps of Engineers instead of entering the MIT freshman class in 1946. His father gave him that life changing advice only a father can give. “Bill why don’t you just try it out for a year. If you don’t like it, you can join the service.” Bill entered MIT as a civil engineering major that summer where he met Walter Hill, an architecture student who asked Bill to help with a project which would be displayed in the Rotundra. This peaked his interest and Bill decided to switch his major to Architecture where none other than Robert Newman was one of his professors and mentors. Bill graduated in 1951 with a Bachelor in Architecture degree and was awarded the American Institute of Architects Student Medal. He received his commission as 2nd Lieutenant and was immediately ordered to active duty. where he served as a unit training and staff officer with the 6th Armored Division and U.S. Army Corps of Engineers, for the duration of the Korean Conflict. Shortly before the armistice was signed, Bill married Ginny Huff, who he met as a student, in 1953. He remained in the Army Reserves with the Army Corps of Engineers until 1982, retiring with the rank of full Colonel. He was awarded by the Army’s Meritorious Service Medal in acknowledgement of his 31 ½ years of continuous service.

After his service, Bill joined the trailblazing acoustical consulting firm of Bolt Beranek and Newman (BBN) in February 1954, from which most acoustical consulting firms can trace a lineage, and where he was guided and deeply influenced by its famous partners, Dick Bolt, Leo Beranek and Robert Newman. Bob Newman, a remarkable and animated teacher, became Bill’s immediate mentor, and encouraged Bill’s own teaching, always emphasizing expressive language that would be persuasive to architects and engineers, and always with an irrepressible enthusiasm. Alongside his consulting practice, Bill soon began teaching acoustics classes at the MIT School of Architecture, the Boston Architectural College, the Rhode Island School of Design, Harvard School of Public Health and Rodger Williams College. Bill’s inspirational teaching led many students to become future clients, and some even became acousticians. Bill once had Tony Hoover sit in on a few classes he taught at the Boston Architectural Centre and, to inspire his younger colleague said “OK, Tony you take over the class now.”

Bill has been deeply involved in nearly all aspects of architectural acoustics and noise control consulting. He has consulted on thousands of projects of all building types, requiring skillful interaction with architects, engineers, and clients, as well as the public. He has a uniquely friendly, thorough, educational, and effective consulting style. Insights

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and research based on his projects have been the source of most of his contributions to the acoustical community at large. There are five areas of Bill's contributions to acoustics and its practical application that are worth special consideration; masking, outdoor venue sound propagation, cinema sound quality, the practice of architectural acoustics consulting, and teaching and mentoring.

Bill was the lead author on the seminal paper "Speech Privacy in Buildings," *J. Acoust. Soc. Am.* 34, 475-492 (1962), that had the daring and the scientific evidence to suggest that adding appropriate background sound could improve acoustical privacy. More research and papers followed, leading to the entire industry of masking systems, and making open plan offices viable by increasing the potential for speech privacy, enhanced concentration, and decreased interruption. Speech privacy remains a high priority, especially, with new federal mandates for privacy in health-care facilities.

Bill's interest in the difficult problem of neighbors' complaints of sound from outdoor amphitheaters led to and has continued to influence the entire field of concert sound monitoring systems, associated methods for improved community relations, and development of acoustical criteria for outdoor concert venues. He has earned a reputation as a skilled negotiator, and sometimes peacemaker in difficult disputes.

Bill's work on cinemas during the 1980's and 1990's with so much activity in improving movie sonic quality led to extensive investigation and testing of movie theaters across the country, resulting in criteria that are now the foundation for quantifying appropriate sound isolation, HVAC noise, and finish treatments. This work had major influences on THX systems and certification of cinemas, which in turn have greatly affected the exploding home entertainment industry.

Bill's outreach to other acousticians and his optimistic vision of the future of acoustical consulting was instrumental in the formation, growth, and vigor of the National Council of Acoustical Consultants (NCAC) and the Institute of Noise Control Engineering (INCE). The benefits to consultants, architectural acousticians, and acoustics practice in general are ubiquitous, dramatic, and enduring. Bill served as President of the National Council of Acoustical Consultants (NCAC 1977-79), and was awarded their C. Paul Boner Medal for Distinguished Contributions to the Acoustical Consulting Profession in 1983, and the inaugural Laymon N. Miller Award for Excellence in Acoustical Consulting in 2015, awarded jointly by NCAC and INCE. He also served as President of the Institute of Noise Control Engineering (1993).

Bill's teaching and mentoring are of special interest. Bill is uniquely generous with his time and support to so many on various aspects of our own careers, research, and teaching. After 17 years with BBN, Bill established, Cavanaugh Tocci Associates, with ASA Fellow, Gregory Tocci, and is regularly represented at ASA, NCAC, and INCE meetings, and boasts three Past Presidents of the NCAC. He was a leader in establishing the Robert Bradford Newman Student Award Fund, a subcommittee of the ASA Technical Committee on Architectural Acoustics, which sponsors Newman Student Medal Awards for excellence in the study of architectural acoustics, as well as the Theodore J. Schultz Grants for excellence in teaching. Acoustics books and teaching aids have benefited from Bill's influence as well, including his essential role in originating the various ASA books based on poster sessions, including "Halls for Music Performance: Two Decades of Experience, 1962-1982," through "Halls for Music Performance: Another Two Decades of Experience, 1982-2002". Bill is the principal co-author of "Architectural Acoustics: Principles and Practice", published by Wiley (1st Ed. 1999, 2nd Ed. 2010). Bill's reputation has generated many invitations to write chapters, forewords, and articles on architectural acoustics and

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noise control, as well as deep participation in many Standards Working Groups.

Bill's service to the Society includes as three consecutive years as Member of the ASA Executive Council, member and Chair of the TCAA, member of the Technical Committee on Noise, and chair or member of numerous administrative committees including Ethics and Grievances, Regional Chapters, Public Relations, Rules and Governance, and more. In fact, Bill was the first Chair of the College of Fellows and of Archives and History. Bill served as Chair of the Wallace Clement Sabine Centennial Symposium in June 1994 and was responsible for the Historical Display at the Society's 50th Anniversary in 1979. He served on the 75th Anniversary Committee and was co-editor with Henry Bass of the ASA 75th Anniversary commemorative book. His work with local chapters and other organizations is outstanding. And, he was awarded the ASA Distinguished Service Citation in 1994, and the ASA Wallace Clement Sabine Award in December 2006.

For many years Bill has worked diligently, and often behind the scenes, for the benefit and recognition of others. He firmly believes, and his actions demonstrate, that much can be accomplished if no one cares who gets the credit. His wise and generous council has provided a bedrock foundation for the high standards for technical, personal, and professional conduct expected of practicing architectural acousticians. Bill's selfless outreach and mentoring to other consultants and acousticians has influenced many outstanding careers in acoustics.

Ginny, his wonderful, loving wife of 57 years, who passed peacefully in 2010, his five children (including Bill, Jr. who died in 1982 at age 24 while on active duty in the US Air Force), his grandchildren, and his great grandchildren are the loves of his life. He is also in love with acoustical consulting, and it shows. His countless friends and admirers are proud to congratulate Bill on this richly-deserved ASA Gold Medal.

Bill Cavanaugh, CONGRATULATIONS and THANK YOU!

K. ANTHONY HOOVER
LEO L. BERANEK
ALLAN D. PIERCE