Noise Control and Acoustics

Sean F. Wu, editor

BY Rick Marboe message from the vice chair

It has been said that the only constant in life is change. For the Noise Control and Acoustics Division (NCAD), this means the conclusion of my two years as division chair and the beginning of Dr. Sheryl Grace's term. I have enjoyed this time and appreciate the many efforts of our members to make NCAD successful. We are celebrating our 25th year as a group but are struggling to determine how to best serve all of our "customers" in this new information age.

Please read the enclosed article about ASME's Continuity and Change initiative. Take a look at all of the presentations on www.asme.org/change. This is YOUR ASME and you need to be aware of how the Society intends to reshape itself to meet the evolved needs of its members, the profession, and the world community.

With change, there is also opportunity. We have the chance to work more closely with other divisions at IMECE and other ASME conferences. We also have the chance to increase the reach of our knowledge dissemination in noise control and acoustics via web based tutorials, paper and lecture archives, perhaps listings of ASME member subject area experts.

The division is doing well by many metrics. Our custodial fund is back on an increasing trend. Our symposia at IMECE in Washington, DC were well attended and had high quality papers. We were blessed with many government forum presenters telling us what to expect in R&D and public policy. The schedule for IMECE in Anaheim packs a lot of great topics into two and a half days. Our membership numbers are increasing yearly. Our technical committees have more active participants but have consolidated now to three major disciplines: Aero / Hydro Acoustics, Structural Acoustics, and Active Noise Control. We have a superb group of technical committee chairs and symposia organizers, yet, we always need new ideas and people willing to become the next group of leaders. Please contact any technical committee chair or executive committee member.

People participate in professional societies for many reasons: knowledge gathering, evaluation of both competitors and potential partners, professional development, career oriented networking, camaraderie with people of similar interests, and even group insurance availability. The Executive Committee is pleased that you have chosen Noise Control and Acoustics Division as a division of interest. If you haven't already, join us as your primary division during the next membership renewal. You can have a real impact on what NCAD will become in its next 25 years. ▲

SUMMER NEWS 2004

BY Adnan Akay Birth of a Division: NCAD Quarter of A Century

Editor's Note: At IMECE 2003, the NCAD celebrated its 25th anniversary. To many, the history of NACD is either unknown or unclear. Therefore it is quite appropriate to have one of the original founders of this division give a historic account of how this division came into being and how it has evolved over the years.

Fall 1978, San Francisco – ASME Winter Annual Meeting, as it was then called, was in full force. Between the sessions, out in a hallway, C. Dan Mote, Jr. and Adnan Akay were having a discussion about noise and acoustics related research. The two had met for the first time just two weeks earlier at the ASA meeting in Honolulu. During these discussions, the idea of establishing a Division within ASME emerged.

They found strong and enthusiastic support among those with whom they discussed the idea of a new division but no one seemed to know where to begin the process.

Congratulations!

Dr. Theodore Farabee of Naval Surface Warfare Center and Dr. Martin Polack of Lockheed Martin were elected Fellows of the ASME in 2003.

The 2003 NCAD Best Paper Award went to "Local Space-Time Adaptive Discontinuous Galerkin Finite Element Methods for Time-Dependent Waves", by Lonny L. Thompson, and Dantong He, Department of Mechanical Engineering, Clemson University (IMECE2003-42542).

Dr. Richard F. Keltie was appointed as the Associate Dean for Academic Affairs at the North Caroline State University. *(See photos on page 6).*

Please let the Newsletter Editor, Sean F. Wu (sean_wu@wayne.edu) know of any news that you would like to share with us.

After submitting a letter of request with 10 signatures, they were notified that the first step in becoming a Division was to become a "National Group," a probationary status, which corresponds to the current sub-group. Becoming a National Group required 100 signatures. The first town-meeting of the organization took place at the following WAM in New York in 1979 with a strong attendance. Questions were raised about the need for a new division and whether there were enough acoustics papers, but generally the audience showed support for this emerging activity within ASME. With the requisite signatures, the Committee on Technical Affairs, then chaired by the late R. J. Roberts, approved the Noise Control and Acoustics (NCA) National Group in 1980.

NCA National Group was assigned to be part of the Industry Department, precursor of the present Environment and Transportation Group that was chaired by Chuck Velzy. The timing also coincided with the impending re-organization of ASME in light of the hydrolevel law suit. As the status of NCA changed from a National Group to a Division, ASME also re-organized itself under the present structure.

In the beginning, Dan Mote as the Chair and Adnan Akay as the Vice-chair were joined by the late Gary Reethof, Henry Scarton, and Terry Dear as members of the executive committee, along with Mort Schiff and several other volunteers. Later Maurice Sevik, Gary Koopmann, Ken Baumeister built the early tradition of NCA Division (NCAD). Dan's leadership, during the first three years, and his continued presence set the tone and the direction of the Division for the years to come; just what the Division needed. Terry Dear creatively and tirelessly promoted the Division. Through Terry Dear, K. Uno Ingard became involved in the Division and was the inaugural Rayleigh Lecturer

and the first recipient of the Per Bruel Gold Medal. Maurice Sevik, who joined the executive committee in its second year, had lasting influence on the division's future. He successfully attracted the underwater acoustics research community into NCAD with many sessions of high intellectual content. Among their many contributions, Maurice Sevik and Terry Dear also created and developed the Per Bruel Award.

NCA National Group organized its very first sessions at the 1979 WAM that took place at the Conrad Hilton Hotel in Chicago. The theme was "Noise Control Engineering in the 1980s."

At WAM '79, members and guests also celebrated its inauguration at the first "wine and cheese party," sponsored by industry groups.

In the early 1980's funding from NSF for Acoustics and Noise Control Research was scarce, if at all available. As part of the division activities Adnan Akay, Dan Mote, and Uno Ingard, organized a workshop sponsored by NSF that brought together many experts. The report that resulted from this workshop brought acoustics and noise control research within the charter of the then newly-formed Dynamic Systems and Control Division. (A. Akay, K. U. Ingard and C. D. Mote, Jr., Eds., Research Needs in Dynamic Systems and Control., Vol. 2, Acoustics and

CONTINUED ON PAGE 3

NCAD Quarter of A Century

CONTINUED FROM PAGE 2

Noise Control, ASME Publications, New York, NY, 1988.)

During the early years, the executive committee would meet four times a year. Meetings would involve substantial planning addressing issues of WAM sessions, symposia, and other usual business matters. Members would look forward to these gatherings. In retrospect, one reason for success and frequent meetings was that the members enjoyed working together; they had fun! Particularly for newly-minted academics, the presence of accomplished seniors was an unusual gift.

With the increasing number of members over the years to the present day membership of 600, NCAD became a focal point within ASME for many years and provided a platform for researchers in other disciplines whose work involved acoustics. Flow acoustics was one such example. Numerous bound volumes that reported progress in this field and others resulted from the meetings NCAD sponsored. When the Journal of Mechanical Design bifurcated, one of the new journals that replaced it, *Journal of Vibrations, Acoustics, Stress, and Reliability in Design*, the precursor of the present *Journal of Vibration and Acoustics*, began to recognize and accommodate the rising number of publications in acoustics. The Rayleigh Lecture series is one of the best attended annual events at IMECE. The Per Bruel Gold Medal recognizes those who have contributed to the field. Since the early 80's, NCAD also started sponsoring student activities including best paper awards.

While some of the founding members of NCAD reminisce about the old days and such late night meetings as a memorable one in Olive Branch, Mississippi, in recent years NCAD developed a new cadre of young leaders that now continues the tradition of excellence under the auspices of ASME. ▲

BY Earl G. Williams

Rayleigh Lecture: Fourier Acoustics, Uncovering the Origins of Sound

Dr. Earl G. Williams, Senior Scientist for Structural Acoustics at Naval Research Laboratory, gives the 2003 Rayleigh Lecture on "Fourier Acoustics: Uncovering the Origins of Sound."

No doubt, Jean Baptiste Joseph Fourier has had a great impact in science. In my Rayleigh lecture, I wanted to show the power of Fourier Acoustics in uncovering the origins of sound; to show the beauty and simplicity of acoustics when the Fourier series is employed as a starting point and then manipulated and tuned to uncover the origins of sound. It is interesting to note that despite Fourier's undeniable influence in science today, the root of which lies with his representation of functions using an infinite series of sines and/or cosines, his series expansion was strongly criticized by Laplace and Lagrange soon after Fourier presented it in 1807 in his memoir titled "On the propagation of heat in solid bodies." Fortunately, this criticism did not sway Fourier from his path, nor did it stunt the growth of nearly 200 years of analysis based on the Fourier series, out of which has grown notable treatises on "Fourier Optics" and "Fourier Acoustics."

In this lecture I wanted to show the simplicity of the theory of a popular measurement technique grown from Fourier acoustics called nearfield acoustical holography (NAH) by recasting the theory almost completely in terms of two-dimensional Fourier series. Starting with a pressure hologram, representing a measurement of a coherent pressure field (phase and amplitude) in two spatial dimensions (often planar in shape), Fourier series allows us to view this hologram as a sum of sinusoids (plane waves) in space similar to a modal decomposition. This sum of sinusoids can be propagated to a different but parallel two-dimensional surface by altering the amplitude and phase of each component as dictated by the wave equation. Furthermore, the pressure on this new surface can be converted to velocity by multiplication by a different amplitude and phase dictated by Euler's equation. If this new surface coincides with the surface of a vibrating source, such as a cabinet panel, then this operation exposes the distribution of velocity on the panel surface, as one would measure with a vibrometer. Even more important is the fact that the amplitudes of the sinusoids that make up this vibration yield the dispersion of waves (phase and group velocities) that travel in the panel. The Fourier series is thus a direct link to the physics of the vibrator.

I demonstrated that the Fourier series approach to NAH applies basically to any geometry. The choice of amplitudes and phases to propagate a 2-D sinusoid from one surface to another conformal surface is analytically defined (that is, known a priori) for any two surfaces making up a separable coordinate system. But even when the surfaces are not part of a separable system, the spirit of Fourier's expansions is still at play. In this case the singular value decomposition provides the 2-D 'sinusoids' to decompose the hologram, as well as the amplitudes and phases to march that decomposition to another surface nearer the source.

One of the most elegant applications of Fourier acoustics was demonstrated; a two-dimensional spherical array built at the Naval Research Laboratory was used to reconstruct the instantaneous vector intensity in a volume showing the direction and location of a loudspeaker source external to the array, thus uncovering the origin of sound. ▲

BY Elio A. Manes, ASME Staff

Continuity & Change Moves Forward

Following months of Society-wide preparation and review the Board of Governors voted on March 13 to approve a new organizational structure ASME. During their two-day meeting, which took place in New York City, on March 12-13, the Board of Governors assessed the proposed plan for change and debated the various issues surrounding the organizational restructuring.

The transition to the new ASME organizational structure will be complete and in place by July 1, 2005. With a 15-month transition now just beginning, the entire organization is set for the next phase of the Continuity and Change Initiative. Past President Reginald Vachon appointed a Project Management Task Force to implement the transition to the Society's new structure.

The Project Management Task Force, comprised of Senior Vice Presidents and their senior staff counterparts, has authority for overall coordination and communication of transition projects with BOG and members/customers. The Task Force will identify and task transition project teams, and will report to the Board of Governors on timely basis to ensure the established transitional timeline is met. In addition to approving the proposed organizational structure and forming the Project Management Task Force, the Board also revised the Society's core values and new vision statement as they were published

under the Continuity and Change Initiative to reflect ASME's commitment to diversity as an organizational strategy.

For further details from the Board of Governors meeting and specific materials on Continuity and Change visit www.asme.org/change.

BY Eric E. Ungar

The Unfolding of Careers

Editor's Note: *This is the fourth of the series of articles written by Dr. Eric E. Ungar, who received the ASME Per Bruel Gold Medal in 1994. Each of these articles presents a unique viewpoint on acoustics and noise control or lesson learned that deserves special attention.*

In the Babylonian Talmud there appears a sequence of three stories about Honi the Circle-Maker. The first tells of Honi at the time of a drought drawing a circle on the ground – hence his name – and vowing not to leave the circle until God provides rain. It soon begins to rain, first not enough to relieve the drought. Then, after Honi asks for more, there results a deluge; finally, after yet another entreaty, rain falls in useful amounts. In the next story we hear of Honi encountering an old man who is planting a carob tree. Honi inquires why the old man is planting a tree that takes seventy years to bear fruit and is told that the tree is intended to serve future generations. In the final story, Honi wakes up after a seventy-year sleep to find that no one believes or respects him any more, but that his grandson now is an adult and an esteemed member of the community.

It is difficult to determine the intent of these tales, but one may find that this set of stories may have been intended as a metaphor for a person's course of life. When we are young, we are brash and ready to challenge the establishment. We perhaps overreach ourselves initially, but eventually get things right. As we get older, we realize that we cannot complete all we want, and we begin planning for those who follow in our footsteps. Finally, once we get to a certain age, we need to leave progress to the younger folks.

I find that this cycle of events also relates to my engineering career. When I started my first job it was clear to me that my mathematics and analysis tools were much sharper than those of my supervisors, and I felt I could solve any problem better. However, given a real-world engineering challenge, I found that I needed some experience-based guidance to develop practical solutions. Eventually, I learned that being able to solve problems is not enough; it is most important to focus on the right problem and on the right aspects of a problem. Later in my career I became involved in research and in methods development, whose payoff would not occur immediately, but whose benefit would accrue to future users of the information. And now, after more than half a century of practice, I am surrounded by younger engineers to whom modern technology is second nature. I find myself reduced to providing general insights and guidance, while they come up with solutions better and a lot faster.

I can't help being reminded of some sage advice I heard some time ago, but whose source I don't remember: "The young should not think that they can substitute intelligence for experience, and the old should not think that they can substitute experience for intelligence."

I don't know to what extent my career cycle is typical, but I do believe that younger engineers (and others) would do well to maintain a long-term perspective and to plan their lives accordingly. Don't wait until it's too late. To quote a statement attributed to the Pennsylvania Dutch: "We get too soon old, and too late smart."

BY Sheryl Grace Another Successful Year for NCAD!

The NCAD sessions at the ASME IMECE along with the associated proceedings are a main service item that the division offers to its constituents. In 2003, the division celebrated it 25th year of existence and offered a stimulating set of 13 sessions at the Congress. Nine of the sessions were topical symposia and four were special sessions. The topical sessions included papers on emerging technical issues such as analyzing and quieting composite structures and recent advances in active noise control. Sessions were also devoted to the continuing themes of flow noise modeling, measurement and control, and computational and analytical structural acoustics. In 2003, a new technical session model was tested. The session was entitled "Case Studies in Noise Control and Vibration." The presentations were given by industrial members who described current noise issues associated with their company's products and their approach for addressing the noise problem.

The 2003 Rayleigh Lecture entitled "Fourier Acoustics: Uncovering the Origins of Sound" was delivered by Dr. Earl Williams of the Naval Research Laboratory. He gave an overview of the acoustic holography methods that he has developed over a number of years. If one would like to obtain more information on this topic, we refer you to Dr. Williams book, "Fourier Acoustics: Sound Raidation and Nearfield Acoustical Holography."

This year's tutorial lecture was presented by Dr. Jerry Ginsberg of Georgia Tech. He described his approach to modal analysis and compared it to other methods in the literature.

The annual special session devoted to issues in noise control and acoustics was enhanced this year by including experts from related government agencies. Dr. William Hughes, who is a vibroacoustics expert and the team leader for dynamics branch at NASA Glenn, offered the perspective of the Engineering and Technical Services Directorate at NASA. Dr. Gary Jebsen joined us from NSWCCD and spoke on the continuing noise control and acoustics problems faced within his division of ship signatures. Dr. Masayoshi Tomizuka spoke about new funding initiatives within NSF and gave an overview of ongoing acoustic related projects in his division of civil and mechanical systems. The comments of these leaders from government laboratories together with the input from the current NCAD technical committee chairs helped to outline emerging issues in our field.

A final special session focused on the newly formed Center of Excellence on Aircraft Noise and Aviation Emission Research. This panel session included center participants: Thomas Connor from the FAA, Robert Bernhard from Purdue University, Joseph Grady from NASA Glenn, and Lawrence Craig from Boeing. The panel described the breadth of this initiative, the challenges that face the center, and the final goals. In addition, mention was made of the fact that the center is focusing mainly on flight planning and management for noise and emission reductions and that there is still much work needed in the field of source reduction (i.e., jet noise, airframe noise).

A successful conference is always the outcome of hard work by the technical committee chairs and the session organizers. Thus, special thanks are extended to: Jeffrey Vipperman, Stephen Hambric, Michael Jonson, Joe Gavin, Lisa Grega, Lourdes Maurice, Steve Sharp, and Lonny Thompson. In addition the NCAD executive committee wishes to extend a special thanks to the authors, panelists, lecturers, and conference attendees who made the entire conference possible.

Finally, as a service to our membership, we are providing access to some of the special panel and lecture presentations via the NCAD web page (www.asme.org/divisions/ncad/forums/index.html). For instance, we obtained permission from the Rayleigh lecturer and our tutorial lecturer to make their presentation slides available. ▲

COMMITTEES

EXECUTIVE COMMITTEE

Chair
Sheryl M. Grace, Ph.D.
Dept. Aerospace & Mech. Engrg.
Boston University
110 Cummington Street
Boston, MA 02215-2407
Tel : 617-353-7364
Email: sgrace@bu.edu

Vice Chair
Richard C. Marboe, Ph.D.
Penn State University
Applied Research Lab
P.O. Box 30
State College, PA 16804-0030
Tel : 814-863-3019
Fax: 814-865-3287
Email:rcm4@psu.edu

Secretary/Treasurer
Kenneth D. Frampton, Ph.D.
Vanderbilt University
Mechanical Engineering Dept.
Box 1592, Station B
Nashville, TN 37235
Tel: 615-322-2778
Email:ken.frampton@vanderbilt.edu

Program Chair
Lonny Thompson, Ph.D.
Clemson University
Dept. of Mech. Engineering
Fluor Daniel Bldg., Rm. 219
Clemson, SC 29634-0921
Tel: 864-656-5631
Fax: 864-656-4435
Email:
lonny.thompson@ces.clemson.edu

Member
Joe Gavin, Ph.D.
Electric Boat Division
75 Eastern Point Road
Groton, CT 06340
Tel: 860-433-1159
Fax: 860-433-2499
Email: jgavin@ebmail.gdeb.com

TECHNICAL COMMITTEES

Active Noise Control Committee
Chair
Jeffrey Vipperman, Ph.D.
University of Pittsburgh
Dept of Mechanical Engineering
648 Benedum Engineering Hall
Pittsburgh, PA 15261
Tel: 412-624-1643
Fax: 412-624-4846
Email:jsv@pitt.edu

Structural Acoustics Committee
Chair
Stephen A. Hambric, Sc.D.
Penn State University
Applied Research Laboratory
P.O. Box 30
State College, PA 16804-0030
Tel: 814-863-3030
Fax: 814-863-1479
Email: sah@wt.arl.psu.edu

Aero/Hydro Acoustics Committee
Chair
Michael L. Jonson, Ph.D., P.E.
Penn State University.
Applied Research Laboratory
P.O. Box 30
State College, PA 16804-0030
Tel: 814-863-3029
Fax: 814-863-5578
Email: mlj@wt.arl.psu.edu

ASME
SETTING THE STANDARD
1880 2003

Noise Control and Acoustics

Three Park Avenue, New York, NY 10016-5990
www.asme.org/divisions/ncad/

NON-PROFIT ORG
U.S. POSTAGE
PAID
SYRACUSE, N.Y.
PERMIT NO. 3893

Congratulations!

Dr. Adnan Akay (left), past Vice President of the Environment & Transportation Group, presents an ASME Fellow certificate to Dr. Theodore Farabee (right).

Dr. Richard Marboe (left), NCAD Vice Chair, presents the 2003 NCAD Best Paper Award to Professor Lonny L. Thompson (right) for his paper entitled, "Local Space-Time Adaptive Discontinuous Galerkin Finite Element Methods for Time-Dependent Waves."

Group picture: (Front row from left to right: Lonny L. Thompson, Sean F. Wu, attendee, Steve Hambric. Second row from left to right: attendee, Sheryl Grace, Virginia Williams, Earl G. Williams, Jerry H. Ginsberg, and Robert Berhnard. Third row from left to right: Theodore Farabee, Martin Pollack, Adnan Akay, Kenneth Frampton, Richard Marboe, Henry Scarton, and Gary Koopmann).

Dr. Adnan Akay (left), past Vice President of the Environment & Transportation Group, presents an ASME Fellow certificate to Dr. Martin Pollack (right).