



# **UFFC** Newsletter

**Ultrasonics, Ferroelectrics, and Frequency Control**



**2006 IEEE International Ultrasonics Symposium  
3 – 6 October 2006  
Vancouver, BC Canada**

## President's Message

Dear UFFC Society Colleagues:

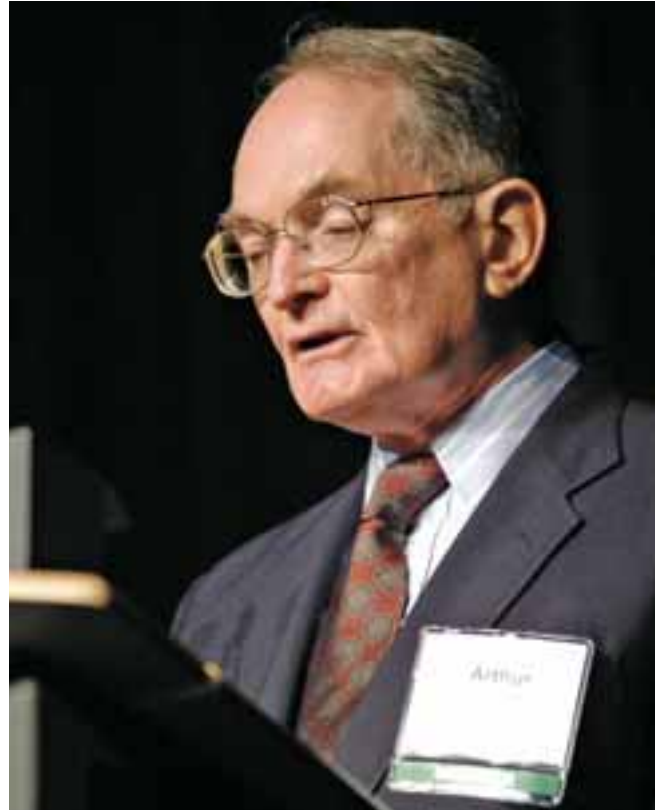
In the Spring UFFC-S Newsletter, I introduced to you our President-Elect, and the newest group of newest group of elected members to the UFFC Administrative Committee. I'd like to continue the introductions by commending to you the executive officers:

- Secretary-Treasurer: Daniel S. Stevens – Vectron International, Hudson, NH, and our Vice-Presidents, who have oversight in four critical Society areas:
- Ultrasonics: Jacqueline H. Hines – Applied Sensor R&D Corp., Annapolis, MD
- Ferroelectrics: Thomas R. Shrout – The Pennsylvania State University
- Frequency Control: Lute Maleki – Jet propulsion Laboratory, Pasadena, CA
- Publications: Donald Yuhas – Industrial Measurement Systems Inc., Aurora, IL.

The 60th Annual Frequency Control Symposium was held in Miami in June. In addition to a Special Session commemorating the 100th Anniversary of the birth of Prof. R. D. Mindlin (Columbia University), the symposium offered tutorials and exhibitions [<http://www.ieee-uffc.org/2006fcs/>]. What began 60 years ago as a meeting of quartz crystal manufacturers has grown, in the ensuing years, into an international gathering that explores the many ingenious modalities devised to produce and distribute stable frequency and timing information.

Kudos to those who chaired this meeting:

- General: Michael Driscoll – Northrop-Grumman, Baltimore, MD
- Technical Program: Donald Malocha – University of Central Florida, Orlando, FL
- Tutorials: John Prestage – Jet Propulsion Laboratory, Pasadena, CA
- Awards: Thomas Parker – National Institute of Standards & Technology, Boulder, CO
- Exhibits: Jack Kusters – Agilent Technologies (retired), Cupertino, CA
- Finance: Raymond Filler – US Army CERDEC, Fort Monmouth, NJ



- Editorial: Debra Coler – OEwaves, Inc., Pasadena, CA
- Academic: Kurt Gibble – The Pennsylvania State University, University Park, PA
- Publicity: Michael Garvey – Symmetricon, Beverly, MA
- Meeting Management: Barbara McGivney – Synergistic Management, Inc., Wall, NJ,  
and to all those other volunteers whose enthusiasm and hard work contributed to its success.


**Cordially,  
Art Ballato  
IEEE UFFC Society President, 2006-2007  
[a.ballato@IEEE.org](mailto:a.ballato@IEEE.org)**

# Table of Contents

## UFFC NEWSLETTER SUMMER 2006

PRESIDENT'S MESSAGE .....2

2006 IEEE INTERNATIONAL ULTRASONICS SYMPOSIUM .....4

 2006 IEEE INTERNATIONAL FREQUENCY CONTROL SYMPOSIUM HIGHLIGHTS ..13

2007 JOINT IEEE FCS AND EFTF WITH ENC – GNSS – TIMENAV '07 .....33

FREQUENCY CONTROL AWARDS .....34


FREQUENCY CONTROL NEWS .....39

ULTRASONICS NEWS .....42

FERROELECTRIC NEWS .....47

IN MEMORIAM .....49


HONORS .....52

 UFFC AWARDS .....55

UFFC ELECTIONS .....60

UFFC ADCOM .....63

UFFC ADCOM 2006 .....72


 OTHER CONFERENCES .....75

HISTORY .....77

IEEE PRESIDENT ELECTIONS .....83

EDITOR'S COMMENTS .....89

FUTURE UFFC SYMPOSIA .....91



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## 2006 IEEE International Ultrasonics Symposium



### 2006 IEEE International Ultrasonics Symposium 3 – 6 October 2006 Vancouver, BC Canada

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#### Special Notes

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**Dates:** 3 – 6 October 2006

**Location:** Vancouver, BC, Canada

**Venue:** Westin Bayshore Resort and Marina

**Hotel Reservations:** before Monday, September 11, 2006

**Advance Registration:** 15 August 2006

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#### An Invitation from the General Chair

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Welcome to Vancouver!



**Stuart Foster**

The 2006 IEEE International Ultrasonics Symposium will be held in Vancouver, British Columbia, Canada from October 3–6, 2006.

The conference will be held at the Westin Bayshore Resort and Marina, situated in the heart of Coal Harbour, one of Vancouver's most historical areas. It is a modern, very well



equipped conference centre that is perfectly suited for conferences like the Ultrasonics Symposium.

Vancouver is a vibrant multicultural city nestled on the slopes of the majestic Coast Mountain range that form the northern edge of the metropolis, and are a major part of its spectacular views. It is a quintessential North American west coast city; beautiful, diverse, irreverent, and teeming with life.

In addition to the natural splendour you'll find many museums, art galleries, sports activities, and oases of tranquility within easy walking distance of the conference centre. Vancouver/Whistler is also the site of the 2010 Winter Olympics. The Ultrasonics Symposium is a great opportunity for a preview of the fun to come.

Hope to meet you in Vancouver, Best regards,

**F Stuart Foster**  
General Chair  
[stuart.foster@sw.ca](mailto:stuart.foster@sw.ca)

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#### Hotel Information and Bookings

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Special price arrangements have been made with The Westin Bayshore Resort & Marina.

The Westin Bayshore, Vancouver  
1601 Bayshore Drive  
Vancouver, Canada  
Phone (604) 682-3377  
Fax (604) 687-3102



Situated in Vancouver's Coal Harbour, The Westin Bayshore, Vancouver is the city's only downtown resort and conference centre. Panoramic views of the coastline, mountains, and Stanley Park add to the beauty and mystique of this unique resort.

Connected to the historic 1,000 acre Stanley Park via its picturesque seawall, you'll be able to enjoy ocean-side jogging, cycling and Rollerblading. Take advantage of our numerous resort amenities, including a full-service health and fitness centre with steam rooms, saunas, elliptical trainers, treadmills, massage therapists, hair salon, both indoor and outdoor pools, and the WestinWORKOUT® Powered by Reebok Gym.

Our 511 spacious guest rooms offer sophisticated furnishings with soothing earth tones, incredible views and the Westin Heavenly Bed®. Our brand new conference facilities feature the largest hotel ballroom in western Canada - the 15,521 square foot Bayshore Grand Ballroom. The 22 other meeting rooms, totaling 48,000 square feet, further enhance our warm and luxurious atmosphere. Wireless Internet Access is now available in public spaces as well.

We are pleased to confirm the following room rates in

Canadian dollars (conference rates in effect October 1 - 8, 2006):

\$225 Single/Double Occupancy  
\$30 Additional person

Applicable Canadian taxes: provincial (10%) and federal (7%).

**You must book before Monday, September 11, 2006 to receive special conference room rates.**

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## Symposium Registration Information

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To take advantage of the reduced advance registration fees, the registration form found at <http://www.ieee-ultrasonics2006.org/registration.html> must be returned before 15 August 2005.

### Registration Fees

The registration fee includes a CD Proceedings. Early Registration prices are shown; the prices for IEEE Member and Non-IEEE Member registration will both increase by \$100 after 15 August 2005

IEEE member	\$425
Non-IEEE member	\$575
Student/Retiree	\$ 90
Life Member	\$ 0
One Day Registration (no Proceedings)	\$300
Additional CD-ROM Proceedings	\$ 75

The UFFC CD Archive is available to UFFC Members only for \$60.

### Short Course Registration

Participants may select from nine short courses. The registration fee per course is (after 15 August):

Member/non-Member	\$150 (\$200)
Student/Retiree	\$ 50 (\$75)

### Guest Registration

Guest Registration (Adults Only)	\$ 35
Guest Tour 1: Vancouver City Tour	\$ 60
Guest Tour 2: North Shore Tour	\$ 90

### Conference Dinner Party

Dinner with the Belugas – Vancouver Aquarium	
Attendees and Guests	\$ 50
Students	\$ 10

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## Short Courses

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**Short Courses**  
**October 3, 2006**

### 1A – Medical Ultrasound Transducers

8 am – 12 pm  
Douglas G. Wildes and L. Scott Smith

General Electric Global Research, Niskayuna, NY, USA

## 1B – Elasticity Imaging

8 am – 12 pm

Stanislav Emelianov

University of Texas at Austin, Austin, TX, USA

## 1C – Advanced Numerical Techniques for Modeling and Simulation of SAW Devices, BAW Devices and FBARs

8 am – 12 pm

Elireza Baghai-Wadji

RMIT University, Melbourne, Australia

## 2A – Medical Imaging Beamformer Design

1 pm – 5 pm

Kai E. Thomenius

General Electric Global Research, Niskayuna, NY, USA

## 2B – Micromachined Ultrasonic Sensors and Actuators

1 pm – 5 pm

Amit Lal\* and B. (Pierre) T. Khuri-Yakub+

\*Cornell University, Ithaca, NY +Stanford University, Stanford, CA

## 2C - Nonlinear Acoustics and Harmonic Imaging

1 pm – 5 pm

Victor F. Humphrey

Institute of Sound and Vibration Research (ISVR), University of Southampton, UK

## 3A – Ultrasound Contrast Agents: Theory and Experimental Results

6 pm – 10 pm

Nico de Jong\* and Michel Versluis+

\*Erasmus MC Rotterdam, The Netherlands, +University of Twente Enschede, The Netherlands

## 3B – Finite Element Modeling for Ultrasound Applications

6 pm – 10 pm

Paul Reynolds and David Vaughn

Weidlinger Associates, Los Altos, CA, USA

## 3C – Flow Measurements and Doppler

6 pm – 10 pm

Hans Torp

Norwegian University of Science and Technology, Trondheim, Norway

## 1A Medical Ultrasound Transducers

Douglas G. Wildes and L. Scott Smith

General Electric Global Research, Niskayuna, NY, USA

This course will provide an introduction to the design, fabrication, and testing of medical ultrasound transducers. Starting from an overview of the basic types of phased-array

transducers (linear, convex, sector), we will discuss how the design for a probe is derived from its target application and how equivalent-circuit, finite-element, and acoustic field models can be used to optimize the design and accurately predict performance. A discussion of the structure of an ultrasound probe will lead to a survey of the different types of materials used in probes and their critical properties. Typical fabrication processes will be introduced and common problems in probe manufacturing will be summarized. Methods for evaluating completed transducers will be discussed. The course will highlight recent developments in probe technology, including single crystal piezoelectrics, cMUT transducers, catheters, multi-row and 2D arrays, and electronics in probes, and will discuss performance advantages and fabrication difficulties which may be associated with each.

**Douglas G. Wildes** is a physicist with GE Global Research. He earned an A.B. in physics and mathematics from Dartmouth College and a Ph.D. in low-temperature physics from Cornell University, then joined GE in 1985. Since 1991, Dr. Wildes' research has focused on aperture design, fabrication processes, and high-density interconnect technology for multi-row and 2D transducers for medical ultrasound. Dr. Wildes has 20 issued patents and 18 external publications. He is a member of the American Physical Society and a Senior Member of the IEEE.

**L. Scott Smith** is a physicist with GE Global Research. He earned B.S. and Ph.D. degrees in physics from the University of Rochester and the University of Pennsylvania respectively. Joining GE in 1976, he developed phased array probes for medical ultrasound. More recently, he examined novel probe materials and led projects on pediatric endoscopes and adaptive acoustics. Dr. Smith has 37 issued patents and over 35 refereed publications. He is a member of the American Physical Society and a Senior Member of the IEEE where he serves as Vice Chair for Transducers on the Ultrasonics Symposium's Technical Program Committee.

## 1B Elasticity Imaging: Signals and Systems

Stanislav Emelianov

University of Texas at Austin, Austin, TX, USA

The main objective of this course is to expose attendees to elasticity imaging with emphasis on principles, approaches and applications. The course will provide both a broad overview and comprehensive understanding of elasticity imaging, and, as such, the course is well suited for both newcomers and active researchers in the field. The course will be divided into several modules. Starting with a brief historical introduction to elasticity imaging, we will examine the foundation and basic principles of static and dynamic approaches in elasticity imaging (theory of elasticity including both the equation of equilibrium and the wave equation, mechanical properties of soft tissues, etc.). We will then discuss experimental aspects of elasticity imaging including imaging hardware, signal and image processing algorithms, etc.

Speckle tracking methods will be introduced and analyzed. Techniques to map elasticity and other mechanical properties of tissue will be presented and discussed. In this part of the course, we will also analyze noise (sources) and primary artifacts, and discuss techniques to increase and optimize signal-to-noise ratio in strain and elasticity images. Finally, the ultrasound elasticity imaging techniques and their biomedical and clinical applications will be presented. Advantages and limitations of each approach will be discussed and contrasted with other elasticity imaging techniques such as MRI or optical elastography. Overall, similarities and differences between various elasticity imaging approaches will be discussed. The course will conclude with overview of several experimental and commercial systems capable of ultrasound elasticity imaging.

**Stanislav Emelianov** received the B.S. and M.S. degrees in physics and acoustics in 1986 and 1989, respectively, from the Moscow State University, and the Ph.D. degree in physics in 1993 from Moscow State University, and the Institute of Mathematical Problems of Biology of the Russian Academy of Sciences, Russia. In 1989, he joined the Institute of Mathematical Problems of Biology, where he was engaged in both mathematical modeling of soft tissue biomechanics and experimental studies of noninvasive visualization of tissue mechanical properties. Following his graduate work, he moved to the University of Michigan, Ann Arbor, as a post-Doctoral Fellow in the Bioengineering Program, and Electrical Engineering and Computer Science Department. From 1996 to 2002, Dr. Emelianov was a Research Scientist at the Biomedical Ultrasonics Laboratory at the University of Michigan. During his tenure at Michigan, Dr. Emelianov was involved primarily in the theoretical and practical aspects of elasticity imaging. Dr. Emelianov is currently an Assistant Professor of Biomedical Engineering at the University of Texas at Austin. His research interests are in the areas of medical imaging for therapeutics and diagnostic applications, ultrasound microscopy, elasticity imaging, photoacoustic imaging, cellular/molecular imaging, and functional imaging.

## 1C Advanced Numerical Techniques for Modeling and Simulation of SAW Devices, BAW Devices and FBARs

Alireza Baghai-Wadji

RMIT University, Melbourne, Australia

E-mail: [alireza.baghai-wadji@rmit.edu.au](mailto:alireza.baghai-wadji@rmit.edu.au)

This short course focuses on modern methodologies for the acceleration and customization of analysis- and synthesis tools for microacoustic device modelling and simulation. Surface acoustic wave devices, bulk acoustic wave devices, FBARs, MEMS and RF-MEMS will be considered and higher-order effects including the radiation of electromagnetic waves in these devices will be accounted for. Following a brief review of traditional design and simulation techniques we will discuss recently developed methods which are by construction extraordinarily flexible and at the

same time promise to be accurate to a desired degree. Included are the so-called conservative finite difference method, finite volume method, this author's fast boundary element method utilizing Universal Functions, wavelet-based techniques, the multiresolution analysis, the fast multilevel multipole expansion technique, genetic algorithms, evolutionary programming, Monte Carlo method, and finally schemes for software- and hardware implementation of fast algorithms. With a particular emphasis on the design and simulation of FBARs we will explain important notions of absorbing boundaries, infinite elements, radial functions and radial wavelets. Furthermore, we will consider the concept of non-orthogonal bases- and dual bases, and address the concept of over-completeness and investigate the construction and properties of frames, dual frames and related topics. The foregoing mathematical concepts will be complemented by introducing a number of physics-based localized analysis functions. Examples will include Wannier functions, coherent states and Green's functions induced wavelets and wavelet-like functions. More specifically, simple recipes for the construction of Meyer, Daubechies, and B-spline wavelets and their application in microacoustic device modelling and simulation will be presented. All tools necessary to conveniently follow the discussion will be developed in the classroom. A comprehensive manuscript enriched by simple and illustrative examples will be provided to course participants.

**Alireza Baghai-Wadji** is a Professor of Electronic and Computational Engineering at the RMIT University, School of Electrical and Computer Engineering, Melbourne, Australia. He is the Director of the Discipline Electronic and Biomedical Engineering, and School's representative for international collaborations and curriculum development. He received his MSc, PhD, and Doctor of Science (Physical Electronics) in 1984, 1987 and 1994, respectively, from Vienna University of Technology, Vienna, Austria. In 2003 he was awarded a Doctor of Science in Quantum Electronics and Materials Science from Helsinki University of Technology, Helsinki, Finland. Prior to joining the RMIT University in March 2005 he was 1979-2005 with Vienna University of Technology: 1997-2005 an Associate Professor in the Department of Electrical and Information Technology, 1994-1997 an Assistant Professor, 1984-1994 a Research Assistant, 1979-1983 a Research Associate. He has more than 130 publications in reviewed journals and conference proceedings and is the owner of one patent in USA.

## 2A Medical Imaging Beamformer Design

Kai E. Thomenius

General Electric Global Research, Niskayuna, NY, USA

A goal of this course is to review the design of ultrasound front ends and beamformers from a linear systems point of view. The approach used will include transduction, beamformation, acoustic wave propagation, and image formation functions. We will discuss several analytical methods used in developing the design of a typical beamformer in use in

diagnostic ultrasound today. The key points to be covered deal with methods of analysis of arrays and beamformers, the interaction of transmit and receive beams with clinically relevant targets, and how this interaction is used in image formation. A brief overview of k-space methods will be given. The means by which these analytical methods contribute to a beamformer design and the trade-offs involved are reviewed. The techniques developed for such analysis will be applied to key topics of current interest such as system miniaturization, 2D arrays and improve spatial sampling of the acoustic fields, synthetic aperture techniques, and aberration correction. Due to successes in system miniaturization such as laptop-sized systems, ultrasound is becoming a candidate modality for new clinical application. We will discuss this development and its impact on beamformer design.

**Kai E. Thomenius** is a Chief Technologist in the Imaging Technologies Organization at General Electric's Global Research facility in Niskayuna, NY. His focus is on Ultrasound and Biomedical Engineering. Previously, he has held senior R&D roles at ATL Ultrasound, Inc., Interspec Inc., Elscint, Inc., Inc as well as several other ultrasound companies, and is also an Adjunct Professor in the Electrical, Computer, and Systems Engineering Department at Rensselaer Polytechnic Institute where he teaches a course in general imaging. Dr. Thomenius' academic background is in electrical engineering with a minor in physiology; all of his degrees are from Rutgers University. His long-term interests have been in ultrasound beamformation and miniaturization of ultrasound scanners, propagation of acoustic waves in inhomogeneous media such as tissue, the potential of bioeffects due to those acoustic beams, and determination of additional diagnostic information from the echoes that arise from such beams. Recently he has contributed to work on coherent beamformers in millimeter wave radar applications. He is a Fellow of the American Institute of Ultrasound in Medicine.

## 2B Micromachined Ultrasonic Sensors and Actuators

Amit Lal\* and B. (Pierre) T. Khuri-Yakub+

\*Cornell University, Ithaca, NY +Stanford University, Stanford, CA

The goal of this course is to introduce the fundamentals of micromachining and the way they affect the design and performance of ultrasonic sensors and actuators. The first part of this course will cover established micromachining techniques, such as bulk micromachining and surface micromachining on silicon. The effect of fabrication conditions on material properties and dimensions, and their effects on ultrasonic device design will be presented. The following topics will be discussed with the help of case studies: (1) Electrostatic actuation of micromachined membranes; Nonlinearities and effective electromechanical coupling, (2) Comparison of bulk-PZT and thin-film piezoelectric actuation of bulk and surface micromachined structures, and sili-

con horn design, (3) microphones and speakers, and (4) Nonlinear ultrasound in microfluidic devices.

**Amit Lal** is an associate professor of electrical and computer engineering at Cornell University. He received his Ph. D. in electrical engineering from the University of California, Berkeley in 1996, and the B.S. degree from the California Institute of Technology in 1990. Amit Lal directs the SonicMEMS group at Cornell University, which focuses on ultrasonics, micromachining, modeling of piezoelectric systems, use of radioactive energy sources in microsystems, and design and analysis of integrated circuits. Specifically his group focuses on design principles for ultrasonically driven MEMS for actuation of microstructures and fluids, and radioactive power sources for autonomous MEMS. He holds several patents, relating to micromachined acoustic sources/receivers, silicon-based high-intensity ultrasonic actuators, microfluidic devices, and power sources. He is also the recipient of the NSF CAREER award for research on applications of ultrasonic pulses to MEMS. He serves on the Technical Committee on Physical Acoustics in the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society.

**B. (Pierre) T. Khuri-Yakub** is a professor of electrical engineering at Stanford University. He received his Ph. D. from Stanford University in 1975, the M.S. degree from Dartmouth College in 1972, and the B.S. from the American University of Beirut, all in electrical engineering. Professor Khuri-Yakub's group research is presently focused on the development of micro-machined ultrasonic transducers and their applications to real time volumetric ultrasound imaging, real time functional photo-acoustic medical imaging, and therapy. Other research activities involve micro-machined drop ejectors and bio-fluidic sensors and actuators. Prof. Khuri-Yakub has extensive patents and publications in the areas of thin film transducers, analog convolvers and correlators, acoustic microscopy, non-destructive evaluation, in-situ sensors, and micro-machined transducers and medical imaging.

## 2C Nonlinear Acoustics and Harmonic Imaging

Victor F. Humphrey

Institute of Sound and Vibration Research (ISVR), University of Southampton, UK

This course will provide an introduction to the origins of nonlinear propagation, and its consequences and applications in medical ultrasound.

The first section will review the basic physics of nonlinear propagation, and discuss the propagation of plane waves as a means of introducing nonlinear acoustics terminology. This will be followed by a discussion of the techniques used to numerically model nonlinear propagation and the specific problems of performing measurements in high amplitude fields with their associated distortion and harmonic content.

The effects of diffraction and attenuation on nonlinear propagation will then be introduced by considering the fields of transducers and arrays, and the fields they generate



in tissue; this will be illustrated by a combination of experimental results and model predictions. This will lead on to a discussion of the consequences for medical ultrasound of nonlinear propagation. Finally the application to harmonic imaging will be described.

**Victor Humphrey** is a Professor of Acoustics at the Institute of Sound and Vibration Research (ISVR) in Southampton, U.K. He received his BSc and PhD degrees from the University of Bristol in 1975 and 1981 respectively. He then moved to the School of Physics at the University of Bath where was promoted to Senior Lecturer. In 2004 he took up his current position at ISVR. His initial research was in the area of laboratory applications of nonlinear parametric arrays in underwater acoustics. For this work he was awarded the Institute of Acoustics A.B. Wood Medal 1988. Subsequently he helped to develop a research programme on the nonlinear propagation of ultrasound in medical fields that investigated these fields both numerically and experimentally. He was awarded the University of Bath Mary Tasker Award for excellence in teaching in 1995.

### 3A Ultrasound Contrast Agents: Theory and Experimental Results

Nico de Jong\* and Michel Versluis+

\*Erasmus MC Rotterdam, The Netherlands, +University of Twente Enschede, The Netherlands

The course consists of 6 main topics:

- a) First an overview will be presented of the (clinical and pre-clinical available) contrast agents, including the properties and characteristics of the gas inside the bubble and the shell surrounding it.
- b) Models of the behavior of small bubbles in a ultrasound field will be discussed. Simple models based on a one dimensional mass-spring system and more complicated models including gas and shell properties.
- c) Experimental ultrasound methods for UCA will be presented for characterizing the bubbles in a UCA, like harmonic and subharmonic scattering, absorption and attenuation. Also the influence of ambient pressure, temperature and gas concentration will be discussed.
- d) Experimental optical methods for characterizing individual bubbles.
- e) Imaging methods for contrast agents, like fundamental, harmonic, subharmonic and superharmonic and multi-pulse methods like pulse inversion, power modulation etc. and new methods like chirp excitation.
- f) Ultrasound mediated drug delivery: Interaction between mammalian cells and ultrasound in the vicinity of bubbles will be discussed.

**Nico de Jong** graduated from Delft University of Technology, The Netherlands, in 1978. He got his M.Sc. in the field of pattern recognition. Since 1980, he has been a staff member of the Thoraxcenter of the Erasmus University Medical Center, Rotterdam, The Netherlands. At the Dept. of Biomedical Engineering, he developed linear and phased

array ultrasonic probes for medical diagnosis, especially compound and transesophageal transducers. In 1986 his interest in ultrasound applications shifted toward the theoretical and practical background of ultrasound contrast agents. In 1993 he received his Ph.D. for "Acoustic properties of ultrasound contrast agents." Currently he is interested in the development of 3-D transducers and fast framing camera systems. De Jong is the project leader of STW and FOM projects on ultrasound contrast imaging and drug delivery systems. Together with Folkert ten Cate, MD, he is organizer of the annual European Symposium on Ultrasound Contrast Imaging, held in Rotterdam and attended by approximately 175 scientists from all over the world. Nico de Jong has been a part-time professor at the University of Twente since 2003.

**Michel Versluis** graduated in Physics in 1988 at the University of Nijmegen, the Netherlands, with a special interest in Molecular Physics and Astrophysics. Later, he specialized in the application of intense tunable UV lasers for flame diagnostics resulting in a successful defense of his PhD thesis in 1992. Michel Versluis is now a lecturer at the University of Twente, the Netherlands, in the Physics of Fluids group working on the experimental study of bubbles and jets in multiphase flows and granular flows. He also works on the use of microbubbles as a tool for medical diagnosis and therapy. Dr. Versluis teaches various courses in Fluid Mechanics, one of them focusing on the physics of bubbles.

### 3B Finite Element Modeling for Ultrasound Applications

Paul Reynolds and David Vaughn

Weidlinger Associates, Los Altos, CA, USA

The aim of this course is to educate the ultrasound expert in the important considerations with regards to the finite element modelling of ultrasound applications. The course will not go into details of the fundamental equations and physics of the problems, but rather the relative merits of the various approaches, leaving the audience free to consider the broader implications rather than the fine detail. By the end of the course, it is our intention that the attendees will have the basic information on finite element simulations, and several common but varied applications, with which to make informed decisions in regards to simulating their own particular problems, and therefore make best use of the resources available to them.

The four main components will be:

- 1) Finite Element Basics: The first section will involve an introduction to the field of finite element modelling, in order to ensure that all participants are aware of the basic assumptions inherent in the various modelling approaches.
- 2) Wave Propagation: The second section will concentrate on the accurate modelling of wave propagation through various media. Initial consideration will be given to the simple, linear, elastic cases and then move to include the effects of long distance propagation, material discontinu-

ities, frequency dependant attenuation, and non-linearity (such as is prominent in higher-harmonic imaging).

- 3) Ultrasound and Thermal Effects: The third section will consider the use of ultrasound to heat tissue, such as with HIFU. Appropriate and accurate calculation of thermal generation (sometimes called the Bioheat Equation) and its application as a load to a thermal model will be detailed, as will advantages and disadvantages of coupling the acoustic and thermal fields, and perfusion. Difficulties in predicting effects such as cavitation and thermal variation of mechanical properties will be analysed.
- 4) Nonlinear electrostatic transducers (CMUTs): Capacitive Micromachined Ultrasonic Transducers (cMUTs) form a significant part of ongoing research into ultrasonic devices, and we detail the modeling requirements imposed by these highly nonlinear electrostatic devices. Full nonlinearity, contact issues, and methods of efficient modeling will be discussed in detail.

**Paul Reynolds** is an Associate with Weidlinger Associates Inc (WAI), developers of the PZFlex finite element modelling package. He obtained his PhD in the Finite Element Analysis of Piezocomposite Devices from the University of Strathclyde in Glasgow, Scotland, before joining WAI. Through his position as PZFlex manager, his work with both academia and industry on topics as diverse as medical imaging, medical therapeutics, SONAR, NDT, sensors and actuators has led to a broad knowledge of the modelling needs across the spectrum, and best practices to ensure efficient use of modeling resources.

**David Vaughan** holds the position of Principal in the Applied Science Division of Weidlinger Associates, Inc. (WAI) and is Principal-In-Charge of WAI's Mountain View, CA office. Mr. Vaughan has an M.S. degree in Aerospace Engineering from Texas A&M University. Mr. Vaughan has extensive experience in modeling and software development for solid mechanics and multi-physics related problems, including piezoelectric applications. He directs the development of the FLEX family of computational structural dynamics codes.

### 3C Flow Measurements and Doppler

Hans Torp  
Norwegian University of Science and Technology  
Trondheim, Norway

This course provides basic understanding of physical principles and signal processing methods for flow measurements and visualization; with emphasis on Doppler methods and blood flow applications. The course starts with an overview of currently used techniques for velocity estimation in pulsed and continuous wave Doppler and color flow imaging. Statistical models for the received signal, as well as commonly used velocity and flow estimators are developed. Several different simulation methods for ultrasound signals from moving blood and clutter signals will be discussed. This includes fast simulation methods, as well as full 3D point scatter models using spatial impulse response techniques or k-space analysis. Efficient simulation tools to

explore estimator properties are derived, and examples on implementation in Matlab will be shown. Methods to suppress clutter signals from slowly moving targets, including regression filter will be discussed. Elements from classical estimation theory will be applied to develop minimum variance velocity estimators in the presence of clutter noise. The performance will be compared with commonly used approaches for clutter rejection and velocity estimation, and practical implementations will be discussed.

Velocity components transversal to the ultrasound beam can not be measured by Doppler techniques. However, several approaches to overcome this limitation has been proposed, including speckle tracking, transit time measurements, and lateral beam modulation. Principles and practical limitations will be discussed. Methods for visualisation of 2D vector flow information will be shown.

**Hans Torp** received the MS degree in mathematics in 1978, and the Dr. Techn. degree in electrical engineering in 1992; both from the University of Trondheim, Norway. Since 1980 he has been working with ultrasound technology applied to blood flow measurements and imaging at the university of Trondheim, in cooperation with GE-Vingmed Ultrasound. He is currently professor of medical technology at the Norwegian University of Science and Technology, and has since 1987 given courses on ultrasound imaging and blood flow measurements for students in electrical engineering and biophysics. His research interests includes statistical signal- and image processing with applications in medical ultrasound imaging

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## Organizing Committee

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### General Chair

F.S. Foster

### Technical Chair

Geoff Lockwood

### Finance

Michael Kolios

### Short Courses

John Hossack

### Exhibits

Sorah Rhee

## Editorial

Marjorie Passini Yuhas

## Awards

Reinhard Lerch

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## Technical Program Committee

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### GROUP 1: Medical Ultrasonics

Vice Chair: **Stanislav Emelianov**: University of Texas at Austin, USA

- **Olivier Basset**: CREATIS, Université Lyon I, France
- **Geneviève Berger**: National Centre for Scientific Research (CNRS), France
- **Charles Cain**, University of Michigan, USA
- **Richard Chiao**: Ultrasound Group, Siemens Medical Solutions, USA
- **Lawrence A. Crum**: Applied Physics Laboratory, University of Washington, USA
- **Jan D'hooge**: Catholic University Leuven, Belgium
- **Emad Ebbini**: University of Minnesota, USA
- **David Evans**: Department of Cardiovascular Sciences, University of Leicester, UK
- **Kathy Ferrara**: University of California Davis, USA
- **Stuart Foster**: University of Toronto, Canada
- **James Greenleaf**: Mayo Clinic College of Medicine, USA
- **Anne Hall**: General Electric Medical Systems, USA
- **Christopher Hall**: Philips Research North America, USA
- **Peter Hoskins**: The University of Edinburgh, UK
- **John Hossack**, University of Virginia, USA
- **Kullervo Hynynen**: University of Toronto, Canada
- **Michael F. Insana**: University of Illinois, Urbana-Champaign, USA
- **Jorgen Jensen**: Technical University of Denmark, Denmark
- **Nico de Jong**: Erasmus Medical Centre and University of Twente, The Netherlands
- **Hiroshi Kanai**: Tohoku University, Japan
- **Jian-yu Lu**: University of Toledo, USA
- **Leonardo Masotti**: Università degli Studi di Firenze, Italy
- **James G. Miller**: Washington University in Saint Louis, USA
- **Kathy Nightingale**: Duke University, USA
- **William O'Brien**: University of Illinois, Urbana-Champaign, USA
- **Helen Routh**: Philips Research North America, USA
- **Georg Schmitz**: Ruhr-Universität Bochum, Germany
- **Ralf Seip**: Focus Surgery, Inc., USA
- **Mickael Tanter**: Laboratoire Ondes et Acoustique, ESPCI, France
- **Tom Thomas**: Ultrasound Division, Siemens Medical Solutions, USA
- **Kai Thomenius**: General Electric's Corporate R&D, USA
- **Hans Torp**: Norwegian University of Science and Technology, Norway
- **Piero Tortoli**: Università degli Studi di Firenze, Italy

- **Ton van der Steen**: Erasmus Medical Center, The Netherlands
- **Keith Wear**: US Food and Drug Administration, USA



### GROUP 2: Sensors, NDE, and Industrial Application

Vice Chair: **Jafar Saniie**: Department of Electrical & Computer Engineering, Illinois Institute of Technology, USA

- **Robert C. Addison**: Rockwell Science Center, USA
- **Walter Arnold**: Fraunhofer Institute for Nondestructive Testing, Germany
- **Nihat M. Bilgutay**: Department of Electrical and Computer Engineering, Drexel University, USA
- **Eric S. Furgason**: School of Electrical & Computer Engineering, Purdue University, USA
- **Jacqueline H. Hines**, Applied Sensor Research and Development Corporation, USA
- **Bernhard Jakoby**: Institute of Industrial Electronics and Material Science, Vienna University of Technology, USA

Austria

- **Fabien J. Josse:** Department of Electrical, Computer and Biomedical Engineering, Marquette University, USA
- **Lawrence W. Kessler:** Sonoscan Inc., USA
- **Pierre T. Khuri-Yakub:** Stanford University, USA
- **Jun-ishi Kushibike:** Department of Electrical Engineering, Graduate School of Engineering, Tohoku University, Japan
- **Lawrence C. Lynnworth:** Lynnworth Technical Services, USA
- **Roman Gr. Maev:** Professor & Director, Center for Imaging Research & Advanced Material Characterization, Department of Physics, University of Windsor, Canada
- **Massimo Pappalardo:** Lab of Acustoelectronics, Dipartimento di Ingegneria Elettronica, University di Roma TRE, Italy
- **Tony Sinclair:** Professor of Mechanical & Industrial Engineering, Department of Mechanical Engineering, University of Toronto, Canada
- **Bernhard R. Tittman:** Department of Engineering & Mechanics, Pennsylvania State University, USA
- **Jiromaru Tsujino:** Faculty of Engineering, Kanagawa University, Japan
- **Donald E. Yuhas:** Industrial Measurement Systems, Inc., USA
- **John F. Vetelino:** Lab for Surface Science & Technology, University of Maine, USA

### GROUP 3: Physical Acoustics

Vice Chair: **Kenneth Lakin:** TFR Technologies, Inc., USA

- **Art Ballato:** Chief Scientist, US Army CECOM RDEC AMSEL-RD-CS, USA
- **Mack Brezazale:** Department of Physics, University of Mississippi, USA
- **Jan Brown:** JB Consulting, USA
- **David Hecht**
- **Fred Hickernell**
- **Yoonkee Kim:** US Army CERDEC, AMSRD-CER-C2, USA
- **Amit Lal:** Assistant Professor, School of Electrical & Computer Engineering, Cornell University, USA
- **John Larson**
- **Moises Levy:** Department of Physics, Naples, Florida, USA
- **George Mansfield:** Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia
- **Kiyoshi Nakamura:** Department of Electrical & Communication Engineering, Graduate School of Engineering, Tohoku University, Japan
- **Valeri Proklov:** Institute of Radio Engineering & Electricity, Russia
- **Rich Ruby:** Avagotech, USA
- **Edgar Schmidhammer**
- **Susan Schneider:** Department of Electrical & Computer Engineering, Marquette University, USA
- **Bikash Sinha,** Schlumberger-Doll Research, USA
- **Yook-Kong Yong:** Department of Civil & Environmental Engineering, Rutgers University, USA

- **John Vig:** US Army CECOM, AMSEL-RD-C2-PT, USA
- **Ji Wang:** Department of Engineering Mechanics and Materials Science, Ningbo University, China



### GROUP 4: Surface Acoustic Waves

Vice-Chair: **Peter M. Smith:** McMaster University, Canada

- **Benjamin Abbott:** SAWTEK, USA
- **Sylvain J. Ballandras:** LPMO, France
- **Kushal Bhattacharjee:** RF Microdevices, USA
- **Sergey Biryukov:** Sergey Biryukov: IFW Dresden, Germany
- **Mauricio Pereira da Cunha:** University of Maine, USA
- **Yasuo Ebata:** Fujitsu, Japan
- **Gernot Fattinger:** Infineon Technologies, Germany
- **Ken-ya Hashimoto:** Chiba University, Japan
- **Daniel Hauden:** CNRS-LPMO, France
- **Mitsutaka Hikita:** Kogakuin University, Japan
- **Chunyun Jian:** Nortel Networks, Canada
- **John Kosinski:** US Army, USA.
- **Donald Malocha:** University of Central Florida, USA
- **David Morgan:** Impulse Consulting, UK
- **Hiroyuki Odagawa:** Tohoku University, Japan
- **Victor Plessky:** GVR Trade SA, Switzerland
- **Bob Potter:** Vectron International, USA
- **Leonhard Reindl:** University of Freiburg, Germany
- **Arne Ronnekleiv:** Norwegian Institute of Technology, Norway
- **Clemens Ruppel:** Epcos, Germany
- **Takahiro Sato:** Samsung, Japan
- **Marc Solal:** SAWTEK, USA
- **Robert Weigel:** University of Erlangen-Nuremberg, Germany

### GROUP 5: Transducers and Transducer Materials

Vice Chair: **Scott Smith:** GE Global Research, USA

- **Christopher Daft:** Siemens Medical Systems, USA
- **Levent Degertekin:** Woodruff School of Mechanical Engineering, Georgia Institute of Technology, USA
- **John Fraser:** Philips Medical Systems, USA
- **Jean-Francois Gelly:** GE Healthcare, France



- **Reinhard Lerch:** Department of Sensor Technology, Friedrich-Alexander-University of Erlangen-Nuremberg, Germany
- **Geoff Lockwood:** Department of Physics, Queen's University, Canada
- **Clyde Oakley:** W.L. Gore, USA
- **Yongrae Roh:** Kyungpook National University, Korea
- **Mark E. Schafer:** Sonic Tech Inc., USA
- **Thomas ShROUT:** Materials Research Lab, Pennsylvania State University, USA
- **K. Kirk Shung:** Bioengineering Department, University of Southern California, USA
- **Stephen W. Smith:** Department of Biomedical Engineering, Duke University, USA
- **Wallace A. Smith:** Materials Division, Office of Naval Research, USA
- **Yasuhito Takeuchi:** Department of Information & Computer Science, Faculty of Engineering, Kagoshima

- University, Japan
- **Vasundara Varadan:** Department of Electrical Engineering, University of Arkansas, USA
- **Jian Yuan:** Boston Scientific, USA
- **Qiming Zhang:** Materials Research Lab, Pennsylvania State University, USA

## 2006 IEEE Int'l Frequency Control Symposium Highlights

### 2006 IEEE International Frequency Control Symposium Highlights 5 – 7 June 2006 Miami, FL USA

#### Reflections from the General Chair



**Mike Driscoll,  
General Chair,  
opening the  
Symposium**

2006 marked the first IEEE International Frequency Symposium (IFCS) held as a non-joint meeting since 2002. The 2006 meeting was also the first-ever IFCS held in Miami. The meeting followed the usual format of one day of Tutorials followed by three days of technical sessions. The technical sessions comprised 198 papers presented by authors from 27 countries on 6 continents. Don Malocha was the Technical Program Committee Chair, and did a fine job of assuring the technical success of the meeting.

John Prestage arranged the Tutorial Program, which included a number of new topics presented by an international group of speakers. The web-based site for abstract submission and program preparation worked smoothly and to everyone's satisfaction. Debra Coler (OEWaves, Inc.) accomplished her usual outstanding job as the TPC Administrator, as did Barbara McGiveny (Synergistic Management, Inc.), the Meeting Manager. Student attendance at both the Tutorial and Technical sessions exceeded expectations, due to the efforts of Kurt Gibble and Tom Parker. Five Student Poster Paper Competition winners were awarded laptop computers and were recognized at the Welcome Reception and the President's reception, hosted by Art Ballato. Also

recognized were the numerous corporate and laboratory "sponsors" of the meeting. There were 22 exhibit booths at the Symposium, thanks to the efforts of Jack Kusters, the exhibit Chair.



**UFFC President, Art Ballato, addressing the opening session**

The Hyatt Regency Miami hotel facilities (including meeting rooms, exhibit hall, and food and beverage) were excellent and offered attendees a unique opportunity to interact both technically and socially. The 2006 IFCS was also the site of the UFFC ADCOM meeting and the Joint Program Committee (JPC) meeting for next year's joint conference with the European Time and Frequency Forum to be held in Geneva at the end of May. The success of the 2006 IFCS was due to many hours of work on the part of those volunteers serving on the Organizing Committee and Technical Program Committee. Their expertise, commit-

ment and continued service to the UFFC Society have my grateful thanks.

**Mike Driscoll**  
General Chair

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## The Technical Program Chair's Review

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**Don Malocha, Technical Program Committee Chair**

The 2006 IEEE IFCS held in Miami Florida had over 350 attendees and 198 contributed and invited talks. The 3 day symposium had 3 parallel sessions and 2 poster sessions. In addition, there was a special student poster competition; the winners in each group receiving a laptop computer. Student participation nearly doubled this year with over 45 students attending. Tutorials were offered the day before the opening of the technical program and over 60 registrants chose between 12 different courses.

The Plenary session was delivered by Dr. Frank De Lucia entitled "Terahertz Spectroscopy and Applications" and was both interesting and informative. A special commemoration of Prof. Raymond D. Mindlin's 100th birthday was organized; a pioneer in BAW theory. There were 2 sessions dedicated to past and continuing areas of research that were introduced through Mindlin's work; attended by not only interested practitioners, but also, his past students, grand-students and great-grand-students. What a "great-grand" legacy!

In addition, there was a strong effort by the TPC to solicit and encourage invited and contributed talks in the area of optical frequency standards and related technology. The TPC members, with a special thanks to Scott Diddams, did a great job increasing the number of submissions and attracting international experts to the symposium.

Breaks in the technical program presentations provided an opportunity to meet colleagues, catch up on business, discuss opportunities, and trade stories of family and friends. The Welcome Reception was well attended and fun; a two man Latin band provided background music during the socializing, eating and drinking. A short break allowed presentation of the Piezoelectric Devices Association Awards and the student poster competition award winners.

The poster sessions were adjacent and in the same area as the exhibits, which allowed maximum opportunity for attendees and exhibitors to interact and conduct business. In the exhibit area, the attendees enjoyed their coffee breaks and the Wireless Café allowed attendees to stay connected to their offices and universities. Following the afternoon poster

session, the Exhibitor's Reception was also well attended and allowed the mixing of business and pleasure.

The technical program was very successful and a sincere thanks to the entire technical program committee and support team for their time, efforts and contributions.

**Don Malocha**  
TPC Chair

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## Attendance

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The total attendance for the 2006 IEEE IFCS was 360, which included:

IEEE Members	121
Non-Members	86
One Day	8
Students	65
Retirees	2
Life Members	3
Complimentary Invited	13
Exhibit Only	62

Attendees represented 27 countries. 64 percent were from the United States. The next largest single country attendance was 8.7 percent from Japan, 6.8 percent from France, 5.3 percent from Germany, 2.7 percent from China, and just under 2 percent each from the United Kingdom and Israel.

The attendance by Regions as designated by IEEE was:

Regions 1 –6 (USA)	64.01%
Region 7 (Canada)	2.07%
Region 8 (Europe, Middle East, Africa)	19.47%
Region 9 (Central and South America)	0.59%
Region 10 (Asia, Australia, New Zealand)	15.34%

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## Tutorials

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The tutorials for the 2006 Frequency Control Symposium held on Sunday, June 4, 2006 were split into three parallel sessions: A) Noise Measurement and Time Transfer, B) Quartz and Atomic Clocks, and C) Resonant Sensors. There were a total of 63 attendees.

In session A Craig Nelson gave the first tutorial entitled, "Phase Noise Measurements", which focused on how such measurements are made with particular emphasis on cross-correlation techniques. Enrico Rubiola gave the second tutorial, "The Leeson Effect: Phase Noise in Feedback Oscillators", which described how this effect relates to the corner frequency where oscillator noise characteristics change between flicker and white phase and how the Leeson effect can be used to extract more detailed information from manufacturer data sheets on noise characteristics. The third tutorial given by Sam Stein on "Digital Measurement of Precision Oscillators" described various measurement techniques for characterizing clocks and oscillators and the statistics used to quantify the results of these measurements. The last tutorial in session A given by Judah Levine on "Time and Frequency Transfer" described the different types

of time and frequency transfer, including one-way transmission from an active to a passive receiver, two-way between two active stations and common-view between multiple passive receivers listening to one transmitter. Specific examples were discussed in detail.



**John Vig presenting his quartz frequency standards tutorial**



**Clark Nguyen presenting his MEMS tutorial**



**Bill Riley presenting his passive atomic clocks tutorial**

The first tutorial in session B by John Vig on "Introduction to Quartz Frequency Standards" discussed the basics of how crystal oscillators work and how the various crystal cuts impact such characteristics as temperature stability, aging and noise. The next tutorial given by Clark Nguyen on "Microelectromechanical Systems (MEMS) for Frequency and Timing References" discussed this rapidly evolving field with special emphasis on how it is being used to create GHz resonators with Q's of over 10,000 and how these devices may ultimately provide vast simplification in the telecommunications industry. The next tutorial was given by Bill Riley on "Passive Atomic Frequency Standards" discussed how atomic clocks work in general with an emphasis on the rubidium, which is his specialty.

The last tutorial in session B was given by Seth Foreman substituting for Jun Ye on "Optical Frequency Measurement and Synthesis". Seth focused on the details of how optical frequency combs work and how these devices have largely revolutionized the field of optical frequency standards.

In session C, the first two tutorials were parts I and II of "Acoustic Foundations of Piezoelectric Sensors", both given by Gerhard Fischerauer. Since the properties of piezoelectric devices depend on their chemical and biological environment, they have evolved into excellent sensors for these quantities. Prof. Fischerauer gave a detailed theoretic introduction to the workings of these sensors. This was extended by Diethelm Johannsmann with a tutorial on "Physic-Chemical Foundations of Piezo-Acoustic Sensors". This tutorial focused on how Bulk Acoustic Wave (BAW) resonators interact with their environment with special attention given to three different models used to predict their behavior. Session C was rounded out by Fabien Josse with a tutorial on "Piezoelectric Sensors as Electronic/electrical Devices" that focused on types of piezoelectric crystal sensors that are available as commercial products: thickness shear mode (TSM) resonators and surface acoustic wave (SAW) devices.

**Eric Burt**  
Associate Newsletter Editor

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## The Plenary Session

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On Monday morning, 5 June 2006 Mike Driscoll, General Chair, officially declared the Symposium open followed by an Awards Presentation and a Plenary Session. The awards ceremony may be found under the FREQUENCY CONTROL AWARDS section of this newsletter.



**Mike Garvey introducing plenary speaker Frank De Lucia**



**Frank De Lucia giving his plenary talk on Terahertz Spectroscopy and Applications**



**Art Ballato with Frank De Lucia and Mike Garvey**

This year's FCS plenary talk, "Terahertz Spectroscopy and Applications" was given by Frank De Lucia of Ohio State University. Prof. De Lucia is former chairman of both the physics department at Duke University and the physics department at Ohio State University and is currently Distinguished Professor of Physics at Ohio State and director of the Microwave Laboratory there. He is winner of the 1992 Max Planck Research Prize in physics and the 2001 William F. Meggers Award of the Optical Society of America. He was introduced by Symmetricom chief scientist Dr. Mike Garvey who was a student of De Lucia's at Duke.

De Lucia's talk focused on the sub-mm/THz region between microwave and optical wavelengths. In its quest for high Q, the frequency standards community has often skipped over this region, yet De Lucia pointed out that it has many opportunities. Among them: molecular vibration levels peak in the THz region, both high absorption (100 dB/km) and low (windows of 1 dB/km) exist in the atmosphere at this wavelength range, enabling studies of atmospheric chemistry and astrophysics. Also, explosive detection and medical applications may be improved by using active and passive imaging in this wavelength region. Precision spectroscopy in the THz range can also be performed by down-converting from optical frequencies using new techniques recently developed for optical standards. De Lucia mentioned an approach to spectroscopy that uses a chirped VCO mixed with a frequency comb, which is very similar to an approach now being used for optical spectroscopy. Because of the broad nature of the comb, combined with the precise frequencies of the comb "teeth", this approach is able to sweep out an entire spectrum quickly thereby increasing data rates and avoiding frequency drift.

De Lucia mentioned several high-profile instruments that currently use THz spectroscopy including, the Hershell-Planck space telescope that investigates star formation and the early universe in the far-IR/sub-mm wavelength range. The ALMA (Atacama Large mm Array) will also use sub-mm wavelengths to study formation of astronomical objects and relic radiation from the Big Bang.

Finally De Lucia noted that some materials are partially transparent at sub-mm wavelengths and so may make THz sources useful for such security applications as weapons detection under clothing.

**Eric Burt**

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## Student Poster Competition

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Each year FCS conducts a student paper competition. The Technical Program Committees (TPC) selects student paper finalists in each of the major technical areas of the symposium.

The selection criteria are:

- Student is first author.
- Work is of high quality and done by the student.
- Abstract clearly describes the work and includes results.
- Student has not won the student prize previously.

This year 19 finalists were selected at the TPC meeting from among 46 submissions. The submissions and finalists are distributed across each of the 5 FCS groups. The com-

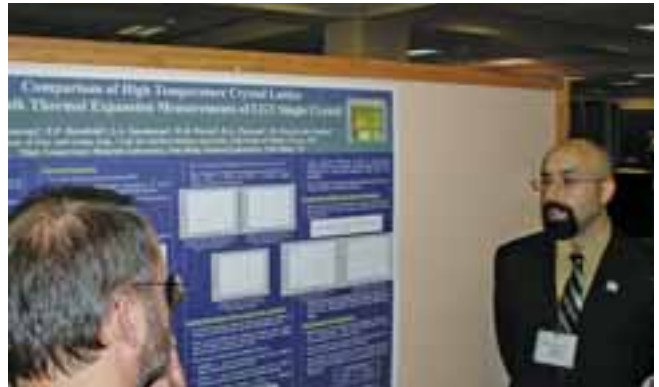
petition is organized by Awards Chair, Tom Parker, and Academic Chair, Kurt Gible, with finalists being selected by the members of each group of the TPC. All finalists received a certificate during the Welcoming Reception of the 2006 IEEE International Frequency Control Symposium 5 June 2006 in Miami, Florida, USA.



**FCS standing committee academic chair, Kurt Gible**

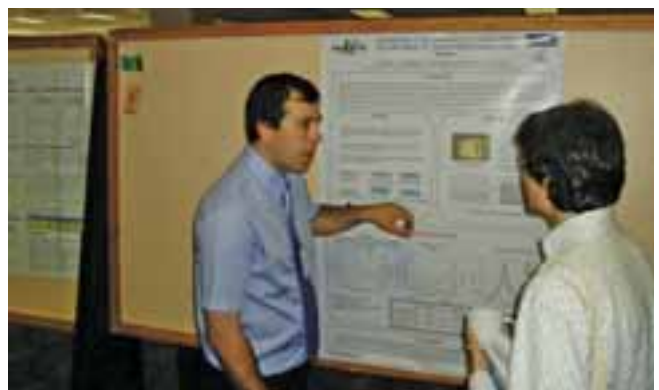
The following are this year's Student finalists.

### Group1: Materials and Resonators



**Timothy Beaucage**

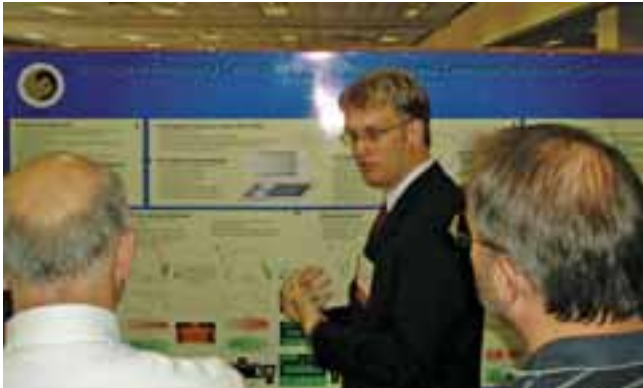
Comparison of High Temperature Crystal Lattice and Bulk Thermal Expansion Measurements of LGT Single Crystal by Timothy Beaucage, Scott Speakman, Wallace Porter, Andrew Payzant, Eric Beenfeldt, Mauricio Pereira Da Cunha



**Dorian Gachon**

Development of High Frequency Bulk Acoustic Wave Resonator Based on Thinned Monocrystalline Lithium Niobate by Dorian Gachon, Gwladys Lengaigne, Ludovic Gauthier-Manuel, Sylvain Ballandras, Vincent Laude





**Daniel Gallagher**

Orthogonal Frequency Coding for Use in Ultra Wide Band Communications and Correlators by Daniel Gallagher, Nikolai Kozlovski, Donald Malocha



**Rodolphe Boudot**

Development of ultra low phase noise X-Band oscillators by Rodolphe Boudot, Vincent Giodano, and Olivier Llopis



**Mihir Patel**

Conceptual Designs of a High Q, 3.4 GHz Quartz Thin Film Resonator by Mihir Patel, Yook-Kong Yong



**Alan Brannon**

A Local Oscillator for Chip-Scale Atomic Clocks at NIST by Alan Brannon, Milos Jankovic, Jason Breitbarth, Zoya Popovic, Vladislav Gerginov, Vishal Shah, Svenja Knappe, Leo Hollberg, John Kitching

## Group 2: Oscillators, Synthesizers, and Noise



**Karim Benmessai**

Study of paramagnetic properties of Fe<sup>3+</sup> ions to realizing Whispering Gallery Maser Oscillator by Karim Benmessai, Pierre-Yves Bourgeois, Mark Oxborrow, Nicolas Bazin, Yann Kersale, Vincent Giordano



**Jaehyun Lim**

Miniature Oven Controlled Crystal Oscillator (OCXO) on a CMOS Chip by Jaehyun Lim, Hyunsoo Kim, Kyusun Choi, Thomas Jackson, Dave Kenny



**Bertrand Onillon**

Optimized Optical Links for High Spectral Purity Ku-Band Signal Distribution by Bertrand Onillon, Benoit Benazet, Jacques Rayssac, Olivier Llopis



**Vishal Shah**

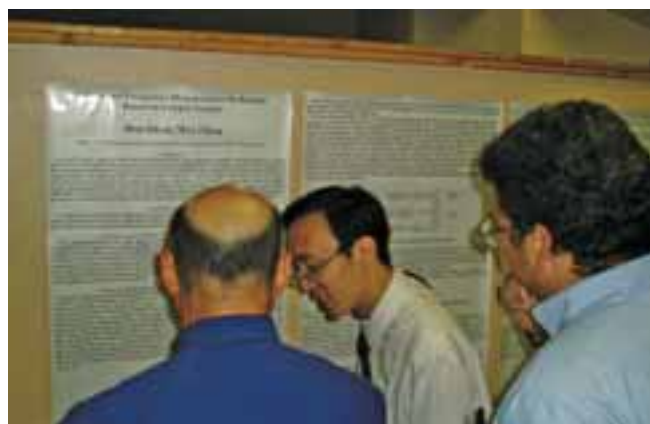
Continuous Light Shift Correction in Modulated CPT Clocks by Vishal Shah, Svenja Knappe, Vladislav Gerginov, John Kitching

### Group 3: Atomic and Optical Standards and Time Keeping



**Jonathan Cox**

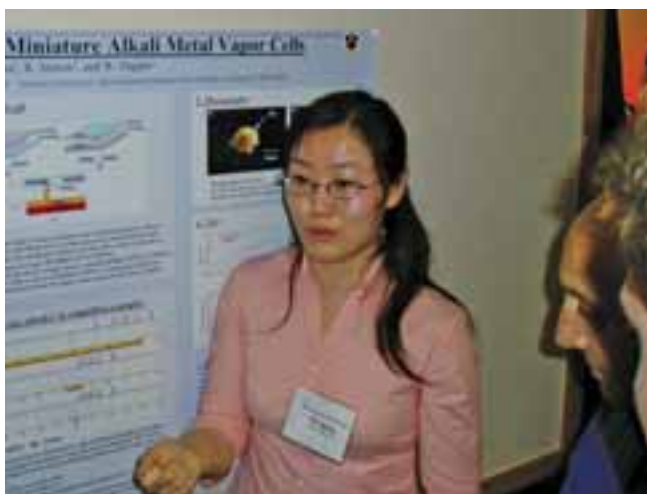
An Ultraviolet Diode Laser System for Laser Cooling Trapped Ytterbium Ions by Jonathan Cox, Marko Cetina, Franz Kartner, David Kielpinski



**Hui Zhou**

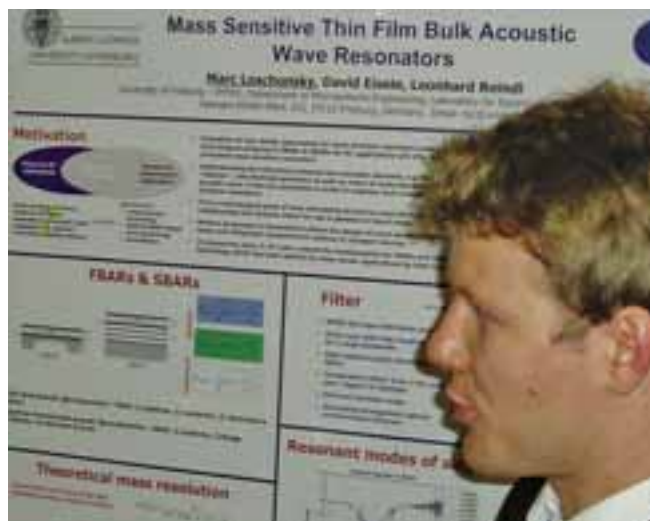
A Time and Frequency Measurement Technique Based on Length Vernier by Hui Zhou and Wei Zhou

### Group 4: Sensors and Transducers



**Fei Gong**

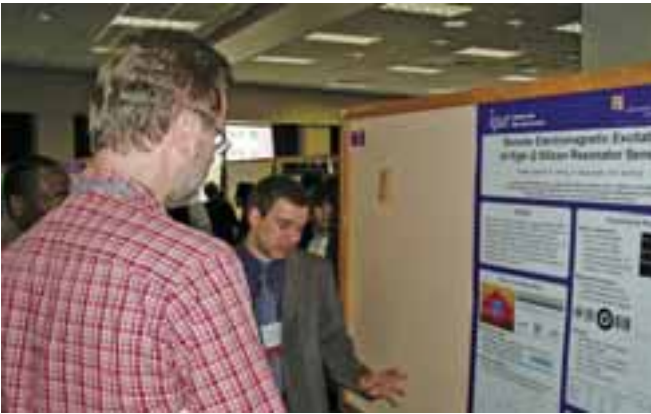
Electrolytic Fabrication of Atomic Clock Cells by Fei Gong, Yuan-Yu Jau, Katharine Jensen, William Happe



**Marc Loschonsky**

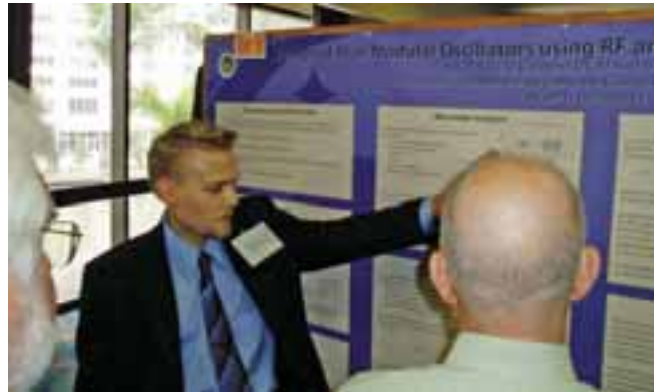
Mass Sensitive Thin Film Bulk Acoustic Wave Resonators by Marc Loschonsky, David Eisele, Leonhard Reindl

## Group 5: Manufacturing and Test Technology



**Frieder Lucklum**

Remote Electromagnetic Excitation of High-Q Silicon Resonator Sensors by Frieder Lucklum, Bernhard Jakoby, Peter Hauptmann, Nico de Rooij



**Nikolai Koslovski**

Design of Mini-Modular Oscillator Using RF and Microwave Design Techniques by Nikolai Koslovski, Daniel Gallagher, Erica Wells, Donald Malocha, Eric Hague



**Fang Li**

Characterizing Extracellular Matrix (ecm) Produced by Fibroblasts in Culture Using tsm Resonator by Qing-Ming Wang, Fang Li, James H-C. Wang



**Jeremy Masson**

High Overtone Bulk Acoustic Resonators Built Using Aluminum Nitride Thin Films Deposited Onto at-Cut Quartz Plates by Jeremy Masson, Dorian Gachon, Sylvain Ballandras, Jean-Michel Friedt, Laurent Robert, Nicolas Bazin, Gilles Martin, Sebastien Alzuaga, Blandine Guichardaz

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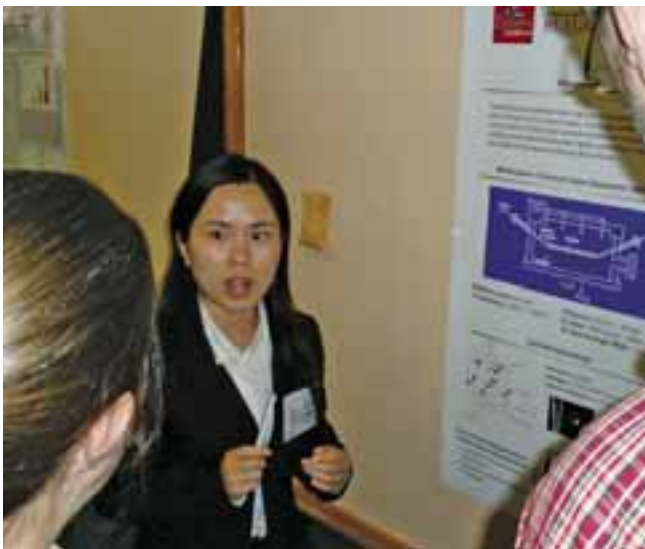
### Student Paper Winners

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On the first day of the 2006 IEEE International Frequency Control Symposium 5 June 2006, the Student Paper Finalists were presented for judging by a panel of experts from each of the major technical groups. The judges selected the winning Student Papers based on:

- Clarity of student's presentation.
- Depth of student's knowledge.
- Degree of the student's contribution to the project.
- Relevancy of the work to the field.

The Student Paper winners were announced at the Welcome Reception Monday evening. Tom Parker, Frequency Control Awards Chair, Art Ballato, UFFC Society President, and Mike Driscoll, Symposium General Chair, presented the



**Zheng Zhang**

ZnO nanotip-Based QCM Biosensors by Zheng Zhang, Hanhong Chen, Jian Zhong, Ying Chen, Yicheng Lu

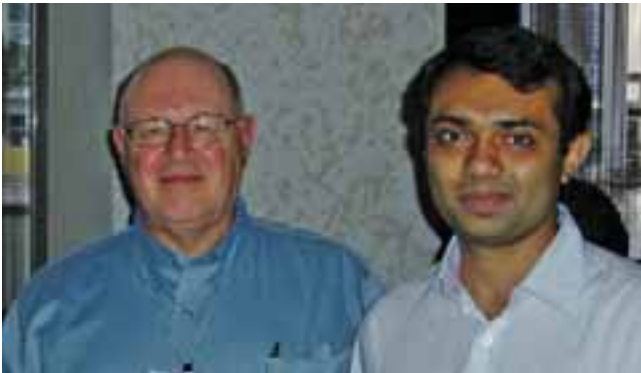
winners with a certificate, a commemorative laser etched UFFC “crystal,” and a laptop Computer with carrying case and mouse. Congratulations to all!



**Mihir Patel, Group 1 Winner, with Mike Driscoll**



**Rodolphe Boudot, Group 2 Winner, with Mike Driscoll**



**Vishal Shah, Group 3 Winner, with Mike Driscoll**



**Frieder Lucklum, Group 4 Winner, with Mike Driscoll**



**Jeremy Masson, Group 5 Winner, with Mike Driscoll**

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## Optical Frequency Standards Sessions

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This year the FCS TPC invited several speakers in the rapidly evolving field of optical frequency standards (ref UFFC Newsletter #40, Spring 2006, p. 85). This very successful endeavor resulted in 4 excellent sessions on this topic. At the paper selection meeting in March, 2006, group 3 of the TPC found that the invited and contributed papers in this area were about equally divided between standards based on neutral atoms and those based on trapped ions. Two sessions on each sub-category were formed with neutral atom standards further broken down into standards based on neutral atoms trapped in optical lattices and those based on ballistic neutral atoms.

Many people in the field of neutral atom standards have assumed that due to the light shift (AC Stark shift due to the electric field component of the light) the light used to capture and cool atoms must be off during the sensitive interrogation period. This results in ballistic standards such as the atomic fountains. However Katori and co-workers showed that for some atoms, there is a wavelength of light where the light shifts of the ground and excited state of the clock transition are the same and so effectively cancelled. This so-called magic wavelength is now being used in optical lattice clocks where the lattice beams employed for atom confinement stay on during interrogation and contribute less than 10<sup>-17</sup> to the fractional uncertainty of the clock. It is fitting therefore that the first talk in the Optical Lattice Clocks I session was Masao Takamoto who works in Katori's lab. He reported on their work using 87Sr atoms in an optical lattice at 813.420 nm with a clock transition at 429 THz. Their standard is phase locked with an optical comb and comparisons on the clock transition have been made using GPS carrier phase time transfer to the 10<sup>-14</sup> level. Mr. Takamoto also reported on work to extend their optical lattice to 3D as a way of trapping more atoms and improving the signal-to-noise ratio.

The second talk in this session was given by Chris Oates from NIST who reported on an optical standard based on Yb atoms trapped in a lattice and another one based on ballistic Ca atoms. While one tooth of an optical frequency comb is locked to the Yb standard another tooth of the comb is beat against the Ca standard to provide a comparison. Dr. Oates reported a stability of 4x10<sup>-15</sup> at one second of averaging

time in this comparison with agreement at the  $1 \times 10^{-15}$  level. He also reported on plans to make a more robust version of an optical standard that might be portable as well as also having plans to create a 3D lattice.



**Leo Holberg (l) with Georgio Santarelli**

The first optical standards session was rounded out by a talk given by Georgio Santarelli on a state-of-the-art optical-fiber-based frequency transfer system that achieves  $10^{-18}$  stability, thus performance that would not limit emerging optical clock performance and a talk given by P. Lemonde on tests of Quantum Electrodynamics conducted by measuring the Casimir force in atoms trapped in an optical lattice near a mirror.

The second session on neutral optical clocks began with an invited talk given by S. Foreman, filling in for J. Ye of JILA on their  $87\text{Sr}$  optical lattice clock. The clock laser is locked to a ULE cavity supported vertically by an attachment at its center, thereby canceling vertical vibration effects. A cavity drift of  $0.5 \text{ Hz/s}$  was observed and using this cavity-stabilized laser a  $5 \text{ Hz}$  atomic line was observed resulting in an atomic line Q of  $2.7 \times 10^{14}$ .

Continuing in this session P. Lemonde gave an invited talk on a French version of the  $\text{Sr}$  optical lattice clock. Lemonde pointed out that while the light shift, which relates to the atomic polarizability, is cancelled at the magic wavelength, higher-order effects, also known as hyperpolarizability, may not be. This second-order light shift was searched for and found to be  $4(4) \text{ mHz/E}^2$ , which will not limit the performance of their clock at this time. Lemonde's lab has compiled an accuracy budget of  $1.2 \times 10^{-14}$  for their  $\text{Sr}$  clock and have performed  $\text{Sr/Cs}$ -fountain comparisons with  $5 \text{ Hz}$  uncertainty.



**(l - r) Fritz Riehle, Patrick Gill and Jim Bergquist**

The third invited talk in this session was given by Fritz Riehle of PTB on ballistic  $\text{Ca}$  optical standards.  $\text{Ca}$  has several significant advantages. First the clock is based on a forbidden  $1\text{S}_0\text{-}3\text{P}_0$  transition that has no electric quadrupole shift. Second  $\text{Ca}$  has the lowest cold atom collision shift of any atom where this shift has been measured. However spurious Doppler shifts introduced by ballistic atom velocity and other causes give rise to a residual Doppler effect of  $0.15 \text{ Hz}$ . The black body shift remains the largest systematic in the PTB  $\text{Ca}$  standard and a total error budget of  $8 \times 10^{-16}$  was reported. Riehle also reported on a novel horizontal support of their clock frequency cavity that reduces sensitivity to vertical vibrations.



**Patrick Gill**

The third optical standards session focused on single ion optical clocks. This approach to optical standards has had a long and rich history dating back to Dehmelt and Wineland in the 1970's. It is fitting therefore that the first talk in this session was given by Patrick Gill of NPL who himself has been an integral part of that history. Gill reported on NPL's  $88\text{Sr}^+$  and  $171\text{Yb}^+$  single ion standards.  $\text{Sr}^+$  does have an electric quadrupole shift, but by using a cancellation scheme proposed by W. Itano, this shift is greatly reduced. A  $1.5 \text{ Hz}$  error budget on the  $674 \text{ nm}$  quadrupole transition in  $\text{Sr}^+$  was reported corresponding to an uncertainty of  $3.4 \times 10^{-15}$ . NPL's  $\text{Yb}^+$  standard based on an octopole transition at  $467 \text{ nm}$  has great potential due to its lack of an electric quadrupole shift but is less developed.

In the second invited talk of this session, P. Dube of NRC in Canada expanded on the electric quadrupole issue by describing his cancellation scheme for the effect in  $88\text{Sr}^+$ . An average over Zeeman components gives an uncertainty in this effect of  $5 \times 10^{-18}$  in the NRC experiment. Other effects were analyzed as well and an atomic line of  $4.5 \text{ Hz}$  was measured resulting in an atomic line Q of  $10^{14}$ .

Another approach to the electric quadrupole shift in trapped ion standards is to use an ion whose clock transition doesn't have one. Such an ion (in addition to  $\text{Yb}^+$  already mentioned) is  $\text{In}^+$  and a talk on continuing work on this ion was given by R. Dumke, a member of L. Wang's group at MPI in Germany. This group is continuing the work of H. Walther, the first group to trap this difficult ion singly. Many optical standards require UV laser light and synthesis of this light can be quite difficult. Recently diode lasers have been

developed that reach into the UV and the last talk in the session by J. Cox of MIT was on gallium nitride UV diode lasers made to operate below 370 nm.



**Jim Bergquist**

One of the most widely regarded researchers in the field of trapped ion optical standards is Jim Bergquist of NIST. Bergquist, who was also awarded this year's Rabi award (See UFFC AWARDS in this newsletter), led off the 4th and final session on optical standards, reporting on NIST's Hg<sup>+</sup> and Al<sup>+</sup> trapped ion standards. Al<sup>+</sup> is somewhat unique among optical standards in that it has no practical cooling transition. In NIST's Al<sup>+</sup> clock, this ion is co-located within a linear ion trap with a Be<sup>+</sup> ion. The latter is readily laser-cooled and it then sympathetically cools the Al<sup>+</sup> ion via coulomb interaction. After the Al<sup>+</sup> ion is interrogated by the 267 nm clock laser, quantum logic techniques are used to transfer the internal Al<sup>+</sup> state to the Be<sup>+</sup> vibrational states where it can be read out. NIST also has a Hg<sup>+</sup> optical standard and when the two are beat together the resultant fractional frequency difference averages down as  $6 \times 10^{-15}/t^{1/2}$  to  $4 \times 10^{-17}$  at 30,000 s. An error budget has been evaluated for Al<sup>+</sup> with an uncertainty of  $2.6 \times 10^{-17}$ . NIST has compiled an error budget for the optical transition in Hg<sup>+</sup> with an uncertainty of  $7 \times 10^{-17}$  and compared Hg<sup>+</sup> with the NIST cesium fountain to derive an Hg<sup>+</sup> accuracy of  $9 \times 10^{-16}$ . The accuracy in Hg<sup>+</sup> and cesium was used to place an upper limit on the time variation of the fine structure constant of  $< 1.5 \times 10^{-16}/\text{year}$ .

C. Tamm from PTB spoke next on the PTB single Yb<sup>+</sup> ion optical clock. They have built two such clocks and the beat frequency between them averages down as between 7 and 30



**Scott Diddams**

$\times 10^{-15}/t^{1/2}$ . The primary systematics have been measured and an absolute uncertainty of the clock of  $9 \times 10^{-15}$  was reported for the 688 THz clock transition. By comparing Yb<sup>+</sup> to Hg<sup>+</sup>, PTB is able to constrain the magnitude of variations in the fine structure constant to  $< 2.1 \times 10^{-16}/\text{year}$ .

S. Diddams from NIST, who led the effort to organize these sessions, gave the next talk on how absolute optical frequency measurements are made with uncertainties below  $10^{-15}$ . One of the most important advances in optical standards was the invention of the octave-spanning frequency comb, which made it possible to phase-coherently link optical frequencies to microwave frequencies where electronics exist to count them. Initially this was accomplished using a mode-locked femtosecond pulsed Ti:sapphire laser to pump a highly non-linear microstructure fiber. Sum-frequency mixing of the Ti:sapphire modes inside the fiber broadened the spectrum to over an octave. Diddams reported that by increasing the power inside the Ti:sapphire laser cavity, the octave can be spanned by that laser alone, without the fiber. In practice the fiber is still used to augment the green end of the spectrum. With one tooth of the comb phase-locked to an optical standard, another tooth can be phase-coherently compared to the NIST cesium fountain resulting in a beat note between the two standards. Comparison of the NIST Hg<sup>+</sup> optical clock to the NIST cesium fountain averages down as  $2 \times 10^{-13}/t^{1/2}$  to a statistical uncertainty of  $8 \times 10^{-16}$ . Combined with a systematic uncertainty in the measurement of  $2 \times 10^{-16}$  the total uncertainty is  $9 \times 10^{-16}$ .

P. Hemelhoff from Stanford completed the session with a talk on a new technique for stabilizing the offset frequency in a femtosecond comb. The technique takes advantage of the high nonlinearity of the emitted electron beam current as a function of applied field in a field emission point (FEP). The FEP is biased with a DC voltage and then exposed to femtosecond laser light focused at the tip. The relative phase of the pulse envelope and the carrier determines the offset frequency of the comb. This relative phase also determines the field applied to the FEP tip over the duration of the pulse thereby changing the amount of current emitted. The detected current gives an error signal that can be applied to the comb to stabilize this offset.

**Eric Burt**  
Newsletter Associate Editor



**Atomic Clock Guys (l-r) Eric Burt, Tom Swanson, Chris Ekstrom, Kurt Gibble, and Robert Lutwak**

## Mindlin Sessions

The 2006 FCS conference highlighted two sessions commemorating the 100th anniversary of Professor Raymond D. Mindlin's birth and included several speakers and session chairs with academic lineage to Prof. Mindlin (denoted 1G, 2G, and 3G). The sessions were organized by Professor Yook-Kong Yong of Rutgers University. Prof. Yong is a second generation (2G) Mindlin student who studied at Princeton University under Prof. Peter Lee (1G). Indeed, it was a pleasure to see Prof. Lee, Mindlin's last student, in the session's audience.



(l-r) Mihir Patel 3G, Yook-Kong Yong 2G, Art Ballato, Peter Lee 1G, and Professor Morio Onoe

Professor Mindlin's seminal work at Columbia University in the area of vibrations of crystal plates, and works of the students that he guided and inspired, contribute greatly to our understanding of crystal resonators. It should be noted that Professor Mindlin's work was mostly completed before the advent of powerful computing machines. Today, opportunities abound to access massive computational power. The talks presented in the two sessions featured a pleasant mix of analytical approaches and computationally intensive techniques based on equations that are rooted in Mindlin theory.

Dr. Dan Stevens (2G-Tiersten) chaired the first Mindlin session. The opening invited speaker was Professor Yook-Kong Yong (2G-Lee). Prof. Yong spoke about the role and capability of Finite Element Analysis in the study of crystal plate vibrations.

It was an honor to have Professor Emeritus Morio Onoe, from Tokyo University, as our next speaker. Professor Onoe studied as a post-doc with Mindlin from 1956-1958 and later shared an office with Drs. Alan Meitzler and Harry Tiersten



Dan Stevens 2G

(1G) at Bell Telephone Laboratories. Professor Onoe spoke about an alternate analysis of vibrations of crystal plates with tilted edges, including a description of some of the efforts being made to extend Mindlin's analysis to SC-cut plates. Onoe's paper did not employ FEM techniques, rather, in the spirit of Mindlin, cast the problem in simple, intuitive functions that illustrate much of the underlying physics of strip crystals with tilted edges.

A paper from Professor Ji Wang's (2G-Lee) group at Ningbo University in China, describing an analytical technique for resonator parameter estimation, including dissipative effects and based on Mindlin's plate equations, was capably presented by his one-time colleague and friend Dr. C.S. Lam (2G-Lee) of TXC Corporation in Taiwan. S.Y. Pao from National Taiwan University presented work on parameter extraction and device optimization, based on Mindlin's 2D model. The first Mindlin session closed with an interesting twist with Prof. Rui Huang's (2G-Lee) presentation of an analysis of trapped torsional vibrations in elastic aluminum plates. Prof. Huang teaches at the University of Texas in Austin.

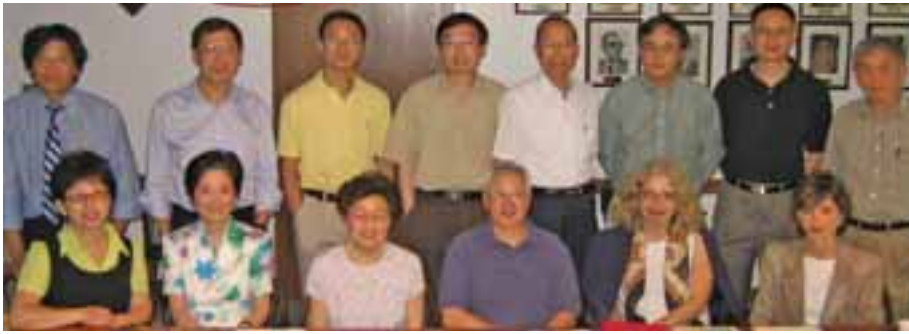
The second Mindlin session was chaired by Professor Yong (2G-Lee). The session opened with a presentation by Prof. Peter Lee (1G), recently retired and now Professor Emeritus at Princeton University. Professor Lee is well known for his work in developing trigonometric plate expansion equations, contrasted to Mindlin's expansion using powers of the thickness coordinate. Professor Lee presented an invited paper including an interesting analysis and improvement to the 2D theory of vibrations of isotropic elastic plates. Prof. Lee showed how a seemingly simple modification to Lee's trigonometric plate expansions provides accurate dispersion relations without the need for correction factors at relevant cutoff frequencies. Next, Prof. Onoe presented his second Mindlin ses-



Yook-Kong Yong 2G, Art Ballato, Peter Lee 1G and John Vig



Professor Morio Onoe with a colleague



**Dr. Lee and his studentstaken at Princeton University, June 2, 2006. Standing (from left to right): C.S. Lam, Y.K. Yong, Rui Huang, J.D. Yu, K.P. Chong, Peter Guo, Ninghui Liu, T. Chao Sitting (from left to right): Mrs. Lam, Mrs. Chong, Mrs. Lee, Peter C.Y. Lee, X. Markenscoff, G. Segol**

it is fair to say that Mindlin-based analysis, after all these years, is alive and well! With the retirement of Prof. Lee and the recent passing of Prof. Tiersten, it is probable that the last of the "1G" Mindlin students have passed through the academic system. Several of the 2G students are now teaching in academia, and it is now up to them to prepare the next "Mindlin generation."

Both sessions were very well attended - indeed, a fitting and wonderful tribute to a great researcher who established the analytical founda-

**Dan Stevens**



**Rui Huang**

sion paper describing characteristics of the complex branches of dispersion equations and Mindlin's angle for tilted edges. (His presentation brought back memories from our grad school days!) The session closed with a presentation from Ningbo University's Dr. J. Du, describing an analysis of piezoelectric plate vibrations taking into consideration the important stiffness and mass properties of the electrodes.

The Mindlin sessions were highly successful, bringing together many of the 1G, 2G, and 3G "students of Mindlin" along with several of Mindlin's former collaborators. Based on the quality of papers in the sessions,

tion of the quartz crystal industry!

### President's Reception

The President's Reception was held after the technical sessions on Tuesday evening, June 6th, in order for President Art Ballato to congratulate award winners, to thank the organizing and technical program committees and to recognize financial supporters of the Symposium. In addition to the good food served, several awards were handed out and special recognition was given to several former students of Raymond D. Mindlin who were present in honor of Mindlin and of the two special sessions held in his name at the conference.



## Special thanks to the Organizing Committee Members



**Mike Driscoll**  
General Chair



**Don Malocha**  
TPC Chair



**Ray Filler**  
Finance Chair



**Tom Parker**  
Awards Chair



**Mike Garvey**  
Publicity Chair



**Jack Kusters**  
Exhibits Chair



**Kurt Gibble**  
Academic Chair



**John Prestage**  
Tutorial Chair



**Barbara McGivney**  
Event Management  
& Registration



**Debra Coler**  
TPC Administrator



**President Art Ballato Thanking the Symposium Organizing Committee**



**Art with Mike Driscoll, General Chair**



**Art and Don Malocha, TPC Chair**



**Art with Jack Kusters, Exhibits Chair**



**Art and Ray Filler, Finance**



**Tom Parker, Awards and Vice Chair Group 3, and Art**



**Mike Garvey, Publicity, and Art**



**Kurt Gibble, Academic, and Art**



**John Prestage, Tutorials, and Art**



**Art and Barbara McGivney, Event Manager and Registration**



**Debra Coler, TPC Administrator, and Art**



Warren Walls, Chair Group 2, and Art



Eric Hague, Mtron and Art



Butch Tysinger, Chair Group 5, and Art



Poseidon Scientific Instruments Rep, and Art

### Financial contributors

In addition to the many people who volunteer significant amounts of time to make the conference a reality, some organizations also contribute to the conference financially. Special appreciation is due this year to:

- IEEE UFFC Society
- Frequency Electronics
- M-Tron
- Nasa/Jet Propulsion Laboratory
- National Institute of Standards Technology
- Northrop Grumman Corporation
- OEwaves Inc.
- Poseidon Scientific Instruments
- Symmetricom Inc.
- Timing Solutions



Art Ballato recognizes JPL for its financial support of FCS. Representing JPL were Lute Maleki, John Prestage and Bob Tjoelker



Sam Stein, Timing Solution, and Art



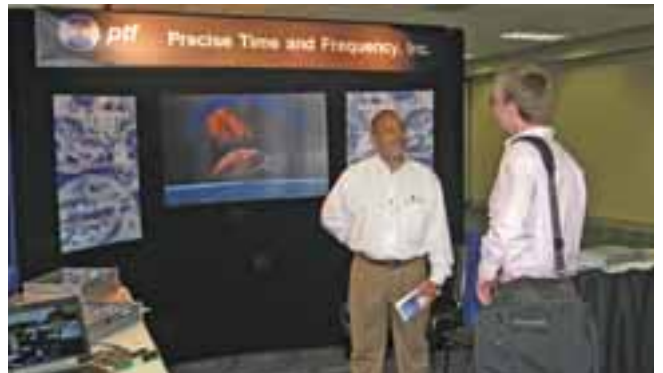
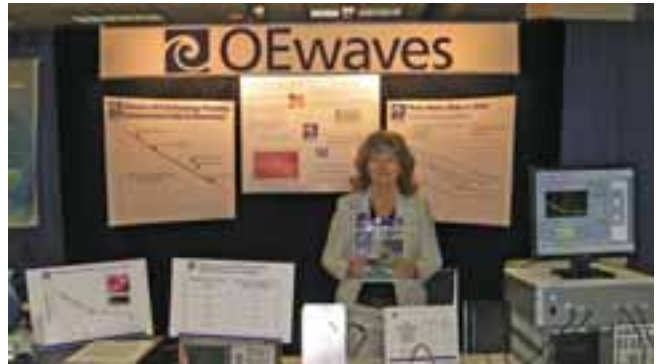
Symmetricom, represented by Robert Lutwak, Mike Garvey and Butch Tysinger, is recognized for financial support of FCS.



Mike Driscoll accepting thanks on behalf of Northrop Grumman

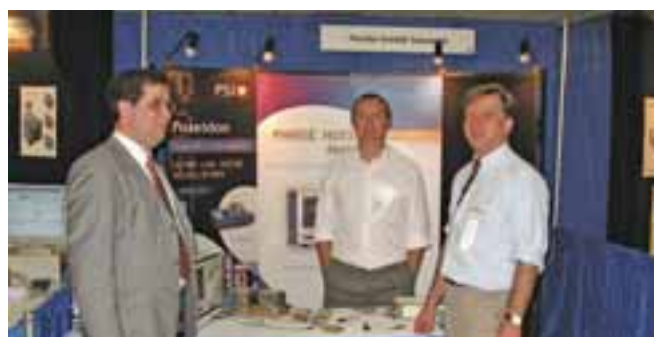


Frequency Electronics represented by Martin Bloch accompanied by his wife Tatiana, mother-in-law Anna, and the newest Frequency Controller Anna Sophia.



## EXHIBITORS

There were 20 exhibitors at this year's symposium. The Tuesday evening Reception was sponsored by the exhibitors and was held in the exhibitor area. With mid-day breaks and the posters also held in the exhibitor hall there were many opportunities for discussions and business among the attendees and exhibitors.





## Around the Symposium



Sharing a laugh



Clark Nguyen and Kushal Bhattacharjee



Rich Ruby



Mike Garvey and Frank De Lucia



**Yuan-yu Jau**



**Sam Stein and Peter Morely**



**Mihir Patel and Yook-Kong Yong**



**Masahiro Yoshimatsu, Takahiro Ohtsuka, Mitsuaki Koyama, Yukihiro Okajima**



**Bernd Neubig and his wife**



**At the plenary Ryzard Lec, Frank De Lucia, and Mike Garvey**



**Barbara McGivney**



**Bill Riley and Bernardo Jadusziwer**



**Tom Heavner and Tammie Chamillon**



**John Vig, Clark Nguyen, and Jan Brown**



**Dr. and Mrs. Shih Chuang, Statek**



**Jim Camparo telling a great joke!**



**Dan Stevens and Clark Nguyen**



**John Vig happy about the Sawyer Award!**



**Mike Nusbaum (r) and colleague**



**Angie VandenAverd and David Howe**



**Martin Bloch, Dan Stevens, and Warren Walls**



**Fabien Josse, Ryszard Lec, and Ralf Lucklum**



**Art and Margaret Ballato and Faye and Peter Lee**



**Manu Agarwal**



**Art Ballato and Morio Onoe**



**Tom Schyuler and colleagues**



**Lute Maleki**



**Anna Sophia – Just let me think, I know the answer!**



# 2007 Joint IEEE FCS & EFTF with ENC – GNSS – TimeNav '07

## TimeNav '07

## 2007 Joint IEEE International Frequency Control Symposium and European Frequency and Time Forum with ENC - GNSS

29 May – 1 June 2007

Geneva, Switzerland



Geneva, Switzerland  
2007

**TimeNav'07**

- a joint meeting:
  - European Frequency and Time Forum (EFTF)
  - Frequency Control Symposium (IEEE - FCS)
- an event of the European Group of Institutes of Navigation (EUGIN):
  - European Navigation Conference (ENC - GNSS)
- one single exhibition

TimeNav'07 - Geneva International Conference Center - 29 May - 1 June 2007



### Symposium Organizers

- Marcel Ecabert, Co-Chair and head of LOC, FSRM, CH
- Bernard Schlueter, Deputy, FSRM, CH
- Bernardo Jadoszilwer – Co-Chair, Aerospace, US
- Don Malocha, Univ. of Central Florida, US, JPC Chair and IFCS technical liaison
- Georgio Santarelli, SYRTE, FR, EFTF JPC co-chair and technical liaison

TimeNav'07 - Geneva International Conference Center - 29 May - 1 June 2007



### European Navigation Conference - ENC (Global Navigation Satellite System - GNSS)

- premier navigation conference in Europe
- focuses on the present status and on the future developments in navigation systems
- hosted on a rotating basis among EUGIN member-countries
- 2007 → 1st time hosted in Switzerland



TimeNav'07 - Geneva International Conference Center - 29 May - 1 June 2007



### Geneva



TimeNav'07 - Geneva International Conference Center - 29 May - 1 June 2007



### JPC Tentative Schedules

- 1<sup>st</sup> Call for Papers June 2006
- 2<sup>nd</sup> Call for Papers Sept. 2006
- Final Call for Papers Dec. 2006
- **Paper Submission due mid-January 2007**
- 1<sup>st</sup> JPC meeting – Wed., March 29, 2006, EFTF
- 2<sup>nd</sup> JPC meeting – Wed., June 7, 2006, IFCS
- 3<sup>rd</sup> JPC meeting – Friday, Feb. 9, 2007, Orlando, USA – paper selection
- 4<sup>th</sup> JPC meeting, final paper selection – end of Feb, 2007, Geneva, CH

TimeNav'07 - Geneva International Conference Center - 29 May - 1 June 2007

### First 2007 TPC meeting



TPC chair Don Malocha leading the first TPC meeting for the 2007 joint FCS/EFTF

The Technical Program Committee (TPC) for FCS usually meets twice each year with the first meeting dedicated to discussion of general planning issues and the second meeting primarily dedicated to paper selection. Previously both meetings were separate from the conference itself and there was a growing opinion within the TPC that this was inefficient. Starting in 2005 the first meeting of the year was held jointly with FCS in Vancouver. Most TPC members felt that this worked well and it was continued this year at Miami. In

2007 FCS will be held in Geneva, Switzerland jointly with the European Time and Frequency Forum (EFTF), so in this first TPC meeting we were joined by many of our European colleagues who serve on the EFTF program committee and were in attendance at FCS. Most of the discussion in this meeting focused on how sorting groups will appear in the call for papers as these are slightly different for EFTF.

**Eric Burt**

## Frequency Control Awards

Three IEEE UFFC Frequency Control Awards are presented annually at the IEEE International Frequency Control Symposium: the Cady Award, the Rabi Award, and the Sawyer Award.

Any of the three awards is open to any worker in any of the fields traditionally associated with the Frequency Control Symposium. The nominee should be responsible for significant contributions to the field selected. The awards shall be given to one or more specific individuals rather than to laboratories or groups. No posthumous awards will be made. The time span over which the contributions have occurred is not limited. The significance of the contributions may be measured, in part, by: the degree of initiative, ingenuity, and creativity displayed; the quality of the work and degree of success attained;

and the overall importance of the work and its impact on frequency control and associated communities.

The selection of the recipient for each award is made by the Frequency Control Symposium Technical Program Committee during its paper selection meeting. The decision of the committee is final. If, in the opinion of the committee, no suitable nominee exists or there are insufficient nominations, no award will be given.

Tom Parker, Chair of the Frequency Control Awards Committee, introduced the awards at the 2006 IEEE International Frequency Control Symposium 5 – 7 June in Miami, Florida, USA



**Tom Parker,  
Awards Chair**

## The W. G. Cady Award

The W. G. Cady Award is to recognize outstanding contributions related to the fields of piezoelectric or other classical frequency control, selection and measurement; and resonant sensor devices. The award consists of \$1000 USD, a laminated certificate and a quartz crystal ball on a wood base.

### 2006 W.G. Cady Award Recipient



**John Vig  
introducing  
Clark Nguyen**



**John Vig presenting the Cady  
Award to Clark Nguyen**

The UFFC Society offers its congratulations to Clark T.-C. Nguyen, the 2006 W. G. Cady award recipient. The award was presented at the 2006 IEEE International Frequency



**Cady Crystal**



**Cady Plaque**



**Clark T.-C. Nguyen**

Control Symposium 5 – 7 June in Miami, Florida, USA:

*“For pioneering research, development, and commercialization of timing and frequency control devices based on vibrating RF MEMS technology.”*

## Laudation

The laudation for Dr. Nguyen was presented by John Vig:

It is a pleasure and an honor for me to present the Cady Award to Prof. Clark Nguyen. I first met Clark when he was a graduate student at Berkeley, in ~1992. Since then, Clark invented and pioneered the field of micromechanical signal processors. He also pioneered the use of MEMS for frequency control. Among his numerous accomplishments are the following:

In 1997, he achieved the first high-order micromechanical filter circuit.

In 1998, he introduced the first micromechanical mixer-filter device, winning the Roger A. Haken Best Student Paper Award at the 1998 IEEE International Electron Devices Meeting.

In 1999, he introduced a VHF micromechanical resonator at 92MHz which exhibited a  $Q \sim 7,500$  for the first time, proving that it was indeed possible to obtain high  $Q$  at VHF frequencies.

In 2000, he introduced the first micromechanical disk resonator, which vibrated at 156MHz with a  $Q \sim 9,500$ .

In 2002, he introduced a micromechanical resonator which used a new electrical stiffness compensation concept to achieve a frequency temperature dependence of only 18 ppm over 25-125°C. Without such compensation, silicon resonators have a high temperature coefficient, as, unlike quartz, silicon has no temperature compensated cuts.

In 2003, he demonstrated a disk resonator operating in a wine-glass mode which achieved a  $Q > 98,000$ .

In 2003, he introduced a fabrication process which allowed micro-scale mechanical resonators to break the GHz frequency barrier for the first time, with  $Q$ 's still in the thousands, even in air.

In 2004, he demonstrated disk and ring resonators which finally attained  $Q$ 's  $> 10,000$  at GHz frequencies, even in air, with world record frequency- $Q$  products, leading to a Best Paper Award at the 2003 IEEE International Electron Devices Meeting. From this point on, the MEMS conferences dedicated full sessions to vibrating RF MEMS, as many more researchers were now working on this topic.

Also in 2004, he demonstrated phase noise performance commensurate with the needs of GSM cellular phones.

Along with his students, he has been awarded seven best paper awards at prestigious conferences for papers focusing on vibrating RF MEMS for frequency generation and control. He has also been awarded 23 patents for inventions in vibrating RF MEMS technology.

He founded the start-up Discera, Inc., which is the first company to commercialize vibrating RF MEMS technology.

He served as the DARPA MEMS program manager from June 2002 to the end of 2005. At DARPA, he was a superstar, generating numerous innovative research programs, with total funding of more than \$350 million - to support MEMS research in a variety of areas, from timing references, to power sources, to sensors. In particular, he managed and sustained the Chip-Scale Atomic Clock (CSAC) program, which has yielded 10 cubic centimeter atomic clocks that consume less than 200mW of power and attain Allan deviations on the order of  $5e-11$  at 100 seconds. With a total budget exceeding \$50 million, the program continues towards its 1 cubic centimeter, 30mW,  $1 \times 10^{-11}$  Allan deviation at 1 hour goals—all once deemed impossible, but now ever closer. The CSAC program is by far one of the more successful of DARPA's program, and should result in many more follow-on programs, such as ones on atomic sensors and on even more advanced chip-scale clocks.

He supported and drove research within the Harsh Environmental Robust Micromechanical Technology (HERMIT) program on environmental control for micromechanical resonators which has now resulted in new processing and packaging techniques that have yielded 2 ppm per year aging and 2 ppm hysteresis in tiny,  $200 \mu\text{m} \times 200 \mu\text{m} \times 10 \mu\text{m}$  resonators which are about to go into production at another startup, SiTime Corp.

Clark has given nearly 100 invited papers at international conferences on MEMS for frequency control, including 11 plenary/keynote presentations. He has educated many researchers on MEMS for frequency control through courses taught at the University of Michigan and via the 6 short courses he has given at international conferences. He has also given tutorials here, at the IEEE Frequency Control Symposium.

Clark is a unique individual – a great researcher, an innovator, a superb presenter and program manager – attributes which made him a superstar at DARPA and which will continue to make him a superstar in his future endeavors. It is my great pleasure to present the Cady Award to him.

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## The I. I. Rabi Award

The I. I. Rabi Award is to recognize outstanding contributions related to the fields of atomic and molecular frequency standards, and time transfer and dissemination. This award consists of \$1000 USD, an original print, and laminated certificate.

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### 2004 I. I. Rabi Award Recipient

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Congratulations on behalf of the IEEE UFFC Society to James C. Bergquist, the 2006 recipient of the I. I. Rabi Award. The award was presented at the 2006 IEEE



Patrick Gill introducing James Bergquist



James C. Bergquist



Patrick Gill presenting the I.I. Rabi Award to James Bergquist

International Frequency Control Symposium 5 – 7 June in Miami, Florida, USA:

*“For seminal contributions to laser spectroscopy and the realization of accurate optical frequency standards.”*

### Laudation

Patrick Gill presented the laudation for Dr. Bergquist:

I have known Jim now for a quarter century, since first meeting him at the 3rd Frequency Standards & Metrology Symposium in Aussois in the French Alps. In all that time, and even before, Jim has made a huge impact on high resolution spectroscopy, so much so that his results have shown the international research and metrology communities what's possible. He has in effect set the benchmarks against which the rest of us have striven to follow.

His list of firsts is outstanding:

- During his thesis with Jan Hall at JILA, he demonstrated the first observation of optical Ramsey fringes, which set the scope e.g. for atom interferometry
- Joining NIST, Jim set about developing ultra-high resolu-

tion sources for laser cooling and detection of trapped ions. He developed cw-laser sources operating deep into the UV below 200 nm for laser cooling mercury ions by means of second harmonic generation and sum frequency mixing techniques with argon lasers and dye lasers. In parallel he developed a probe laser source using a dye laser with fast intra-cavity feedback for probing the mercury 282 nm optical clock transition

- This led to the observation in 1987 of quantum jumps in mercury in parallel with other works of Hans Dehmelt in Washington and Peter Toschek in Hamburg.
- Another first was the cooling of an ion to its zero point of motion in the trap in the late 1980s. This particular achievement remained the only demonstration of its type for several years, and even today only a handful of groups worldwide have managed to emulate this.
- In the meantime, Jim was perfecting his laser stabilization techniques, demonstrating ~ 20 Hz line widths for probe laser light locked to an ultra-low- expansion super-cavity. Just as the rest of us were getting close to catching up, he pushed the boat out a little further, and by 1999, was able to demonstrate laser line widths of ~ 0.1 Hz, truly a major achievement still not surpassed to date.

This has enabled him to go even further in recent years, with:

- The observation in the mercury ion of the narrowest optical clock transition at ~ 6 Hz, corresponding to a Q of ~  $2 \times 10^{14}$ .
- With femtosecond comb colleagues at NIST, the demonstration of the optical clock concept
- The absolute frequency measurement of the mercury ion quadrupole optical clock transition to an uncertainty of  $9 \times 10^{-16}$  close to the limiting uncertainty of the cesium primary microwave standard.
- Demonstration of trapped ion standard instabilities more than a factor of ten below this, reaching  $4 \times 10^{-17}$  at 30,000 seconds.
- Examination of the reproducibility of the mercury ion standard through the study of systematic uncertainties which total ~  $7 \times 10^{-17}$ .

All these achievements point to the arrival of the optical clock capable of surpassing the current day primary frequency standards. Jim has played a major role in all of this.

On a personal level, Jim has always made time and freely given advice to help others both in-house and world-wide to achieve their own successes in high resolution spectroscopy. Most of us in the field have learnt a great deal from him.

So it gives me great pleasure to present, on behalf of the IEEE, the 2006 I. I. Rabi Award to Jim Bergquist. Very well deserved, Jim!”

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## The C.B. Sawyer Memorial Award

The C. B. Sawyer Memorial Award (“Sawyer Award”) is to recognize outstanding contributions in the development, production or characterization of piezoelectric materials of interest to the Symposium Technical Program Committee, or to recognize entrepreneurship or

leadership within profit or non-profit organizations in the frequency control community (including all parts of the community). The Sawyer Award consists of \$1000 USD, a laminated certificate, and an appropriately engraved quartz crystal

## 2004 C. B. Sawyer Memorial Award Recipient



Art Ballato  
lauding John  
Vig



Art Ballato presenting John Vig with  
the C.B. Sawyer Award



John Vig



C.B. Sawyer Award

The UFFC Society is pleased to congratulate John R. Vig as the recipient of the 2005, C. B. Sawyer Memorial Award. The award was presented at the 2006 IEEE International Frequency Control Symposium 5 – 7 June in Miami, Florida, USA:

*“For seminal contributions to the science and technology of quartz and piezoresonator devices, and for leadership in the frequency control and timing community extending over many years.”*

### Laudation

Dr. Vig was lauded by his colleague and friend of many years, Art Ballato:

I am happy for this opportunity to honor John Vig – a most deserving colleague, and a good friend for more than thirty years. John came to Fort Monmouth as a lieutenant, and published his first paper at the 26th Annual Frequency Control Symposium in Atlantic City, NJ, in 1972. The paper, joint with Manny Gikow, was entitled “A superconducting tunable filter with broad tuning range.” Since then, his output has been prolific, with more than 50 patents, and many, many papers.

Notice that the criteria for the Sawyer Award mention technology OR entrepreneurship. In John’s case, AND would be more appropriate. Let me mention, in simple bullet fashion, some of his achievements in each category:

#### 1) Contributions to the development, production or characterization of piezoelectric materials

- Chemical polishing of quartz
- Methods of fabricating high-shock (gun-hardened) resonators

- Polyimide bonding of resonators
- UV-ozone cleaning of resonators
- Educational compendium: Tutorial on quartz resonators & oscillators, <http://www.ieee-uffc.org/fcmain.asp?view=review#tutor>
- Dual-mode resonator and sensor development
- Environmental effects, aging studies
- Review papers on aging (with T. Meeker) & hysteresis (with J. Kusters)
- Laser-assisted X-ray goniometer for highly precise orientation of quartz plates

#### 2) Entrepreneurship or leadership

- Led the Army’s frequency control programs as Chief of the Frequency Control and Timing Branch, 1980-1997, and has had a significant role in other programs since, e.g., DARPA’s programs (Chip-Scale Atomic Clock, nanoresonator development, optical oscillator [aPROPOS], ...)
- Negotiated with the then UFFC-S President for the UFFC-S to take over the Frequency Control Symposium (which had been US Army sponsored up to that point)
- Served as President, UFFC-Society (and was twice elected to AdCom)
- Founded the UFFC-S website; is responsible for assembling much of the content, such as the tutorials and review papers; served as Web-Editor-in-Chief, and as Web-Editor of the frequency control section
- Had major role in establishing UFFC-S digital archive, including obtaining the rights to post several complete books in the archive
- Had significant roles in negotiating joint activities with European Frequency and Time Forum (EFTF) and Quartz Devices Conference
- Vice-Chairman, then Chairman, then Vice-Chairman of the Standards Coordinating Committee on Time and Frequency (of IEEE I&M, UFFC and MTT Societies); made significant contributions to IEEE Standard 1139, “Standard Terminology for Fundamental Frequency and Time Metrology,” and to IEEE-Standard 1193, “IEEE Guide for Measurement of Environmental Sensitivities of Standard Frequency Generators,” and to their revisions.

And so, it gives me great satisfaction to present the 2006 C. B. Sawyer Memorial Award to my colleague and good friend, John Vig.

## Frequency Control Awards Nominations

Nominations for the 2006 Frequency Control awards are welcome from anyone. Information about the awards is available at <http://www.ieee-uffc.org/fc>.

All nominations must be submitted in writing (e-mail preferred) and must contain a proposed citation. Each written nomination must include the following:

- Name of the nominee
- Current contact information (e-mail, if available) of the nominee

- Name of the award for which nominated
- Description of accomplishments (for example initiative, ingenuity, creativity, quality and degree of success, etc.) and their importance to the frequency control community
- Proposed citation (see examples on the first pages of any

Proceedings since 1983 or visit <http://www.ieee-uffc.org/ulmain.asp?page=awardscript>)

The nomination should not exceed two typewritten pages and must contain the name and address of the nominator.

## Piezoelectric Devices Association Awards

The Piezoelectric Devices Association (PDA) sponsors two awards: The David P. Larsen Memorial Award and the Juergen H. Staudte Memorial Award, both of which were presented at the 2006 IEEE International Frequency Control Symposium held in Miami, Florida, USA, 5 – 7 June 2006. Tom Parker, UFFC Frequency Control Awards Chair, introduced Marci Staudte and Mike Nusbaum, Chair of the Piezoelectric Devices Association, who presented the awards during the Monday evening Welcoming Reception of the 2006 IEEE International Frequency Control Symposium 5 – 7 June in Miami, Florida, USA:



Tom Parker

The UFFC Society congratulates this year's award recipients!

### 2006 David P. Larsen Memorial Award Recipient

The David P. Larsen Memorial Award is presented annually for many years of dedication and engineering contributions to the industry.



Mike Nusbaum presenting the Larsen Award to Bernd Neubig



Congratulations from UFFC to Bernd Neubig the recipient of the 2006 David P. Larsen Award

*"For wide ranging contributions in the Design, Development, Production, Testing, and Education of Frequency Control Products and Piezo Sensors, comprising Quartz and other piezoelectric material such as Languite and Gallium Phosphate."*

Michael Nusbaum lauded Bernd Neubig's achievements and presented him with the David P. Larsen Memorial Award.

### 2006 Juergen H. Staudte Memorial Award Recipient

The Juergen H. Staudte Memorial Award is bestowed annually for many years of outstanding leadership, dedication, and contribution to the industry.

Congratulations to George Maronich for receiving the 2006 Juergen H. Staudte Memorial Award

*"For outstanding contributions and service to the Frequency Control Industry and the Piezoelectric Devices Association."*

Marci Staudte introduced the award named after her late husband and presented the highlights of George's career and lauded his achievements.



Marci Staudte



Marci Staudte with George Maronich  
the Staudte Memorial Award recipient



## FREQUENCY CONTROL NEWS

### Minutes of the UFFC-S Frequency Control Standing Committee 22 February 2006 Orlando, Florida USA

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#### Call to Order

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General role was taken as follows:

Lute Maleki, Standing Committee Chair  
Sam Stein, Standing Committee Vice-Chair  
John Prestage, Tutorial Chair  
Tom Parker, Awards Chair  
Don Malocha, TPC Chair, 2006-2007  
Bernardo Juduszliwer, General Chair, 2007-2008  
Eric Burt, Asso. Editor, UFFC Newsletter  
Kurt Gible, Academic Chair; TPC Chair 2008-2009  
Mike Garvey, Publicity Chair  
Mike Driscoll, 2005-2006 Chair  
Ray Filler, Finance Chair  
Debra Coler, Editorial Chair

The meeting was called to order by the Chair, Lute Maleki.

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#### Approval of Minutes

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The Chair, Lute Maleki, presented the minutes from the August 30, 2005 Standing Committee Meeting. He asked for comments or amendments, there were none so the minutes were declared approved.

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#### Report from AdCom

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**Lute Maleki** The new AdCom president, Art Ballato, has begun his term. He is making some changes to the committee that will be forthcoming. The UFFC budget is doing well, but we will still be required to budget for a 20% sur-

plus. The next meeting will be in June at our FCS conference in Miami. Ray reported that his is the vice-chair of the nominating committee so if anyone wants to run for AdCom please let him know. Lute reported that one of the appointments that Art has made is to ask Mike Garvey to serve in newly created role of Conferences Chair. This responsibility of the role is to coordinate data across all three sub-societies and try to benefit from a larger body of knowledge. Mike said he is now collecting that data and asked the past general chairs to share their experiences and suggestions with him.

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#### Finance Chair Report

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Ray reported that for the 2005 symposium we ended up with a net gain of \$60,799.49 which is 30.3% surplus. He said that is a record. A big thank you to Mike Driscoll for a job well done. Corporate donations for 2006 are coming in pretty well at this stage.

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#### Awards Chair Report

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Tom reported that everyone should have received the list of nominees, there are about 8 votes received from those who won't be coming tomorrow. We are in good shape as far as the conference awards for this year are concerned but next year we will need to figure out a budget for the awards since we won't have conference revenue to use. There was discussion about where we get revenue for next year, such as corporate sponsorships and book broker fees. We will have expenses even though we are not hosting the conference. On the subject of the student poster awards, where should we do the presentations of the awards? There was discussion about the President's Reception or the Welcome Reception as last

year. It was decided to go ahead and announce the judges' decision immediately following the judging and then all of the finalists will be invited and recognized at the President's Reception. Don reported that the student winners will be given new laptops for prizes. We will use these laptops in the sessions and then they will be given to the students. Tom will prepare certificates for the finalists.

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### Academic Chair Report

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Kurt said we need to put the link for Student Paper Contest on the conference website. We will put a list of the finalists up after they are decided tomorrow. We will then post the winners on the UFFC/FCS website after the conference. There was discussion about allowing students who have won in previous years to enter the contest again.

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### Tutorial Chair Report

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John reported that he has the tutorial schedule put together but not all presenters have confirmed. There was discussion about giving honorariums to everyone as was done in 2004 following the Ultrasonics standard. As it has been for FCS in the past we offer travel expense support for those who request it, and we handle it on a case by case basis. Ray said that we don't have a budget for giving honorariums and in the past when we have given them it comes out of the invited speaker budget. After much discussion it was decided to offer everyone an honorarium and if they can't accept it, then they can refuse it. We will offer travel support on an "as needed" basis. John said to go ahead and put the schedule up on the website.

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### Publicity Chair Report

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**Mike Garvey** has been recently appointed to this position and he had some discussion regarding the possible job descriptions. He talked about getting the symposium listed on different calendars; the second thing is ISAF being coordinated by Marj and Don Yuhas. The third item is the website, whose responsibility is it? He thought we should do it the same way every year, using a standard format. Lute said the Publicity Chair position is a very proactive position and the main responsibility is to make sure the conference gets publicized using any and every kind of medium possible. Using FASS, IEEE or whatever make the most sense. Mike asked if announcing the conference is one thing publicizing the structure of the conference is another thing. There was discussion about putting a link to the conference's website on the various companies' websites that are represented at FCS, such as Symmetricom, Timing Solutions, FEI, etc.

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### Editorial Chair Report

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There was some discussion about the Proceedings. Kurt asked if there was a way to be able to grab certain papers and

extract them to put them on his hard drive. Debra said she would check into it and if we can do that and if not add it for next year.

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### 2006 Conference Report

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**Mike Driscoll**

Mike Driscoll handed out his report; everything is in place for the upcoming conference in Miami. He presented the most recent version of the budget and event schedule. He thinks we will add a Welcome Reception to the schedule. He is projecting a 19% surplus. He also presented pictures and a layout of the hotel. There is a good place for the poster session near the big windows that look out on the water. Don reported that we have 216 papers submitted to date. There is a change in the time grid for papers which could be 15 minute for oral and 30 minute for invited or 20 minute/40 minute. We will discuss this tomorrow.

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### 2007 Conference Report

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This conference is combined with EFTF and will be in Geneva, Switzerland. Bernardo reported that a meeting is scheduled for March at EFTF where policy issues will be discussed and there will also be the first TPC meeting held there as well. Bernardo will have a list of topics to discuss at the meeting. These topics will include specifically the things we incorporate in our conference that are different than EFTF.

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### 2008 Conference Report

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Bernardo reported that the contract is signed for the Hilton Hawaiian Village in Honolulu, Hawaii. We did get good prices and IEEE has approved the site and contract. Will the first 2008 TPC meeting be at EFTF? Kurt said he thinks it is a good idea but we need money to pay for it. Ray said we could pay for it out of earlier year's money. Don said there is another way to deal with it and that is to ask AdCom for a budget to use for next year. Lute said can we mandate of the surplus funds from 2006 to use for FCS related expenses for the combined conference in 2007. Lute, Mike, Ray, and Bernardo will get together to discuss this further.

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### 2009/2010

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We need some recommendations for a General Chair for these years. 2010 possibility is in China and we have had some interest from Australia. Kurt Gible will be the TPC chair for 2008 and 2009. Since 2007 is in Geneva and if we have 2010 in China then we probably have to stay in the continental US in 2009.

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### Role Discussion

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Lute explained that we need to identify further the individual role or job descriptions for each Standing Committee





**Sam Stein**

position. Some are identified by AdCom but most are not. Lute appointed a sub-committee of Sam, Tom and Ray to look into this issue and report back at the next meeting. Lute announced that in one year he will step down as Vice President of FCS, which means Sam will then take over that role. Before Lute leaves he would like to have a document in place that clearly defines all of the Standing Committee roles. Some have already submitted their job descriptions and for all those who have not please submit them to Sam by the end of March.

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### New Business

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Ray said he became aware that the Smithsonian is asking donations for an exhibit that begins in 2007 on Navigation and Time. Carlene Stephens is one of the curators, she has given some talks here at FCS. Ray would like to approach AdCom to request that a donation be made on our behalf. Lute said he will talk to Art directly about doing that.

Eric Burt commented that Scott Diddams did an excellent



**Carlene Stephens**

job of heading up this effort of putting together speakers for Optical Standards this year. We now have a really outstanding slate of invited speakers for this conference. Lute said this should be an example of what we can do to highlight specific areas of technology.

There was discussion regarding web conferencing. Don explained his research on this subject and he does not feel that it would be very advantageous to those in attendance or those who call in. There is also the issue of the cost, although overall the cost is not a big deal. 95% of the papers have already been decided on electronically before we get to the meeting so to have a telecom for the remaining 5% does not seem to be worthwhile. Don said it is not clear at this time if the technology is in place yet that makes this economically or logistically feasible. Lute said we need to continue to look into this. Web conferencing is probably the best option if we can figure it out.

The meeting was adjourned.

**Debra Coler**  
Editorial Chair

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## 20th Meeting of the European Frequency and Time Forum 27 – 30 March 2006 Braunschweig, Germany

The 20th meeting of the European Frequency and Time Forum (EFTF) took place in Braunschweig Germany from March 27-30, 2006. Braunschweig is the home of the Physikalisch Technische Bundesanstalt (PTB), the national metrology center of Germany. There were 270 attendees from 20 countries.



The EFTF presents an opportunity for international technical exchange in the areas of frequency and time. The EFTF has twice met jointly with the IEEE International Frequency Control Symposium (1999 and 2003) and will



**The Braunschweig Lion standing over a conversation among (clockwise) Lute Maleki, Hartmut Schweda, Bernie Schlueter, Marcel Ecabert. The Braunschweig lion (this one is a copy) dates from Henry the Lion in the 12th century.**

meet jointly again in Geneva from May 29 to June 1, 2007. There will be a tutorial preceding the Forum.

EFTF 2006 provided featured notable sessions on the timing infrastructure of Galileo and optical frequency standards. There was an interesting tour of the historic city of Braunschweig.



Prior to the Forum, members of IEEE International Frequency Control Symposium (IFCS) and the EFTF Organizing Committees met to plan the joint conference in 2007

**Mike Garvey**

**From the Conference Organizer's dinner: (clockwise) Lute Maleki (blue shirt), Don Malocha, Bernie Schlueter, Marcel Ecabert, Giorgio Santarelli, Pierre Thomann, Bernardo Jaduszliwer**

**Don Malocha and Raymond Besson, EFTF Founder**

## Minutes of the Ultrasonics Standing Committee Meetings 3 June 2006 Miami FL and 16 June 2006 Chicago IL

### Call to Order



**Jackie Hines**



**Mauricio Pereira da Cunha**

The Ultrasonics Committee met in two parts this June, with the first meeting held on June 3, prior to the AdCom meeting in Miami FL, and the second meeting held June 16, prior to the IEEE International Ultrasonics Symposium 2006 Technical Program Committee (TPC) meeting in Chicago IL. The meeting minutes below combine the discussions and results of votes held at both meetings as compiled by Mauricio Pereira da Cunha (Ultrasonics Committee Vice-

Chair) and Jackie Hines (Ultrasonics Committee Chair). Participating were:

#### **Miami meeting:**

Gerry Blessing  
Jan Brown  
Fred Hickernell  
Jackie Hines  
Rysard Lec  
Jian-yu Lu  
Massimo Pappalardo  
Mauricio Pereira da Cunha  
Victor Plesski  
Bob Potter  
Leo Reindl  
Clemens Ruppel  
Dan Stevens  
Herman Van de Vaart  
Kendall Waters

#### **Chicago meeting:**

Stuart Foster  
Jackie Hines  
Jian-yu Lu  
Don Malocha  
Massimo Pappalardo  
Mauricio Pereira da Cunha  
Peter Smith  
Ton van der Steen  
Ji Wang  
Yook-Kong Yong

The meetings were called to order by Vice President Jackie Hines at 6:30 pm.

## Ultrasonics Symposia

### 2005 Symposium



**Herman van de Vaart**

Herman van de Vaart presented the preliminary financial report from the 2005 IUS. While these results are not final, they show an income of \$572,085 and expenses of \$523,487, which results in a surplus of \$48,598 or 9.3% of expenses. The social function was a major portion of the overall expenses, with the cost of the party boat being approximately \$81,000 and the event ticket registration income being only about \$23,000 (around \$37 per person). The symposium had 20 exhibits at \$2,000 each, which is a good number, and the short courses were a success both technically and financially. Final symposium management expenses were about \$50,000 for FASS and about \$25,000 for ERASMUS.

The committee also received progress reports from either Jackie Hines or the Chairs of the upcoming Symposia for 2006, 2007, and 2008 with respect to detailed planning, proposed budgets, finalization of contracts, and selection of venues. The committee then received briefings on candidate venues for 2009, voted on a venue for 2009, and began discussion of potential sites for 2010. At the Chicago meeting, co-location of the IUS with the Frequency Control Symposium starting in 2009 was discussed.

### 2006 Symposium



**Stuart Foster**

**General Chair: Stuart Foster**  
**s.foster@ieee.org**  
**Vancouver, Canada**  
**3 – 6 October 2006**

In Miami, Jackie Hines presented a summary provided by Stuart Foster showing the number of abstracts submitted (889) and the technical groups and geographic distribution. There were 392 abstracts submitted in medical, 161 in sensors and NDE, 133 in transducers, 102 in physical acoustics, and 99 in SAW. As usual, a vast majority of the abstracts were submitted in the final few days prior to the submission deadline. The new online abstract submission process provided by Oasis worked smoothly, and reviewers who had used the online review process gave it good ratings. In Chicago, General Chair Stu Foster gave a detailed update on the 2006 International Ultrasonics Symposium to be held in Vancouver, British Columbia, Canada. The Symposium Committee consists of:

**General Chair:** Stuart Foster  
**Technical Program Chair:** Geoff Lockwood  
**Short Courses Chair:** John Hassock  
**Finance Chair:** Michael Kolios

**Local Arrangements:**  
**Exhibits Chair:**  
**Editorial Chair:**  
**Awards Chair:**

Michael Watkins  
 Sorah Rhee  
 Marj Yuhas  
 Reinhard Lerch

The symposium will be held at the Westin, and Stuart presented slides of the facility. A discussion of the Oasis online abstract submission and review process resulted in agreement that the process was very successful, and that the 2007 IUS committee has decided to use Oasis as well, as per the current 3-year contract. The organizing committee has decided to combine the President's reception, AdCom dinner, TPC dinner, etc. into one function to be held the first night of the conference, as a tour of Vancouver harbor. Thursday, there will be a dinner at the Vancouver Aquarium, which is costing the conference about \$100 per person, but the fee will only be \$50 for attendees and guests and \$15 for students. The plenary speaker will give a presentation on killer whales and sonar. Financial supporters of the conference include Siemens, Phillips, GE, and Visual Sonics. These supporters are providing approximately \$35,000 in support to the conference. The organizing committee has decided to use TelAV for audiovisual services during the conference, and authors will be able to upload their presentations prior to the conference.

### 2007 Symposium



**John Kosinski**

**General Chair: John Kosinski**  
**j.a.kosinski@ieee.org**  
**New York City, New York, USA**  
**28 – 31 October 2007**

Jackie Hines presented a summary prepared by John Kosinski on planning for the 2007 Ultrasonics Symposium in New York City (at both meetings). The contract with the New York Hilton and Towers has been finalized, and the conference will utilize the entire floor of meeting space, providing two additional rooms than previously planned. The Symposium Committee consists of:

**General Chair:** John Kosinski  
**Technical Program Chair:** Mauricio Pereira da Cunha  
**Short Courses Chair:** Stanislav Emelianov  
**Finance Chair:** Jackie Hines  
**Banquet and Special Recognitions Chair:** Elisa Konofagou  
**Student Arrangements:** Koray Akdogan  
**Publicity Chair:** Sorah Rhee  
**Audiovisual Chair:** Oliver Ketimann-Curdes  
**Proceedings Chair:** Marjorie Passini-Yuhas

An Exhibits chair is also being sought. The preliminary budget was presented by Jackie, and Herman van de Vaart suggested some revisions, including a change to a simplified

format he used for the 2005 meeting. Jackie will make modifications and send the revised budget for review by Herman and the rest of the Ultrasonics Committee prior to submission for approval by AdCom. Some highlights of the conference: The organizing committee has decided that the reception Monday night will be at the hotel due to excessive venue costs outside the hotel, and there will be no banquet Tuesday, to allow everyone to take advantage of the wide range of opportunities NY provides (theatre, dining, etc.). After considerable discussion about the cost of breakfasts at the hotel, it was decided that a guest room with coffee and tea in lieu of breakfast for guests will be provided at the hotel, and at least one tour will be arranged, with information on more to be provided.

## 2008 Symposium



**General Chair: Jian-yu Lu**  
**Jilu@eng.utoledo.edu**  
**Beijing, China**  
**2 – 5 November 2008**

Jian-yu Lu reported at both meetings on planning for the 2008 Ultrasonics Symposium to be held November 2-5, in Beijing, China. The conference will be held at the Beijing International Convention Center (BICC), which is within the new Olympic complex. Planning is proceeding well for the conference. Local arrangements will be done through a company – a contract has been signed with CICCST (Chinese International Conference Center for Sciences and Technology) for a total of just over \$192,000 to handle all local aspects, including the venue, A/V, advance program and abstract books, VISA arrangements, guest tours, coffee breaks, internet café, dinner party, formal lunch, social event, all lunches, meetings, presidential reception, etc. etc. This price includes a wide variety of culturally significant entertainment at the social event Tuesday. Hotel and meal costs remain very inexpensive relative to western and European conferences. We will have a 600 room block available at a rate not to exceed \$105 per night. Planning is now ongoing to determine what conference management company in the US (possibly Oasis) will coordinate with CICCST. All prices negotiated with CICCST are in Chinese Yuan. As the exchange rate is expected to change somewhat over the next few years, some cushion will need to be included in the conference budget. CICCST has also negotiated excellent room rates at the Continental Grand Hotel of \$95/night at current exchange rates.

The full organizing committee consists of:

**General Co Chairs:** Jian-yu Lu and Hailan Zhang  
**Technical Program Chair:** Tom Shroud  
**Finance Chair:** Jan Brown  
**Short Course Chair:** Roman Maev  
**Publicity Chairs:** Sorah Rhee and Ji Wang  
**Exhibit Chair:** Mark Schafer

Some discussion of the exchange rate risk occurred, and Jackie Hines assured the committee that Jan Brown and Herman van de Vaart would pay close attention to this issue, and determine a prudent course of action.

## 2009 Symposium



**Massimo Pappalardo**

**General Chair: Massimo Pappalardo**  
**pappalar@uniroma3.it**  
**Rome, Italy**  
**19 - 23 September 2009**

The Committee discussed Stockholm, Warsaw, and Rome as candidate venues for the 2009 Symposium. At the last Committee meeting, it was agreed that the key criterion in selecting one of these venues is the layout of the conference facilities in terms of sizes of rooms, ability to accommodate posters, and ease of moving between rooms and sessions. In order to gather sufficient detail regarding these issues for the proposed venues, Jackie Hines visited each location briefly earlier this month. All three venues have sufficient room capacity for the conference, although the details on how each venue would accommodate the conference vary substantially. At both the Miami and Chicago meetings, presentations were made on each venue, and a vote was taken.



**Oliver Keitmann-Curdes**

Jackie Hines presented Stockholm on behalf of Oliver Keitmann-Curdes at both the Miami and the Chicago meetings. The Stockholm convention and visitor's bureau has generously offered to provide a reception for up to 1200 people at the stunning Stockholm City Hall. This would include the venue, a full meal buffet-style, and wine. The estimated cost of this function, which would be provided free to the symposium, is 100,000 euro. The Stockholm International Fairs convention center, which is located about 9 minutes by train from downtown Stockholm, has an outstanding facility, with more than enough space for the conference, tremendous flexibility in layout, and excellent audiovisual and logistics support. A brand new business type hotel, the Rica Talk Hotel, has just opened, and is located on site at the conference center. There are numerous hotels in downtown Stockholm, and the site would provide substantial flexibility for people traveling with families to stay downtown and take the train (about 9 minutes) to the conference, or for those not interested in tourism to stay at the conference center hotel. Hotel rates for four and five star hotels start at about 215 euro for single rooms in September. Hotel costs could be lower if the conference was held in July, but this schedule change was not desirable. The Clarion Hotel in downtown Stockholm is the only hotel willing to consider fixing a rate for 2009, even with provision made for inflation. Jackie commented that the Stockholm

convention center seemed like the easiest and best location to organize a conference, from a logistics point of view. Costs for the conference center would be approximately 115,000 euro, including all audiovisual, security, cleaning, etc. While this cost is substantially higher than other venues under consideration, the overall cost to the conference is also offset substantially by the free reception. Stockholm would make a wonderful venue, especially if the exchange rate caused the dollar to be stronger, which would make the hotel rooms less expensive.



**Victor Plesski**

Victor Plesski presented information on Warsaw at the Miami meeting, and Jackie Hines gave the same presentation at the Chicago meeting. Victor and Jackie both met with Piotr Kielczynski of the Polish Academy of Sciences to tour the potential venues. Warsaw has two principal potential venues, the Marriott Warsaw and the Palace of Culture and Science. These two are located within about 5 minutes walk from each other in downtown Warsaw. The Marriott is a world-class hotel, with excellent accommodations and food on site. Room rates would start at 90 euros for a single room, including breakfast but not including the 7% VAT, which is substantially less than the other venues under consideration. There are numerous other hotels in Warsaw, with a range of prices, as well as accommodations for students. Victor stated that the Marriott would have enough room for the conference if sessions are planned carefully (based on room capacities), since the total number of attendees is only about 1000, and total seating capacity in all six session rooms would be 1330. The planning committee had been looking for venue with rooms for six parallel sessions, with seating for 350/300/300/250/200/200 at a minimum based on 2005 numbers. The Marriott actually has rooms for 300/300/250/180/160/140, which Jackie considered marginally adequate. The Marriott is currently in discussions with a bank adjacent to the hotel (they share a common wall) to obtain additional space that would seat about 450 theatre style. If this space is obtained by 2009, it would be ideal. A second option for the conference is to have the Marriott as the conference hotel, with short courses and AdCom meetings there, and hold the plenary and technical sessions at the Palace of Culture and Science, a short walk away. The Palace is the largest congress center in Warsaw, and can accommodate over 4500 attendees. The architecture of the Palace is impressive, with huge columns and high ceilings. The condition of much of the palace is very good, and we were assured that the lack of air conditioning is not a problem especially in the fall (the building uses natural ventilation). The layout of the floor plan within the Palace could be problematic from two perspectives. First, the floors are arranged around a hollow center, meaning that if sessions were held in each room, people going from session to session would have to walk through other sessions, which is unacceptable. To avoid this, we would need to have rooms on several levels of the Palace. To ensure other groups did

not use the areas our attendees would traverse between sessions rooms would require us to rent three floors of the Palace, making the cost substantially more than at the Marriott. Also, there are only two elevators between the three floors, and they are old and slow. For these reasons, the Palace may not be an ideal venue, and we should probably try to fit the conference into the Marriott if Warsaw is selected as the venue. Warsaw has many wonderful sites for guest tours and site-seeing, including "Old Town", a region within Warsaw that was devastated by the war and then rebuilt in period style in the mid 1900s, Chopin's birthplace, several palaces, and other cultural attractions. Poland also has excellent food, and has a very strong academic population involved in acoustics, which would be supportive of this meeting.



**Massimo Pappalardo**

Massimo Pappalardo presented Rome as a potential venue at both the Miami and Chicago meetings. The hotel and conference center in Rome would be the Ergife Palace Hotel, a business hotel with the largest conference facilities in Rome. The Ergife is located in a residential area in the city, with easy access to subway and bus lines, and only a short distance by transport to St. Peters and other site seeing destinations. The committee will look into arranging a shuttle from the hotel to specific locations of interest. There are eight alternate hotels of varying price and quality within about 1 km of the Ergife, and anyone who wants to stay in an extremely luxurious (though expensive) hotel can stay at the Cavalieri Hilton, a short ride away. The room rate at the Ergife will be \$193 U.S. single and \$232 U.S. double (based on the current exchange rate), including both breakfast and VAT. These amounts (which are the 2006 prices) will be fixed in euros, and will increase slightly, but not by more than the ISTAT government index, which has been averaging about 3-4% per year. So we anticipate the costs in 2009 to be about \$210 U.S. single/\$250 U.S. double provided the exchange rate remains about the same. The Ergife conference facilities are more than adequate to accommodate the conference. The room layouts are flexible, and the rooms are located near each other with easy access and good spaces for use as poster, exhibit, and coffee break areas. The total cost for the conference facilities at the Ergife will be \$110,000 U.S. (again the caveats above about exchange rate and ISTAT increases apply), and the food and beverage costs are very reasonable. The organizing committee would need to evaluate options for reducing the exchange rate risk, and will seek Jan Brown's and Herman van de Vaart's input in these areas. Based on logistics related to a large group of people trying to find lunch in the area surrounding the hotel, the conference committee is likely to offer lunches each day to all attendees as part of the registration fee. Massimo presented several potential daily guest tours, both within Rome and in the surrounding areas, with prices ranging from 32 euro to 49 euro. He also presented options for several longer guest tours, including a two day tour to Naples, Pompeii,

Sorrento, and Capri (256 euro), and a four day tour to Assisi, Siena, Firenze, and Venice (630 euro). The conference committee would gather information on such tours and make this information available to attendees through an outside travel agent and on the web site, in the event that conference attendees want to arrive a few days early or stay a few days after the conference for sightseeing. Only the single day guest tours would be arranged through the conference.

Following all three presentations, votes were taken at both meetings. Each person got one vote, even if they were present at more than one meeting, and of the resulting 21 votes cast, 13 were for Rome, with Warsaw a distant second place and Stockholm coming in last. Thus, Rome was selected as the clear choice for the 2009 Symposium, with Massimo Pappalardo as the general chair. Jackie congratulated Massimo and asked him to finish forming his proposed organizing committee. Once the issues of co-location have been resolved (see below), the selection of Rome by the Ultrasonics Committee will be brought before AdCom for approval.

As a side note on Rome, the facilities prices shown by Massimo included VAT. However, at the Chicago meeting, Ton van der Steen noted that in the Netherlands the IUS did not pay VAT on use of the main facility. The 2009 organizing committee needs to be aware of this and look into tax issues to make sure we do not incur costs we can avoid.

## 2010 and Beyond

Jackie Hines reiterated the decision of the last Ultrasonics Committee meeting that the site for the 2010 conference should be in the Americas. Bob Potter has been looking into several locations, and at the Miami meeting Bob briefly discussed San Diego, Cancun, and Long Beach as possibilities, and presented information on some potential facilities. Discussion at the Miami meeting strongly discouraged locating the conference in a hurricane-prone region such as Cancun. Austin Texas was also mentioned, along with San Francisco, as potential locations. Bob agreed to look further into San Francisco, Austin Texas, San Diego, and Long Beach, and to present details on these venues at the next Ultrasonics Committee meeting. At the Chicago meeting, Jackie summarized Bob's activities and the venues under consideration, and also remarked that an attempt would be made to coordinate with FCS/EFTF if possible for co-location. No additional venues were suggested.

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## FCS/IUS Symposium Co-location

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Lute Maleki

Between the Miami and Chicago meetings, Jackie Hines spoke in depth with Lute Maleki, Chair of the Frequency Control Committee, about the interest expressed by both groups in exploring having both the Ultrasonics and Frequency Control Symposia consecutively in the same week and at the same venue with pos-

sibly a few overlapped sessions on Wednesday. This would allow for attendance at two symposia in a single travel week rather than requiring two separate trips. This also might help to grow attendance at the Frequency Control Symposium. Lute and Jackie agreed that there was enough technical material of common interest to the two communities (materials, physical acoustics, sensors, etc), that this could be of benefit to a significant number of attendees in both areas. It could also enhance the exhibit portion of the IUS, and strengthen the FCS meeting as well. Reduced rate registrations could be provided for individuals attending both conferences, or attending one conference and a single day of the other conference. The two conferences would remain separate entities both financially and from a proceedings standpoint, but the organizing committees would work together to ensure proper alignment of technical sessions, utilization of facilities, etc. Also, EFTF has asked FCS to consider holding a joint conference every year, to strengthen both groups, and Lute is considering this as well. After considering the normal geographic rotation schedule planned for both the IUS and the FCS, Lute and Jackie agreed to see if this could work starting in 2009, which is the first year for which both groups had not yet selected a venue. The FCS Symposium would normally be held in Europe in 2009, so the Ultrasonics Committee's selection of Rome may be workable. Additionally, FCS is usually held in June, while the IUS is normally in the fall. Lute has discussed this and indicated that FCS would be willing to move to September for the 2009 meeting. Jackie is providing Lute with details on the venue for consideration by the Frequency Control Standing Committee. However, it was the strongly expressed opinion of many members of the Ultrasonics Committee that we want the IUS to be held in Rome in 2009, independent of whether the FCS chooses to co-locate. In 2010, the co-located conferences could return to the Americas, and in 2011 they would return to China, where the FCS has already made a rather firm commitment of intent (though no contracts are signed). Massimo will wait to hear back from Jackie and Lute about the decision the Frequency Control Committee makes regarding co-location in Rome, and will then begin arranging the hotel contract, as contract specifics will depend on the overall length of the meeting, etc.

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## Next Meeting

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The next meeting of the Ultrasonics Committee will be held in Vancouver, BC on Tuesday, October 3, 2006, just prior to the UFFC-S AdCom meeting held in conjunction with the 2006 IEEE International Ultrasonics Symposium.

Mauricio P. da Cunha  
Jacqueline H. Hines

## FERROELECTRICS NEWS

### IEEE UFFC-S Ferroelectric Committee Meeting Minutes Lillehammer, Norway March 6, 2006

#### Call to Order



**Tom Shrout**

Seven members of the Ferroelectrics Committee met for an IEEE-UFFC Ferroelectrics Committee Meeting held in Lillehammer, Norway, on March 6, 2006. In addition, Prof. Henrik Raeder, the conference co-chair, was in attendance. The Committee meeting was held in conjunction with the Polecer II conference. Committee members present were:

Andrew Bell  
Dragan Damjanovic  
Andrei Kholkin  
Maria Kosec  
Tom Shrout  
Tadashi Takenaka  
Susan Trolier-McKinstry

#### Meeting Summary

##### ISAF 2006

**General Chair: Jon-Paul Maria**  
[jpmaria@ncsu.edu](mailto:jpmaria@ncsu.edu)  
Sunset Beach, North Carolina, USA  
30 July – 2 August 2006  
<http://www.mse.ncsu.edu/isaf2006/index.html>



**David Cann and Jon-Paul Maria**

Susan Trolier-McKinstry provided an update on the 2006 ISAF meeting to be held in Sunset Beach, North Carolina, at the Sea Trail Resort. It was noted that approximately 275 abstracts had been received. The deadline for abstracts was extended to March 10, 2006. It was noted that the number of abstracts received from the USA was down, with good representation from Europe. Attempts to combine the non-volatile memory group were marginally successful, with few abstracts submitted.

##### ISAF 2007

**General Chair: Tadashi Shiosaki**  
[shiosaki@ms.naist.jp](mailto:shiosaki@ms.naist.jp)  
Nara City, JAPAN  
27 – 30 May 2007  
<http://fma.naist.jp/isaf2007>

Tadashi Takenaka presented current information regarding the meeting to be held in Nara, Japan, May 27–30 following the FMA meeting in Kyoto, Japan. The meeting is chaired by T. Shiosaki and assisted by Kiyoshi Uchiyama. A question posed by K. Uchiyama was the requirement of co-sponsorship. It was clarified by Susan Trolier-McKinstry that no co-sponsorship was required in the IEEE memorandum of agreement (a copy is attached for future needs). Sorah Rhee was suggested as publicity chair and has accepted.

##### ISAF 2008

**Co-Chairs: Paul Clem and Bruce Tuttle**  
[pgclem@sandia.gov](mailto:pgclem@sandia.gov)  
Santa Fe, New Mexico, USA  
23 – 27 February 2008



**Paul Clem**

No discussion was given. The meeting is set for February 23 –27, 2008, in Santa Fe, New Mexico.

##### ISAF 2009

**Co-Chairs: Tadashi Takenaka and Wei Ren**  
[tadashi@ee.noda.tus.ac.jp](mailto:tadashi@ee.noda.tus.ac.jp)  
Xi'an, China  
May 2009



**Tadashi Takenaka**

Tadashi Takenaka gave an overview of the proposed ISAF 2009 meeting to be held in Xi'an, China, May 2009, by Yao Xi. Details of the meeting are given in the prepared attachment. Tadashi Takenaka will be the co-chair for the meeting, with assistance from Wei Ren. The meeting will be held in conjunction with IMF-12.

## Start Point of the Silk Road



A question on publisher/journal was discussed, since the Ferroelectrics journal is usually used for IMF.

### ISAF 2010

Andrew Bell gave a brief overview of a possible ISAF 2010 to be held in Harrogate. The time/date was discussed. Possible collaboration with the 2010 ECAPD meeting could have a potential of ~600 attendees.

### Future ISAFs

Dragan Damjanovic (1) A local IEEE Chapter should be pursued for any meeting in Tanzania

(2) Australia, New Zealand

- Topics:
- Future meetings should try to combine with other meetings that are similar in topic and those which could expand the technical scope.
  - Issue of publication, e.g. if combined – Journal of Electroceramics could be overcome by dual proceedings, as it has for previous meetings.

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### Ferroelectrics Award

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Dave Cann is the Ferroelectrics Award chair and will work closely with Ahmad Safari.

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### Next Meeting

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2 August 2006 (Lunch) at ISAF 2006, Sunset Beach, NC, USA



## IN MEMORIAM

*It is with great sadness that we report the loss of Professor Harry F. Tiersten. We wish to extend our condolences to Harry's family, friends, colleagues, and students. A few of his former students have provided their remembrances of their advisor, mentor, colleague and friend.*

### Harry F. Tiersten, Professor and Ph.D. 1930–2006

Sadly, Professor Harry F. Tiersten, a member of the Rensselaer Polytechnic Institute's Department of Mechanical, Aerospace, and Nuclear Engineering faculty since 1967 passed away suddenly from a heart attack on 12 June 2006.

Harry F. Tiersten was born in Brooklyn, NY in 1930. He received the B.S. degree in civil engineering in 1952, and the M.S. and Ph.D. degrees in engineering mechanics in 1956 and 1961, respectively, all from Columbia University, NY, where he studied under Professor Raymond D. Mindlin. Prior to joining Rensselaer, from 1952 to 1953 he worked at Grumman Aircraft Engineering Corporation as a Stress Analyst. During 1953 to 1956 he was a structural designer with J. G. White Engineering Corp in New York City. Dr. Tiersten worked as an instructor in Civil Engineering, The City College of the City of New York, and as research assistant at Columbia University from 1960 to 1961.

His extensive contributions to the technical literature began in 1961 when he joined the technical staff of Bell Telephone Laboratories working under Allen Meitzler in an ultrasonic device department headed by John Rowen. While at Bell Telephone Laboratories from 1961 to 1968, Harry also was a visiting faculty member at Rensselaer Polytechnic Institute, where he eventually joined the faculty in 1968 and remained until his untimely death.



**Harry F. Tiersten**

He was a member and fellow of IEEE, the Acoustical Society of America, the American Society of Mechanical Engineers, and the Society of Engineering Science organizations. He was the recipient of the IEEE UFFC Frequency Control C.B. Sawyer award in 1979 "for contributions to the theory of piezoelectric resonators." He received the IEEE UFFC Society Achievement Award in 1993 "For developing several rational theories for analyzing the electroelastic behavior in anisotropic crystals, including piezoelectric, nonlinear and energy-trapping effects for bulk and surface acoustic waves." He became a Fellow of IEEE in 1995 "for contributions to the analysis of thickness-shear quartz resonators and surface acoustic wave devices."



**Allen Meitzler and Harry Tiersten 1 November 1993**



**Jim Greenleaf (l) presenting the UFFC Achievement Award to Harry Tiersten with Robert Smyth looking on in 1993**

Dr. Tiersten had a distinguished and internationally recognized career. Professor Tiersten coauthored the IEEE Standard on Piezoelectricity and was largely responsible for the theoretical part. His 1969 book *Linear Piezoelectric Plate Vibrations* by Plenum has been a major reference on theoretical piezoelectricity ever since. During the study of piezoelectric resonators, in addition to linear piezoelectricity, to analyze resonator frequency stability, Professor Tiersten systematically developed the theory of nonlinear electroelasticity for large deformations and strong fields, the linear theory for infinitesimal fields superposed on finite

biasing fields, and the perturbation theory for frequency shifts in piezoelectric resonators. These theories have shaped the field many researchers are working in today. His contributions also extend to theories for more general non-linear interactions of elastic deformations with electromagnetic fields in continuous media, including thermal effects and conduction or semiconduction. He was also highly respected in the mechanics community internationally. He was considered as one of the founders of the macroscopic theories of continuum electrodynamics. His style was exemplary of Mindlin's school of applied mechanics researchers, ranging from fundamental theories to applications in technology. For one example, his work on resonator acceleration sensitivity in the 1980s is crucial to missile guidance technology today.

Harry was known for the rigor of his analysis and the precision with which it was presented. These attest to his deep understanding of the underlying physical principles. It is without exaggeration to say that the loss of Professor Tiersten represents the end of an era of theoretical piezoelectricity. The marks left by him in this field are permanent.

Dr. Tiersten is survived by his wife Helen and their two children. Professor Tiersten will be remembered as a quiet man with honesty and integrity as his core values. His death is a loss to us all.

[This short biography was excerpted from Dr. Tiersten's website, Rensselaer Polytechnic Institute website, his biography appearing in the UFFC Transactions vol. 41, No. 4, July 1964, p. 422 on the occasion of his receiving the UFFC Achievement Award, and the in memoriam by Jiashi Yang of the University of Nebraska-Lincoln which appeared in the UFFC Transactions vol. 53, no.8, August 2006, p. 1399]

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### Personal Remembrances – Bikash Sinha

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Here are some of my personal recollections of Professor Tiersten as his third doctoral student at RPI:

Professor Tiersten taught graduate courses on the Theory of Elasticity, Linear Piezoelectric Plate Vibrations, Nonlinear Vibrations, and Electromagnetism in Deformable Continua --- among several others. He has been a very thorough and demanding Professor. During his first year of teaching at RPI, he was so appalled to see the quality of answers given by students that he ended up giving a substantially higher fraction of class a failing grade. Subsequently, Chairman Fred Ling made a humorous comment, "Harry, these students have many distractions and other interests than studies --- compared to the days when we were students. Please be a bit more considerate in grading. (The Vietnam War was just winding down --- but there were still some demonstration in the school when students would not show up for classes)". Many students were afraid of taking his courses in the next few semesters --- he was considered to be a strict teacher.

Harry Tiersten was also a perfectionist. I remember that at the beginning of his lecture, he would spend about 5 minutes breaking white chalk sticks right at the middle. Any chalk stick that was not broken in the middle was thrown in

the garbage. When asked, why he was so particular about using such broken chalk sticks -- he replied that the ones that he selected would not make squeaking noise while writing on the board.

Harry Tiersten was a great mentor and advisor. Once as a poor graduate student, I was trying to change the alternator of my car to save some money. It turned out that I turned the wrench in the wrong direction and broke the solenoid as well. Ultimately I ended up spending more money than the cost of just changing the alternator. When I described this incident to Professor Tiersten, he said that "you should concentrate on doing those things that you are really good at"..... I still treasure his advice ...

Many of us have known Harry Tiersten as a hard-working and brilliant scientist.... the stack of papers next to him in the photograph above contains all of his hand-written notes on a variety of topics. This stack used to be so high that we used to tell him that in the event of an earthquake it would all fall to the floor --- he used to be very patient in properly balancing that stack of notes.

Harry Tiersten was a very honest scientist who always spoke from his mind irrespective any negative consequences. He was also very critical of plagiarism.

I have learned a lot from Professor Harry Tiersten and feel fortunate to have had him as my thesis advisor and mentor.

**Bikash K. Sinha**  
6 July 2006

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### Personal Remembrances – John Baumhauer

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I was Dr. Tiersten's student the same time as Bikash Sinha. Bikash and I shared an office in the basement of the Science Center in Dr. Ling's Mechanics Division at RPI. Dr. Tiersten's 1st student was, I believe, R.C. Davis who worked on thin film guided surface waves. Then, a year or so later, I believe in 1970, Bikash and then, some weeks later, I became Dr. Tiersten's students. A couple of years later came C.F. Tsai, H.G. deLorenzi, etc.

Upon arriving at Rensselaer in the fall of 1968 for my graduate studies, I switched from engineering to Dr. Ling's 'Mechanics Division' and took two Elasticity courses from Dr. Tiersten in 1969. He started with a thorough understanding of the continuum description of materials, and built the entire theory by way of examining all assumptions, approximations and mathematics necessary. For the first time in my education, I felt as if I actually understood 'strength of materials' and its foundations. I knew that Dr. Tiersten was someone I wanted to learn from, and went on, in 1970, to take Dr. Tiersten's 'Elastic Deformation in Electromagnetic Continua' 2-course sequence. (This is the course sequence which he developed and taught at Bell Labs-Allentown some years earlier.)

It was at the beginning of this sequence that Dr. Tiersten took me on as his Doctoral student -- his third. He explained to me that I was going to work on nonlinear dynamical theory which would lead, upon approximation to "small fields superposed upon a finite bias" in electroelastic continua.

Before long we were into the implications on the Piola-Kirchhoff stress tensor, density and surface normal changes between initial and bias states, and much more! I could tell Dr. Tiersten was excited about developments and their implications on his future work. Dr. Tiersten was not one to let his students waste time when they hit technical road-blocks. I remember going to him with a question about every other day; these would almost always lead to extended hours of animated (on his part) discussion where the clock did not exist -- this is where I learned a great deal!" Eventually, in 1973, introduced by Dr. Tiersten, I visited Bell Labs-Indianapolis (my home for the next 27 years working on acoustical telephone transducers) and presented my Ph.D. thesis -- one listener in the back of the room smoking a big cigar was G.M.C. Fisher, III (later, CEO at Motorola and Kodak), who worked with Dr. Tiersten in Bell Labs-Murray Hill years earlier. Dr. Tiersten was truly a pioneer in developing, from fundamental principles, applied field theories covering nonlinear dynamical deformation in electroelastic continua. His contributions will represent an enduring contribution to Mechanics.

**John C. Baumhauer**  
10 July 2006

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### Personal Remembrances – Mario Ancona

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A few personal thoughts and recollections about Professor Harry F. Tiersten

I found several aspects of Prof. Tiersten's character and scientific approach exceptional as well as inspirational:

- 1) He had a deep and lifelong dedication to truth and clarity. This was exhibited in things large and small, from his devotion to work to his insistence on precision in language. In the latter regard, when working on a manuscript, I well remember when it came to writing past some murky point he would always forthrightly declare: "we are now operating as lawyers".
- 2) He had a preference for problems that involved interacting fields, e.g., elasticity became much more interesting to him when electromagnetism became involved. I recall him once telling me that in graduate school he was referred to as "The Electrician" because of this predilection. I suspect that this characteristic also made him closest in matching Mindlin's breadth of interest and accomplishment of anyone in the Columbia group. (Perhaps one of Mindlin's students remembers this history directly and can verify or amend my second-hand knowledge.)
- 3) His gruff manner and sometimes-intimidating presence hid a great generosity of spirit and kindness towards his students and colleagues. In my case, he was the ideal mentor having bequeathed a research style and, to a large extent, a career with absolutely no strings attached.

Perhaps a few comments from the perspective of one who chose not to work on piezoelectricity would also be of interest:

- 1) Like probably all of his students who took such an "alternative" path, the reason for steering clear of the theory of piezoelectricity was simply Prof. Tiersten's mastery of the subject. It just seemed impossible even to formulate

a question that he couldn't answer instantly!

- 2) In my particular field (semiconductors), his questions and thoughts were often those of a beginner, yet at the same time he had invaluable insights into the foundations of electron transport theory (of course derived from his thorough understanding of classical field theory) that essentially no one in this quantum-mechanics-obsessed field could appreciate, much less come up with. As it happens, his questions, hints and perspectives eventually led to equations that are now common tools of semiconductor device engineers.
- 3) By far my favorite course in college and graduate school was Tiersten's electromagnetism (that was the origin of his wonderful little book: H.F. Tiersten, *A Development of the Equations of Electromagnetism in Material Continua*, Springer, 1990). While the course was nominally on electromagnetism, it was emphatically not Jackson (as he often contemptuously said!), but rather a rigorous course in classical field theory illustrated first by the continuum theory of electromagnetism (following Livens), and then the elastic dielectric (following Toupin and Mindlin), piezoelectricity (following Mindlin), magnetoelasticity (following Tiersten), superconductivity (following London and Tiersten), etc., etc. His joy in this material was such that he taught it my year even though I was the only student officially enrolled! His courses on elasticity and piezoelectricity were also memorable especially for teaching a deep appreciation of the nonlinear theories. In all cases his lectures, though at times abstruse, were always supremely logical and therefore could be counted on to reward dedicated study with eventual understanding.

**Mario Ancona**  
10 July 2006

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### Personal Remembrances – Daniel Stevens

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I first ran into Prof. Harry F. Tiersten sometime in the mid 1970's in RPI's Science Center, the home of the Mechanics Department. I noticed that he seemed to be an intense thinker, often at his desk with tall stacks of folders. He was very traditional, always wearing a tie to work. Curious, I looked him up in the department brochure. There was his quote, something like, "Equations form my understanding of nature." Little did I know how true that was!

Later on, in graduate school, I asked my department head if there were any opportunities to earn some extra money by doing some computer programming for some project. He asked me to talk to Dr. Tiersten. Well, that was a memorable experience! Prof. Tiersten's first question of me was, in an excited, energetic voice that some may recall, "Can you solve transcendental equations?" Having taken some courses in numerical methods, I confidently answered in the affirmative. This prompted a barrage of questions, only a few of which I could answer, followed by his ushering me down the hall to meet my future mentor, Dr. Bikash Sinha. "Bikash, Dan will be helping you." Looking at me, "You need to take

my course.” That was it. So I worked with Bikash for about two years and slowly increased my understanding and interest in elasticity, piezoelectric plate vibrations and wave propagation. When Bikash left RPI to join Schlumberger, I started working directly with Prof. Tiersten. I held a staff position at RPI for four years while I worked on my doctorate. We worked on some fascinating problems, largely funded by NSF and the U.S. Army, as well as from several companies and other government and military agencies. Coming from a heat transfer undergraduate program, I was amazed that calculations could be made that are accurate to parts-per-million. I was amazed at how much could be accomplished with pencil and paper, not computers. I was amazed at Prof. Tiersten’s depth of understanding of contemporary and classical issues of continuum physics.

HFT, as we called him, was not an easy professor to study under, but I grew to genuinely enjoy the intensity of our conversations. Half of the time I came away from the conversations very humbled and quite challenged to fill in gaps in my understanding. I have to believe that this was his style of teaching, whether he knew he was doing it or not – skip a few steps and let the student ponder them later.

Over time, I learned that Professor Tiersten was a complex individual. He was, as many know, a passionate and intensely focused expert in his field. But at the same time he was a compassionate and caring person, a characteristic that is possibly not well recognized in our technical community.

“He was one of the few genuine persons I’ve known,” is one comment that was very recently returned to me by a professor that left RPI many years ago. “Professor Tiersten will be remembered as a quiet man with honesty and integrity as his core values,” said Alan Cramb, dean of RPI’s School of Engineering. Prof. Tiersten fostered professional development of his students through professional presentations and publications. I presented my first conference paper in 1980. I was a bit nervous, but, as Art Ballato later informed me, HFT was substantially more so. At the time, I wondered why, but I later came to understand.

It is difficult to figure out how to close out life’s chapter with someone who has taught you the foundation of your professional life, taught you to build on your strengths, helped you achieve a certain amount of professional success, introduced you to people that have made a genuine difference in your career, and had pride in your accomplishments. I will miss the now seemingly infrequent calls that typically started with something like, “I’m looking at equation 34. I have a question about ...” No introduction, no reference to whatever paper it was, etc. Out of the blue... and total confusion on my end. That was Prof. Tiersten - intense, passionate, and profoundly knowledgeable. He already knew the answer to his question; he just wanted to keep in touch. I wish I could.

**Daniel S. Stevens**  
10 July 2006

## HONORS

### Lute Maleki



**Lute Maleki**

It is with pleasure that we note Lute Maleki was honored this year by two other professional societies, in addition to IEEE, in recognition of his significant contributions to science and technology.

The Board of Directors of the Optical Society of America (OSA) elected Dr. Maleki a Fellow at their October 2005 meeting in Tucson, AZ, and in November 2005, the Council of the American Physical Society (APS) also elected Dr. Maleki to Fellowship. These two honors follow Dr. Maleki’s 2000 election into the IEEE Fellows of the UFFC Society.

Lute was recognized by OSA’s Board of Directors “for unique contributions to the science and technology of optical generation of microwave references and to optical whispering gallery mode microresonators.” Only 48 OSA mem-

bers were elevated to the rank of 2006 Fellow, with the number of Fellows being limited to only 10% of total OSA membership. The 2006 recipients will be recognized at OSA meetings throughout the year.

Peers in the APS Topical Group on Fundamental Constants recognized Dr. Maleki “for seminal contributions to the science and technology of frequency standards and their applications to tests of fundamental physics.” Election to the Fellowship of APS is limited to only one half of one percent of the membership.

Dr. Maleki’s 2000 election to the IEEE Grade of Fellow was “for contributions to the science and technology of frequency standards.” As in the other societies, selection is limited and the total number selected in any one year does not exceed one-tenth percent of the total voting Institute membership.

To be elevated to the status of Fellow by one organization is highly esteemed, however, to be the recipient of three Fellowships is quite rare. Congratulations Lute!

## 100th Birthday Anniversary of Raymond D. Mindlin

### A Personal Remembrance

This year marks the 100th birthday anniversary of Raymond D. Mindlin, one of the greatest solid mechanicians in the last century.

### Beijing Symposium

The celebration of Prof. Mindlin’s 100th birthday anniversary was first kicked off with a Mindlin Symposium organized by Prof. Ji Wang of the Ningbo University at the China Congress



**Prof. Mindlin at Princeton University in 1979**

of Theoretical and Applied Mechanics in Beijing in August 2005. Prof. Yih-Hsing Pao, a former Mindlin's student at the Columbia University, of Cornell University, Institute of Applied Mechanics of the National Taiwan University, and Zhejiang University in China, was the invited speaker for the talk "Raymond D. Mindlin and Applied Mechanics." As Prof. Pao was legally blind, I helped him to prepare the presentation. Subsequently, I presented the talk for Prof. Pao also.

Prof. Yook-Kong Yong of the Rutgers University, a former student of Prof. Peter C.Y. Lee at the Princeton University, also attended the meeting in Beijing. Prof. Lee was also a student of Prof. Mindlin at the Columbia University. After listening to the talk, he suggested that I write something for the newsletters. At first I declined as I thought it was more appropriate for a direct student of Mindlin like Prof. Lee or Prof. Pao to do it. Further, who could write more than what was said in the article "Raymond David Mindlin, A Biographical Sketch" - <http://www.personal.psu.edu/faculty/g/a/gal4/AcademicLineage/MindlinBio.pdf#search='mindlin>.

The article was beautifully written by Prof. Herbert Deresiewicz of the Mechanical Engineering Department at Columbia University as an introduction in the "The collected papers of Raymond D. Mindlin" published by Springer-Verlag in 1989. [This article is reprinted in the HISTORY section of this newsletter.] These two-volume books collected the 129 papers published by Prof. Mindlin from 1934 to 1986. Among those of us who are "academically-related" to Prof. Mindlin we sometimes respectfully call them the "new and old testaments of Mindlin's works."

After giving it some thoughts, I decided it's too difficult to add to what Prof. Deresiewicz had written, I agreed to write something which I "knew" about Prof. Mindlin.

## First Meeting

The first time I met Prof. Mindlin was at the Frequency Control Symposium in 1980 when his student Prof. Lee, my advisor at Princeton University, received the society's Sawyer award "For contributions to the theory of vibrations in quartz crystal plates." Prof. Mindlin retired a few years earlier from Columbia University. He showed up in Philadelphia at the conference just for the occasion. I didn't get to speak to him but was glad to see him even from a dis-

tance. The second time I saw him, in fact the last time, was in December 1986 at his ski lodge in New Hampshire. He passed away in November 1987. "In Memoriam: Raymond D. Mindlin" appeared in the 1988 - 42nd Annual Frequency Control Symposium proceedings - <http://www.ieee-uffc.org/archive/fc/proceed/1988/proceed/s8810002.pdf>.

I arrived at the Bell Laboratories in North Andover, Massachusetts in 1985 after finishing my Ph.D. under Prof. Lee at Princeton University. Dr. Dan Stevens, a student of Prof. Harry Tiersten at RPI (Prof. Tiersten was also a student of Prof. Mindlin) arrived there around the same time. Back then, Bell Laboratories began to consolidate its BAW and SAW R&D efforts in New England. We arrived there really at the best of time as we were able to continue our study on piezoelectric vibrations. We found out from Prof. Lee that Prof. Mindlin moved to New Hampshire a year or two earlier. Dr. Stevens and I decided to pay Prof. Mindlin a visit. That was December 1986. Through Prof. Lee's arrangement, we got in touch with Prof. Mindlin. Our first appointment was canceled due to heavy snow. The night before the second appointment we again got a foot of snow. I remember the next morning when I was clearing up the snow along with my neighbor; he asked if I had any plan afterward. I told him I was to visit my advisor's advisor. He was really puzzled as many people like him tried to forget about their advisors - not to mention about advisor's advisor! I enjoyed reading George A. Lesieutre's article on "Academic Lineage" - <http://www.personal.psu.edu/faculty/g/a/gal4/AcademicLineage/AcademicLineage.html>.

## A Drive to New Hampshire

Dr. Stevens and I drove up to Grantham, New Hampshire and had lunch with Prof. Mindlin. He was a very kind gentleman and he invited us to come to his ski lodge. He sped away in his Datsun Z280 from the restaurant parking lot and we had a hard time following him. He was 80 years old then. Prof. Mindlin moved to New Hampshire as he loved to ski. His ski lodge was warm and cozy but it was the books in there which struck us both - many of them were first prints he acquired from old book stores in his many trips to Europe. We had coffee and tea in the warmth of the books and woodstove. It's a meeting I never forget. Before we left he gave us each a signed copy of his recent paper, in the end it was his last, the #129 - "Flexural Vibrations of Rectangular Plates with Free Edges," *Mechanics Research Communications*, 13, 349-357 (1986).

In the keynote talk by Prof. Pao in Beijing last year, I mentioned two from the 129 papers Prof. Mindlin published - the #125 "Third Overtone Quartz Resonator," *Int'l J. Solids Structures*, Vol. 18, No. 9, 809-817 (1982) and #129. Prof. Mindlin wrote #125 when he was 76 years old. One can find in the paper "Page 815..... Figures 2 and 3 required about 58 and 49 hours of computation, respectively, on the HP-45....." At 76 years old Prof. Mindlin was still doing calculations using a calculator which one could only find in museums nowadays. Prof. Mindlin wrote #129 when he was 80 years old. The paper was typed by him with a regular typewriter and the equations were all hand written.

## Other Celebrations

In addition to the session in Beijing last year, two celebrations of Mindlin's 100th birthday anniversary were held in June - The Mindlin Session at the 2006 IEEE International Frequency Control Symposium in Miami, Florida, on June 5-7 and the Mindlin Centennial Symposium, jointly sponsored by the ASCE and ASME at the 15th US National Congress of Theoretical and Applied Mechanics in Boulder, Colorado on June 25-30. I was most happy to know that Prof. Yih-Hsing Pao was fit enough to deliver the invited keynote speech "Raymond D. Mindlin and Applied Mechanics" at the Colorado meeting.

## Mindlin's Students

Prof. Xi Chen at the Columbia University organized the Mindlin Centennial Symposium and he also put together the list of Mindlin's former students and their key affiliations as follow (in alphabetical order and may be incomplete)-

Bleustein, Jeffrey, Ph.D. 1965, Harley-Davidson  
Bogdanoff, John, Ph.D. 1949, Purdue  
Brady, Kevin, DES 1964, Bell Labs  
Cheng, David, Ph.D. 1944, CUNY  
Deresiewicz, Herbert, Ph.D. 1952, Columbia  
Drucker, Daniel, Ph.D. 1940, UIUC  
Duffy, Jacques, Ph.D. 1957, Brown  
Eshel, Nachman, Ph.D. 1965, CUNY  
Furray, Martin, Ph.D. 1955, C.W. Post  
Fox, Edward, Ph.D. 1958, RPI  
Gazis, Denas, Ph.D. 1957, IBM  
Gong, Chung, DES 1970, Ebsco  
Goodman, Lawrence, Ph.D. 1949, Univ. of Minnesota  
Haines, Daniel, Ph.D. 1968, Univ. of South Carolina  
Hoppmann, W. H., Ph.D. 1947, Univ. of South Carolina

Huang, Y. T., Ph.D. 1961, Huang & Associate  
Kane, Thomas R., Ph.D. 1953, Stanford  
Kaul, Raj, Ph.D. 1963, SUNY Buffalo  
Lee, Peter C. Y., DES 1963, Princeton  
Lubkin, J. L., Ph.D. 1964, Michigan State Univ.  
Lubowe, Anthony, DES 1961, Bell Labs  
McNiven, Hugh, Ph.D. 1958, Berkeley  
McCoy, John, Catholic Univ.  
Mediek, Mathew, Ph.D. 1957, Michigan State Univ.  
Newman, E. G., IBM  
Pao, Yih-Hsing, Ph.D. 1959, Cornell  
Robinston, Kenneth, ITEK Corp.  
Rongved, Leif, Ph.D. 1953, Bell Labs  
Schwartz, Jeremy, DES 1969, Naval Weapons Lab  
Tsai, James, Ph.D. 1961, SUNY Stony Brook  
Tiersten, Harry, Ph.D. 1961, RPI

My advisor Prof. Lee retired from Princeton last month. Fifteen or so of his former students, including myself, returned to Princeton to celebrate the event in the form of a mini conference. In 1974 Prof. Mindlin's students celebrated his retirement also but in a much grander scale with the publishing of a book dedicated to Mindlin - "R.D. Mindlin and applied mechanics: A collection of studies in the development of applied mechanics, dedicated to Professor Raymond D. Mindlin by his former students," edited Hermann, George. (1974) New York: Pergamon Press. These two retirement gatherings were 32 years apart..... I shall always treasure the fact that I am part of this greater Mindlin's academic family.....

**C.S. Lam, Ph.D.**  
**TXC Corporation, Taiwan**  
**July 2006**

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## 2005 and 2006 UFFC Senior Members

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### Newly Elevated Senior Members

On behalf of the UFFC Society, we would like to congratulate those members who have been elevated to the grade of Senior Member thus far in 2006.

Walter Arnold  
E. Bopp  
Philippe Delachartre  
Anne Hall  
Kullervo Hynynen  
Michael Insana  
Boguslaw Jarosz  
Kouros Sariri  
James Smith  
Yongping Zheng

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### Senior Member Grade

The grade of Senior Member recognizes those who have achieved professional proficiency, as demonstrated by degrees received and/or work experience. It is a professional recognition of your peers for technical and professional excellence.

The grade of Senior Member is the highest for which

application may be made and shall require experience reflecting professional maturity. For admission or transfer to the grade of Senior Member, a candidate shall be an engineer, scientist, educator, technical executive, or originator in IEEE-designated fields.

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### How to Apply

Individuals may apply for Senior Member grade online at <http://www.ieee.org/organizations/rab/md/smfirms.htm>

The Senior Member application form is available in 3 formats.

- Online version
- Downloadable version
- Electronic version

The application may be submitted online, by snail mail or as an email attachment. Reference letters may also be completed online or sent electronically. To expedite the processing of your application, it is suggested that you submit your application online or send the electronic version to [senior-member@ieee.org](mailto:senior-member@ieee.org).

We encourage you to apply for Senior Membership, as soon as you meet the requirements. One cannot become an IEEE Fellow without first becoming a Senior Member.

## UFFC AWARDS

Honoring our UFFC Society members is a privilege.

The UFFC Society has a number of awards, which are given at symposia sponsored by our three groups. Each member can get involved in the process by submitting nominations for awards through the respective Award Chairs and committees. Information can be found on the UFFC Society website ([www.ieee-uffc.org](http://www.ieee-uffc.org)). The names and citations of past awardees also appear on the website.

### UFFC Distinguished Lecturer Award

The Distinguished Lecturer represents the UFFC Society by giving lectures worldwide to the larger technical community. The subject of the lecture must be of current interest and the lecturer must be a prominent contributor in the field of the lecture. The speaker is selected for speaking style, prominence in the topic, and willingness to commit significant time and energy to preparation, travel and lectures. The Lecturer is selected by the AdCom from a list of nominees presented by the Distinguished Lecturer Subcommittee of the UFFC-S Awards Committee from nominations received from the general membership. Presentation of the award is usually at one of the Society's major symposia.

The award consists of a certificate, and reimbursement for an international lecture tour, which consists of roughly 30 or more lectures during an 18-month period.

You are encouraged to invite the Distinguished Lecturer to your Chapter or institution.

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#### 2005 – 2006 Distinguished Lecturer

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**Dr. Ken-ya Hashimoto**

#### **Dr. Ken-ya Hashimoto**

Department of Electronic and Mechanical Engineering  
Faculty of Engineering  
Chiba University  
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#### **Simulation of Surface Acoustic Wave Devices**

Presently, surface acoustic wave (SAW) filters are mass produced and widely used in various consumer products and communication equipment. For their research and development, use of fast and precise simulation and design tools is essential, and much effort has been paid for their enhancement for many years.

Fortunately, recent rapid progress of computer technologies has made it possible to deal with large-scale problems using small personal computers. So as for computers, anyone can set up the latest research environment with small investment. The remaining task is to establish simulation and design software tools.

This lecture reviews simulation technologies used in the research and development of modern SAW devices. Firstly, a simple discussion is presented on the role of the numerical simulation to clarify its applicability and necessity. Although a number of simulation techniques have been developed, none of them are perfect. So we must select appropriate ones for each purpose with the trade-off between computation speed and precision.

The simulation techniques are categorized into two types. The first type is based on the full-wave analysis, and is used for parameter extraction, design verification, theoretical examination, etc. where precision is more important than the calculation speed. In this category, the finite element method (FEM), boundary element method (BEM), spectral domain analysis (SDA) and their combinations are representative. In the second part of the lecture, these techniques are practically applied in the SAW device design.

The second type is based upon phenomenological models, and is used in the optimization process. In this case, the calculation speed is also very crucial because the simulation will be executed for a huge number of iterations to search for the optimal solution. Presently, the coupling-of-modes, p-matrix and equivalent circuit models are widely used. In the third part of the lecture, they are compared and their use in practical device design is detailed. It is demonstrated how precise and speedy this type of simulation can be performed provided that all necessary parameters were determined correctly in advance.

Once simulation tools are ready, it is a starting point of a trial road. This is because minor effects in former days become obvious after evolution, and further improvement is always necessary. In the final part of the lecture, various hot topics in this direction are presented and hidden problems in current simulation tools are revealed.

#### **Dr. Ken-ya Hashimoto**

**Ken-ya Hashimoto** was born in Fukushima, Japan, on March 2, 1956. He received his B.S. and M.S. degrees in electrical engineering in 1978 and 1980, respectively, from Chiba University, Japan, and Dr. Eng. degree from Tokyo Institute of Technology, Japan, in 1989.

In 1980, he joined Chiba University as a Research Associate, and is now Associate Professor of the University. In 1998, he was a Visiting Professor at Helsinki University

of Technology, Finland. In the winter of 1998/1999, he was a Visiting Scientist of the Laboratoire de Physique et Metrologie des Oscillateurs (LPMO), CNRS, France. In 1999 and 2001, he was a Visiting Professor at the Johannes Kepler University of Linz, Austria.

Dr. Hashimoto has authored or co-authored more than 130 papers in refereed journals and conference proceedings. He has contributed to 6 books including a textbook "Surface Acoustic Wave Devices in Telecommunications" published by Springer Verlag in 2000. His current research interests include various types of surface and bulk acoustic wave devices, acoustic wave sensors, piezoelectric thin films, and application of thin-film micro-machining technologies to the acoustic wave devices.

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## Dr. Hashimoto Reports

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### Distinguished Lecturer Tour to USA in 2006 RF Monolithics, Dallas, TX

In the morning of March 5 (Sun), I arrived at Dallas, TX as a start point of my very tough USA tour. In contrast to unusually cold Japan, it seemed spring has already come there.

On March 6 (Mon), I visited RF Monolithics (RFM) Inc., Dallas, TX. As you may know, both RFM and SAWTEK described later are spin-out companies founded by SAW pioneers in Texas Instruments Inc. (TI). Dr. Ji-Dong Dai, who first proposed my visit, was out of the office due to unexpected business, and Dr. Bob Kansy, VP of engineering, kindly served as a host for my visit.

In the company, I gave five lectures:

1. Simulation of Surface Acoustic Wave Devices, Review
2. Basics of RF Filter Design
3. SAW Resonator Design
4. SiP/SoC Integration of RF SAW/BAW Filters
5. SAW Sensors

I enjoyed discussions on various topics related to SAW technologies with talented R&D researchers.



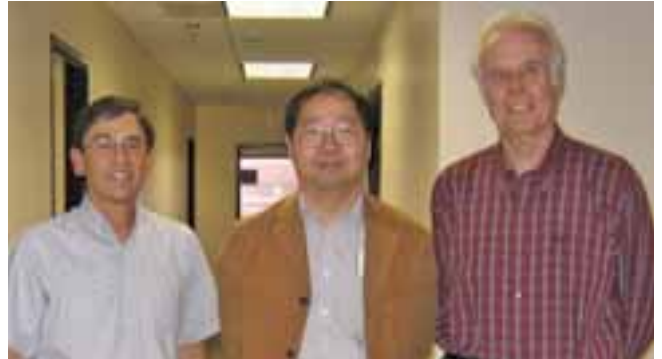
With Lecture attendees at RFM Bob Kansy and I are in the first row.

Dr. Kansy also invited me to dinner. Although I have visited Dallas many times, I did not expect we could experience such delicious seafood dishes in the city. Thanks Bob!

### Rockwell Collins, Scottsdale, AZ

On March 7 (Tue), I moved to Scottsdale, AZ. Dr. Dave Penunuri of Rockwell Collins, Co. Ltd., picked me up at the

airport, and took me to his office. He gave me the invitation as the UFFC Representative of the IEEE Phoenix Section, Waves and Devices Chapter. He was also an active member of our society, and engaged in the research and development of SAW devices in Motorola for long years. Dr. Fred Hickernell, Dave's former colleague at Motorola and former President of our society, joined us later, and we had a wonderful time with various non-technical discussions. In the evening, Dave invited me to an Italian restaurant, where we enjoyed wonderful wines, foods and talks for a while.



At Rockwell Collins, from left, Dave Penunuri, Ken, and Fred Hickernell

### FreeScale, Inc., Scottsdale, AZ

On March 8 (Wed), Dave took me to FreeScale Inc., Scottsdale, AZ, where I gave a talk on the SiP/SoC Integration of RF SAW/BAW Filters at a meeting of the wave and device society, IEEE Arizona Chapter. Until the meeting, I wondered how many attendees would appear. But I was too pessimistic. About 20 people gathered and showed significant interests on the topic. In the evening, we went a Mexican restaurant, and enjoyed spicy foods and Mariachi music. Dave kept on service as a host from my arrival and departure. I must express my special thanks to his hospitality. Please do relax.

### SAWTEK, Orlando, FL

On March 9 (Fri), I visited SAWTEK Inc., Orlando, FL, through the invitation of Dr. Ben Abbott. He is a native Floridian, and got his Ph-D degree on SAW devices from University of Central Florida (UCF). His thesis advisor and former President of our society, Prof. Don Malocha of UCF and his lab members also attended my lectures.

Following Ben's request, I gave the following four lectures at the company:

1. Simulation of Surface Acoustic Wave Devices, Review
2. Resonator Design
3. 2D Analysis
4. SiP/SoC Integration of RF SAW/BAW Filters

I was surprised by the number of European attendees. I knew that Dr. Robert Aigner and Dr. Marc Solal moved to SAWTEK from Infineon Semiconductor AG and TEMEX SA, respectively. But my info was incomplete. Dr. Pascal Ventura left from TEMEX and serves as a consultant for SAWTEK. In addition, Dr. Gernot Fattinger also joined the company from Infineon right after my visit.

In the evening, Ben invited me to a Japanese dinner. You





**At a Japanese restaurant in Orlando, from left, Ben, Marc, Pascal, Ken, Sunder, and Robert**

will see that SAWTEK natives are only Ben and Dr. Sunder Gopani. How quick and drastic our world changes! Anyway, we enjoyed Sushi with my old friends. Thanks Ben!

### **RF Micro-Devices, Greensboro, NC**

On March 10 (Sat), I arrived at Greensboro, NC. Dr. Kushal Bhattacharjee of RF Micro-Devices, Inc. extended the invitation to me. The company is specialized on RF ICs and has grown rapidly from its foundation in 1991. Now integration of RF SAW/BAW filters is one of the hottest topics for RF ICs. In fact, the company just released its latest transceiver module called POLARIS 2 in which RF SAW quad filters are embedded.



**At Hanging Rock State Park, Sergei, Ken, and Kushal**

On Sunday, Kushal took me on an excursion to Hanging Rock State Park. When I went down to the hotel lobby in the morning, Dr. Sergei Zhgoon of Moscow Power Engineering Institute waited for me with Kushal. He occasionally visited the company on the period, too! We could refresh ourselves through the hiking around hills and a lake. I was born in a small city surrounded by mountains, hills and lakes like Greensboro. Greensboro felt like my home town, and of course I loved it. In the evening, Kushal also invited us to his home. We enjoyed very tasty handmade dinner prepared by his wife Anu. I wish to work and live in this atmosphere. Thanks Kushal and Anu.

On March 12 (Mon) and 13 (Tue), I gave a full series of lectures in the company under Kushal's request:

1. SiP/SoC Integration of RF SAW/BAW Filters

2. Simulation of Surface Acoustic Wave Devices, Review
3. RF Filter Design
4. COM Theory
5. Resonator Design
6. 2D Analysis

We had a fruitful discussion with RF-IC, MEMS and SAW/BAW professionals.

### **Vectron International Inc., Hudson, NH**

On March 14 (Wed), I visited Vectron International (VI) Inc., Hudson, NH. Dr. Bob Potter invited me. Because Bob was absent on the day I was there, Dr. Dan Stevens, Dr. Jeff Mink and Dr. Dong-Pei Chen served as hosts.

Following to his request, I gave the following three lectures:

1. SiP/SoC Integration of RF SAW/BAW Filters
2. SAW Wireless Sensors
3. SAW Device Fabrication by EB Lithography

In the evening, Jeff and Dong-Pei invited me to nice Chinese dinner.

On March 15 (Thu), I was free in the day time, and Dong-Pei took me to the Boston Museum of Fine Art. I like the museum very much, and have been there more than five times. There are many wonderful paintings by impressionists such as Renoir and Monet. And I am sure that the collection of Japanese historical arts is the best in the world. But it was the first time for Dong-Pei to take Boston MRT and to visit the museum! He might be a workaholic.



**Attendees of my lecture at Vectron International, from left in middle, Dong-Pei, Dan, Ken, Bob, and Jeff**

In the evening, we returned to VI to give a talk as an open seminar. Bob had come back from Dallas, and served as a host. I gave a lecture on 'Simulation of Surface Acoustic Wave Devices, Review'.

Even though the seminar started at 6 PM, a number of people were gathered from MA-NH area. I concluded my USA tour with great success and happiness.

Early in the next morning, Bob took me to Boston airport, and I returned to cold Japan. Hospitality given by VI people was excellent. Thanks all.

Finally, I express my deepest appreciation to all my friends in the USA again.

### **Distinguished Lecturer Tour to Korea in 2006**

In the afternoon of March 26 (Sun), I arrived at Incheon, Korea. This is third trip for me to this country. Although cherry blossoms were about to come out in Chiba, spring seemed still far away in the country.

Mr. Seong-Su Hong of Samsung Electro-Mechanics (SEMCO), Co. Ltd., picked up me at the airport and took me

to Bucheon. Bucheon is one of the biggest satellite cities around Seoul, and is intended to be the high-tech center in Korea.

When I met Mr. Hong and Mr. Frederic S. Jang of ITF, Co. Ltd. at the last Ultrasonics Symposium held in Rotterdam, they requested me to give lectures in Korea. Of course, I accepted their invitation, and I asked them to arrange my lectures to be given to two groups together. Then Mr. Jang arranged the meeting place at Bucheon College in the Techno-Park.



**Attendees of my Lecture with Frederic**

On March 27 (Mon) and 28 (Tue), about 20 young engineers from SEMCO and ITF were gathered, and I gave a full series of lectures:

7. Simulation of Surface Acoustic Wave Devices, Review
8. RF Filter Design
9. COM Theory
10. Resonator Design
11. 2D Analysis
12. SiP/SoC Integration of RF SAW/BAW Filters
13. Wireless SAW Sensors

I thank all the attendees for staying to hear my lectures from morning to evening for two days.

In the evenings, Mr. Hong and Mr. Jang invited me to a nice Korean dinner. We had wonderful seafood dishes on March 27, while we choose Korean BBQ on March 28. Korean foods are fascinating to me, and this is one of the main reasons to revisit this country. Thanks Mr. Hong and Mr. Jang!

On March 29 (Wed), Mr. Hong took me to the National Museum of Korea in Seoul. It is so big, and displays five thousand years of Korean history and beauties. I am always surprised by how Japanese culture is strongly influenced by Korea.

Mr. Hong has stayed in our lab for half a year. He indicated that in the Museum, there is a Buddha statue which has exactly the same design with the one in the old capital city of Nara, Japan. Of course, both of them are most famous national treasures in each nation. I believe the design or the statute itself came to Japan about 1,500 years ago from this country. How small our world was in ancient days!

On March 30 (Thr), I left Incheon and returned to Japan.

Finally, I must express my deepest appreciation to Mr. Hong, Mr. Jang and all my Korean friends for their hospitality and the support to this lecture tour.

**Ken-ya Hashimoto  
Chiba University**



**At the National Museum of Korea with Mr. Hong**

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### **2006 – 2007 Distinguished Lecturer**

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**Dr. Andreas  
Bauch**

Dr. Andreas Bauch  
Physikalisch-Technische Bundesanstalt  
Fachbereich Zeit und Frequenz, AG 4.42  
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### **The Galileo Timing System**

The future European satellite navigation system Galileo will use an independent timescale - Galileo system time (GST) - as a reference for the determination of satellite orbit and clock parameters. In Europe, several smaller and larger research institutes are dealing with time and frequency measurement. The equipment as well as the human expertise are spread. The European Community has thus supported studies organized by the Galileo Joint Undertaking

(GJU), Bruxelles, to define the Galileo Time Service Provider (GTSP), an entity that will act as the interface between Galileo core operations and the European timing institutes. A so-called Precise Time Facility (PTF) will be developed as part of the Galileo Ground Mission Segment and GST shall be physically realized there. This development is directed by the European Space Agency and performed by European industries.

Inevitably, the PTF will have to be accurately and reliably linked to the participating timing institutes, and one major task of the GTSP is the organization and management of such time links. I will explain the techniques foreseen in the Galileo operations and demonstrate which performance level of such systems has been achieved. The number-one technique is two-way satellite time transfer over commercial telecommunication satellites. Time transfer using signals of the Global Positioning System as well as of Galileo itself – once a sufficient number of satellites will have been launched – will be used as well.

I will probably address also the timing aspect of interoperability of Galileo and GPS as far as it is still a matter of concern at the time the talk shall be given.

Whenever time actually matters (not only frequency) the calibration of the time transfer equipment is a major issue. PTB has been and will be actively involved in several calibration campaigns. I will present the techniques employed and the results obtained. This issue, of course, has wider importance than GNSS operations since the realization of International Atomic Time bears on accurate time comparisons among the contributing institutes world-wide.

Explicitly talking about Galileo is rather timely chosen since at the end of 2007 the so-called In-Orbit Validation of Galileo is scheduled. So the ground infrastructure has to be established by then. Also the GTSP has to be operational at that time, and the three-year contract covering this activity is to be signed by GJU in these days. PTB is very probably included in the team made up by industrial and scientific partners which will be entrusted with the activity.

**Please contact Andreas Bauch to schedule a visit to your area during the period from July 2006 – December 2007.**

### **Dr. Andreas Bauch**

**Andreas Bauch** was born in Wiesbaden, Germany, on January 17, 1957. He received his Diploma degree in Physics and his Dr. rer. nat. degree in 1982 and 1986, respectively, both from Johannes-Gutenberg Universität, Mainz, Germany.

He joined the Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany, as a PhD student in 1983, studying frequency shifting effects in caesium atomic clocks. Since then he has been always involved in time and frequency metrology, focussed at first on the development and operation of atomic clocks, later more and more on time comparison techniques (GPS CV, TWSTFT). He became Head of PTB's Time Unit Laboratory in 1991. Today he is Head of PTB's Time Dissemination Services responsible for the management and operation. He serves as delegate to the Comité Consultatif du Temps et Fréquences (CCTF), to

Study Group 7 of the International Telecommunication Union and to EUROMET.

Dr. Bauch has authored and co-authored more than 90 papers in refereed journals and conference proceedings. He is currently strongly involved in the development of the timing system of the future European satellite navigation system Galileo.

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## **2007 – 2008 Distinguished Lecturer**

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**Dr. Thomas  
R. Shroul**

### **Dr. Thomas R. Shroul**

Professor of Materials and Senior Scientist  
Materials Research Laboratory  
The Pennsylvania State University  
University Park, PA 16802  
TShroul@psu.edu

### **Innovations in Piezoelectric Materials for Ultrasound Transducers**

Piezoelectric materials lie at the heart of ultrasonic transducers. For transducers used in medical imaging (3–5 MHz), PZT-5H ceramics offer high electromechanical coupling ( $k_{33} \geq 75\%$ ), resulting in good bandwidth and sensitivity. As transducer arrays become smaller with increasing frequency, the development of high permittivity (vs. 3,400 for PZT-5H), piezoelectrics based on PMN-PT have been made, providing improved electrical impedance matching. Advancements in medical diagnostic techniques, including contrast and harmonic imaging, have taken advantage of the recent development of single crystal Relaxor-PTs that offer electromechanical coupling coefficients ( $k_{33s} > 90\%$ ) and subsequently significant increases in bandwidth. For applications such as small animal testing, ophthalmology, dermatology, and cellular imaging, higher resolution is demanded, thus requiring transducers operational in the range of 20–100 MHz.

Advancements in ceramic processing include pore-free and fine-grain ( $\leq 1$  micron) piezoelectric ceramics (100 MHz) of PT and PZT, being an “enabling” technology, allowing the fabrication of single element and annular array polycrystalline ceramics. Novel single crystals of PZN-PT (tetragonal), KNbO<sub>3</sub>, and LiNbO<sub>3</sub>, are particularly promising for high frequency, single element transducers, offering both high coupling and a relatively low dielectric permittivity ( $\epsilon_R < 500$ ). Innovations in the fabrication of high frequency arrays ( $\geq 30$  MHz) include tape casting and sol-gel molding techniques. Of particular significance, DRIE (deep reaction ion etching), has demonstrated the ability to mill out ultra-fine features, allowing 1–3 and 2–2 single crystal-polymer composites operational at frequencies  $> 40$  MHz, far beyond that achieved by current state-of-the-art dicing.

Finally, comments on new high T<sub>c</sub> morphotropic phase boundary (MPB) piezoelectrics and the environmental issue of lead-free materials will be discussed.

**Please contact Tom Shroul to schedule a visit to your**

area during the period from July 2007 – December 2008.

### Dr. Tom Shrout

**Dr. Tom Shrout** was born in Kingwood, West Virginia in the fall of 1954. He received both his B.S. and Ph.D degrees in Ceramic Science in 1976 and 1981, respectively, from the Pennsylvania State University. He is a Fellow of the American Ceramic Society.

In 1986, he joined Penn State as a research associate at the Materials Research Laboratory, and is now a Prof. of Materials and Senior Scientist. Prior to joining Penn State he worked in the R&D facilities of Sprague Electric and AVX, both multilayer ceramic capacitor manufacturers. In 1987 he was a visiting scientist at the Plessey Research Laboratory in Caswell, Towster ( UK). This was followed by a stay at the Shonan Institute of Technology in Tsujido-Nishikaigan, Fujisawa ( Japan) in 1994.

Prof. Shrout has authored or co-authored more than 250 papers in refereed journals and conference proceedings. He is a co-inventor on 17 patents. His current research interests are in the development of novel piezoelectric materials for high frequency medical ultrasound and high performance sonar transducers. In 2005 he received the Ikeda Award for

his contribution in the growth of ferroelectric oxide single crystals and their piezoelectric applications.

## Nominations for Distinguished Lecturer Award



**Bernie  
Tittmann**

Nominations may be submitted at any time. Any member may submit a nomination by sending the nominee's name and a description of that person's main contributions, along with the submitter's own name and address. Members are also encouraged to suggest topics, which they feel, would be of interest. Send nominations and topics to:

**Bernhard R. Tittmann** – Awards Vice-Chair  
Chair, UFFC-S Distinguished Lecturer Subcommittee  
Schell Professor

Engineering Science & Engineering  
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[Bernhard.tittmann@ieee.org](mailto:Bernhard.tittmann@ieee.org)

## UFFC ELECTIONS

Dear Colleagues:

You will shortly be receiving ballots with the candidates running for positions on the UFFC Administrative Committee (AdCom). We have provided the candidate information below for your preview. When you receive your ballots we encourage you to vote.

If you would like to be a candidate in the future or know of someone else who would like to be a candidate please contact me. Happy voting,

**Bob R. Potter**

[bpotter@vectron.com](mailto:bpotter@vectron.com)

**Nominations Chair IEEE-UFFC**

### E. Koray Akdogan



E. Koray Akdogan is currently serving the IEEE-UFFC as the Chair of the Education Committee (EdCom) and as the Society Liaison to the IEEE Education Activity Board as of July 2003 and March 2005, respectively. Since his appointment as the chair, the EdCom has now a web page on the Society web page, which is rapidly expanding. He has also been a peer reviewer for the Transactions of the UFFC since 2002. Koray is being nominated to Senior Membership as of April 2005.

Koray holds B.Sc. (1991) and M.Sc. (1994) degrees in Materials Engineering from METU in Ankara, Turkey. He did his doctoral work in Ceramic Engineering at Rutgers University (1994-99), where he was also a NATO-AGARD

A1 Fellow (1994-95). He is currently a research faculty in Electroceramics Group of same department since 2001. His area of expertise includes but is not limited to nanoscale phenomena in nonlinear dielectrics, ferroelectrics, and piezoelectrics with special emphasis on processing-property relations and phenomenological theories. He has published numerous articles in related fields, and is also the author of five invited review articles and/or book chapters.

### Dragan Damjanovic



Dragan Damjanovic received his B.Sc degree in Physics from College of Mathematics and Natural Sciences of University of Sarajevo in 1980. He then attended The Pennsylvania State University (PSU) where he received PhD in Ceramics Science in 1987 for his work on piezoelectric anisotropy in lead titanate based ferroelectrics. After a working briefly on high temperature superconductors at Materials Research Center of Energoinvest Corp. in Sarajevo, he returned in 1988 to Materials Research Laboratory (MRL) of PSU. At MRL he worked on dielectric, piezoelectric and ferroelectric properties of ferroelectric and relaxor ceramics, biological polymers, ceramic-polymer composites for underwater applications. He joined the Ceramics Laboratory, Materials Department, at the Swiss Federal Institute of Technology in Lausanne (EPFL) in 1991 where he presently heads the group for investigation of bulk piezoelectric materials. His current research interests include investigations of the mechanisms that contribute to

the piezoelectric hysteresis, relaxation and nonlinearity, applications of piezoelectric materials under extreme conditions (low frequency, high temperature, high pressure, reducing conditions), piezoelectric materials for medical applications, piezoelectric sensors and actuators for vibration and noise control, properties of relaxor-ferroelectric thin films and single crystals, properties of lead-free based ferroelectrics, and anisotropy in ferroelectric materials. He is a senior member of the IEEE, an associate editor of the IEEE Transactions on UFFC and the Journal of the American Ceramics Society and is a member of the Ferroelectrics committee of the IEEE UFFC Society.

Dragan Damjanovic has been appointed a Senior Scientist at the Swiss Federal Institute of Technology in 2006. In the last ten years he participated in and directed a dozen of Swiss and European projects on applications of ferroelectric and piezoelectric materials and has carried out several Swiss National Science Foundation projects investigating fundamental properties of ferroelectric materials. He has published over 140 papers and book sections, has two patents in the field of application of ferroelectric materials and has given about 40 invited talks on piezoelectric and related materials at international conferences and meetings.

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### Michael M. Driscoll

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Michael M. Driscoll received his BSEE degree from the University of Massachusetts in 1965, the same year he joined the Westinghouse Defense and Space Center (now Northrop Grumman Electronic Systems) in Baltimore, Maryland. Mike is currently a Senior Consulting Engineer in the Product

Technology and Program Engineering Group, working primarily on the design and development of low noise signal generation hardware used in Northrop Grumman Radar Systems.

Mike is a recipient of the George Westinghouse Innovation Award (1993), the George Westinghouse Signature Award of Excellence (1994), and the Northrop Grumman Lifetime Achievement Award (2006). Mike has served as President, Vice-President, and Secretary-Treasurer of the Baltimore, Washington, and Northern Virginia chapter of the IEEE UFFC Society, and he has been a member of the UFFC International Frequency Control Symposium (IFCS) Technical Program Committee for the past 20 years. Mike has been an IEEE member since 1980, and was elected as an IEEE Fellow in 1991. He was awarded the UFFC Society's Cady Award in 1997 for Outstanding Contributions to the development of Low Noise Signal Generation Hardware. Mike has also served as the Co-Chair of the 2005 IFCS-PTTI Joint Conference and Chair of the recent 2006 IFCS. Mike has authored over 70 technical papers in IEEE Proceedings and Technical Journals, primarily dealing with the design and test of low noise signal generation hardware, and holds 15 U.S. Patents.

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### Glen Fox

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Glen Fox has engaged in the research and development of ferroelectric, thin film and ceramic materials for the past 18 years at industrial, university, and government laboratories. He received a B.S. in Ceramic Science and Engineering in 1987 and a Ph.D. in Solid State Science in 1992 from The Pennsylvania State University.

For his Ph.D. dissertation he studied sputter deposition, microstructure and the electrical properties of ferroelectric thin films. This work led to models that explained the relationships between deposition processes, microstructure, and ferroelectric properties. After leaving Penn State, he joined the faculty of the Swiss Federal Institute of Technology in Lausanne, Switzerland where he held research associate and assistant professor positions. As part of multinational scientific collaborations and projects funded by the European Union and the Swiss National Science Foundation, he developed tunable optical fiber devices, such as phase modulators and integrated wavelength modulators that used piezoelectric and resistive fiber coatings. In addition, Dr. Fox invented processes for fabricating piezoelectric microtubes with diameters as small as 10  $\mu\text{m}$ .

Since 1997, Dr. Fox has worked for Ramtron International Corporation where he is currently the manager of the High Density FRAM Development Group. Ramtron is the only US manufacturer of non-volatile ferroelectric random access memories (FRAM). Dr. Fox directs a joint development program that is responsible for the design, materials characterization, functional test and reliability testing of 256 Kb and 4 Mb FRAM test chips as well as a 4Mb FRAM product built on a 130 nm, 5 level-metal, Cu/FSG process line. He has been issued 7 patents related to ferroelectric random access memories and has authored or coauthored over 60 scientific journal articles, proceedings and book chapters. His professional activities include acting as an advisory board committee member for two international conferences and providing reviewer services for journals and scientific organizations.

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### Ken-ya Hashimoto

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Ken-ya Hashimoto was born in Fukushima, Japan, on March 2, 1956. He received his B.S. and M.S. degrees in electrical engineering in 1978 and 1980, respectively, from Chiba University, Japan, and Dr. Eng. degree from Tokyo Institute of Technology, Japan, in 1989.

In 1980, he joined Chiba University as a Research Associate, and is now a Professor of the University. In 1998, he was a Visiting Professor at Helsinki University of Technology, Finland. In the winter of 1998/1999, he was a Visiting Scientist of the Laboratoire de Physique et Metrologie des Oscillateurs (LPMO), CNRS, France. In

1999 and 2001, he was a Visiting Professor at the Johannes Kepler University of Linz, Austria. In 2001, he served as a guest co-editor of the IEEE MTT Trans. Special Issue on Microwave Acoustic Wave Devices for Wireless Communications. He also served as a publicity co-chair of the 2002 IEEE International Ultrasonics Symposium. Since 1996 he has been a member of the technical program committee of the IEEE International Ultrasonics Symposium, and since 2001 of the IEEE Frequency Control Symposium. In 2002, he was appointed to a member of the speaker's bureau of the IEEE MTT-Society. He serves as the International Distinguished Lecturer of IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society during July 2005 and December 2006.

Dr. Hashimoto has authored or co-authored more than 160 papers in refereed journals and conference proceedings. He has contributed to 7 books including a textbook "Surface Acoustic Wave Devices in Telecommunications" published by Springer Verlag in 2000. His current research interests include various types of surface and bulk acoustic wave devices, acoustic wave sensors and actuators, piezoelectric thin films, and application of thin-film micro-machining technologies to the acoustic wave devices.

Dr. Hashimoto is a Fellow of the IEEE and a Member of the European Microwave Association, the Institute of Electronics, Information and Communication Engineers, the Institute of Electrical Engineers of Japan, and the Acoustical Society of Japan.

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### Oliver Keitmann-Curdes



Oliver Keitmann-Curdes (Member IEEE), born 1974, studied Electrical Engineering (Dipl.-Ing., comparable to M.Sc.) at Ruhr-University Bochum, Germany. In 2000, he started his scientific work at the Institute of High Frequency Engineering in Bochum (Prof. Helmut Ermert). His work in ultrasonics involved an ultrasonic transmission camera and ultrasonic nondestructive testing. Oliver worked in the simulation of ultrasonic wave fields, the optimization of beamforming parameters, experiments with ultrasound contrast agents in transmission mode, the design and development of single element ultrasonic transducers for applications in NDT and 3D contour detection. He authored and co-authored more than 20 scientific papers (four of them in refereed journals) and one patent application. His Ph.D. studies will be finished in 2006. Since May 2006, Oliver is employed by Flexim GmbH, Berlin, Germany, where he is working in the R&D group for ultrasonic flow meters.

Apart from his scientific work, Oliver has been active within IEEE in 1995. Since then, he served as chair and vice-chair in the IEEE Student Branch Bochum as well as in the German IEEE Section (as Electronic Communications Officer). Later, he became Student Representative within the UFFC Society from 2004-2005. He is currently part of the organization committee for the 2007 IEEE Ultrasonics Symposium and is proposing Stockholm as the next

European venue for the 2009 IEEE Ultrasonics Symposium.

Oliver is married and became father of his first son in 2006. Leisure activities and interests include his family, hiking, cycling and reading.

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### Roman Maev



Roman Gr. Maev (M'95-SM'96) was born in 1945 in Moscow, USSR. He received combined B.S. and M.Sc. degrees in Theoretical Solid-State Physics from Moscow Physical Engineering Institute in 1969, and a Ph.D. in the Theory of Semiconductors in 1973 from the Physical N. Lebedev Institute of the USSR Academy of Sciences. In 2001 he received a Dr. Sc. Degree from the Russian Academy of Sciences, and in 2005 received a Full Professor diploma in Physics from the Russian Federation Government.

In 1978, he was appointed as Associate Professor and since 1979 he served as Acting Chair of the Applied Physics and Biomedical Physics Chair at the Moscow Physics Technical Institute (University). In 1984, Dr. Maev established and led the Biophysical Introscopy Laboratory at N. Semenov Institute of Chemical Physics, Moscow. In 1987, Dr. Maev established and became Director of the Acoustic Microscopy Center (AMC) at the Russian Academy of Sciences, Moscow.

In 1995 he was appointed as a Full Faculty Professor with Tenure in the School of Physical Sciences at the University of Windsor. Dr. Maev established and is the Director of the Centre for Imaging Research and Advanced Material Characterization (CIRAMC) at the University of Windsor since its inception in 1997. In 2002 he was appointed as Chairholder of the DaimlerChrysler/Natural Sciences and Engineering Research Council Industrial Research Chair in Applied Solid State Physics and Material Characterization. Further, in 2006 Dr. Maev received the rank of University Professor at the University of Windsor. Dr. Maev is an Adjunct Professor at the Johns Hopkins University, Baltimore, MD. He has published over 250 articles, various reviews, two monographs, has been the editor of several books, and holds twenty-three patents.

In recognition of his contribution to the development of ultrasound techniques, Dr. Maev was awarded the Pioneer Award by the American Institute of Ultrasound in Medicine in 1988. Dr. Maev holds a few Annual Awards for the Best Research Results from the Russian Academy of Sciences; the Centenary Ernst Abbe Medal from the World Microscopical Society, 1989; a Letter of Recognition from the Deputy Prime Minister of Canada for Research Excellence, 2001; 2002 and 2006 Award for Outstanding Research and Development from the DaimlerChrysler Corporation; Awards in recognition of research and scholarship excellence from the University of Windsor, 2000, 2001, 2002, 2004 & 2005; and the 2002 Canada Innovation Summit Award in recognition of contributions to new knowledge and technical innovation. Dr. Maev is a Senior Member of IEEE, Associate Editor of IEEE TUFFC.

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## Marc Solal



Marc Solal received his Engineer degree from Ecole Nationale Supérieure de Physique de Marseille in 1981, a “Docteur-Ingenieur” diploma in 1983, and the “Habilitation à Diriger les Recherches” in 2000.

He has been involved in the SAW field since 1981 when he joined the SAW team of Thomson, Sophia-Antipolis, France (now Temex). His research efforts were first focused on SAW dispersive and bandpass transversal filter design and analysis. Since 1991, his research interests have been in low loss filters for mobile radio, including device modeling and design, investigation of new piezoelectric materials and filter structures. He developed, with his colleagues, the RSPUDTs SAW filter widely used today. He holds about 20 patents.

From 2000 to 2004, while continuing his work in his company; he was Director of the “Laboratoire de Physique et de Microsonique”, a joint laboratory between Thomson Microsonics (now Temex) and the Laboratoire de Physique et Métrologie des Oscillateurs (LPMO) of Centre National de la Recherche Scientifique, Besançon, France. His work included building long term collaboration with academic laboratories, resulting in numerous research projects. He also participated to the supervision of several PhD students.

In November 2004 he joined TriQuint semiconductor, Orlando, Florida, where he is involved in the development of acoustic technologies. Since 2003, he has served as a Technical Program Committee member for the IEEE Ultrasonics Symposium.

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## Gregory L. Weaver



Gregory L. Weaver joined the Senior Professional Staff of JHU/APL in 2003 and works within the RF Engineering Group of the Space Department. He is a technologist with extensive background in both the technical and business aspects of the frequency control industry and has held positions as a senior design engineer, technical manager and marketing strategist over a 20 year career history, including vice president positions with Biley Technologies

Inc. and the former Piezo Crystal Company. He received his M.S. in Technology Management from the University of Pennsylvania in 1993 and his B.S. in Physics from Dickinson College in 1982. He is a licensed professional engineer in the state of Pennsylvania, member of the IEEE and the UFFC Society. He has contributed frequently to a variety of technical conference proceedings including the IEEE International Frequency Control Symposium and the European Frequency and Time Forum.

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## Wilko G. Wilkening



Wilko G. Wilkening was born in Bonn, Germany in 1970. He received his Master's degree (Diplom-Ingenieur) in 1995 in Electrical Engineering from the Ruhr-Universität Bochum, in Bochum, Germany. During a yearlong internship in the Advanced Development Department of Siemens Medical Systems, Inc.,

Ultrasound Group, Issaquah WA, USA, he contributed to the early developments of 3-D and contrast ultrasound. While working towards his PhD (Doktor-Ingenieur), which he received in 2003 from the Ruhr-Universität Bochum under the supervision of Prof. Helmut Ermert, he further pursued research on ultrasound contrast imaging. During that time, he led the interdisciplinary project on the same topic within the Ruhr Center of Excellence for Medical Engineering (Kompetenzzentrum Medizintechnik Ruhr, KMR), which is funded in part by the German Federal Ministry of Education and Research. Other research interests include beam forming and flow imaging. In 2004, he joined Krohne Messtechnik GmbH & Co. KG as an R&D scientist working on ultrasonic flowmeters.

From 1997 to 2000, he served as secretary of the German UFFC Chapter, and he was involved in activities of the local IEEE Student Branch. Dr. Wilkening is also a member of VDE - the Association for Electrical, Electronic & Information Technologies and of the German Association of Biomedical Engineering. He received the “Young Investigator Award” at the Fifth Heart Centre European Symposium on Ultrasound Contrast Imaging in 2000, and in 2003 he was awarded the “Gebrüder Eickhoff-Preis” for his PhD thesis. In his leisure time, he enjoys singing in an a capella group, dancing, languages and cultural activities.

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## UFFC AdCom

### UFFC-Society AdCom Meeting Minutes of 4 June 2004 [Subject to AdCom Approval]

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#### Call to Order

The Administrative Committee (AdCom) meeting of the Ultrasonics, Ferroelectrics, and Frequency Control Society (UFFC-S) was called to order at 8:18 a.m. on 4 June 2006, by Society President Art Ballato. The meeting was held in



Art Ballato

Miami, Florida, in conjunction with the 2006 IEEE International Frequency Control Symposium.

## Attendees

Art Ballato*	Gerry Blessing*
Jan Brown	Mike Driscoll
Mike Garvey	Ruyan Guo*
Fred Hickernell	Jackie Hines*
John Kosinski	Moises Levy
Bob Lorenz	Jian-yu Lu
Lute Maleki*	Rajesh Panda*
Massimo Pappalardo*	Mauricio Pereira da Cunha
Victor Plessky*	Bob Potter*
Leonhard Reindl*	Sorah Rhee*
Clemens Ruppel	Tom Shrout*
Sam Stein	Dan Stevens*
Bernie Tittmann	Susan Trolier-McKinstry*
Herman van de Vaart*	John Vig
Kendall Waters	Marjorie P. Yuhas

*(Note: 15 voting members\* were present for most of the meeting's business.)*

## President's Report

Society President Art Ballato welcomed everyone, especially the newly elected members, who began their terms in January 2006. The new members are Amit Lal, Sorah Rhee, Tadashi Takenaka, and Manfred Weihnacht.

## TAB



At the TAB meeting in February in Phoenix: (l-r) Moises Levy, Art Ballato, Jan Brown, John Vig, and Fred Hickernell



Art Ballato with Bob Lorenz, Director Division II

Art provided AdCom with some comments about the IEEE TAB (Technical Activities Board) meeting from 14-19 February in Phoenix. Art introduced Bob Lorenz, the IEEE TAB Division II Director 2005/2006. Bob presented his background, both personal and IEEE and discussed the various Societies that comprise Division II. He noted that Tom Habetler will be taking over the Division II role. Bob is interested in hearing our comments and concerns. Jan Brown expressed concern that it is difficult for UFFC, being a small society, to get the opportunity for representation. Bob replied that he is in favor of rotation, but not in a forced sense.

## Minutes



Susan Trolier-McKinstry

Lute Maleki made and Susan Trolier-McKinstry seconded a motion that passed unanimously (15 in favor, 0 opposed): to approve the September 2005 (Rotterdam) AdCom minutes.

## Secretary's Report



Dan Stevens

Society Secretary/Treasurer Dan Stevens requested that everyone update contact information on the AdCom roster and took a head count for lunch and dinner. He also thanked Jackie Hines for her service as Secretary/Treasurer.

## Finance Report



Herman van de Vaart

Finance Chair, Herman van de Vaart, provided an oral and written report, including the 2005 Operating Statement, 2006 Status and proposed 2007 Budget.

The highlights from 2005 included a surplus of \$286.2K. Our Net Worth is \$920K, which is 58% of expenses. Jackie discussed the CD archive and some small charges each month from FASS. Jackie will get a spreadsheet that details this to Dan, Herman, Jan, and Don Yuhas.

Herman presented a status report of the 2006 Budget and end-of-year forecast. A TAB finance analyst called him, looking for variances in the budget. YTD income is \$389.3K and Expenses are \$172.6K. The Budget shows a \$74.5K surplus, while the present Year-End Forecast shows a surplus of \$122K.



## Conference Accounting

Herman reminded us again about the effect of the change in accounting rules. Herman indicated that the new accounting rules regarding symposia makes the process complicated. In the past, we accounted for income produced by conferences in the year that the final financial report was finished and the surplus, if any, was transferred to the Society. This was generally the year after the conference was held. However, IEEE now requires the income from a conference to be reported in the year it is held, often resulting in an estimate of the income followed by a correction in the following year. He noted that in a given year, you may not get an accurate estimate of how a particular conference does.

## 2007 Budget Approval

Herman presented the proposed 2007 budget, which showed an expected surplus of \$82.6K.

The budget included conference income/expenses: 2007 IFCS \$10K for incidental expenses only (it is being held jointly with EFTF who will retain all income and will be responsible for all expenses), 2007 IUS \$500K income, \$400K expenses, and 2007 ISAF \$200K income, \$165K expenses, all estimates since no conference budgets have been finalized yet.

Herman van de Vaart made and Gerry Blessing seconded a motion to approve the 2007 Budget. Discussion commenced. Jackie brought up she expects higher AdCom expenses in 2007 due to the high cost of food, etc. in New York during the 2007 IUS. Tom Shrout suggested that that number won't substantially change the picture. Nevertheless, Herman will change it from \$113.6K to \$125K per Jackie Hines' suggestion.

Quite a bit of discussion began about IEEE/TAB Administration fees and the impact they are having. Art asked that the issues be summarized as we needed to move on. Herman summarized the IEEE/TAB Administration fees as follows: – 2004 \$141K, 2005 \$186K, 2006 \$235K, 2007 \$335K.

Herman will increase \$126K to \$135K for AdCom expenses and noted that the \$165K for FASS for producing the Transactions needs finalization. The motion passed (14 in favor, 1 opposed): to accept the 2007 Budget with these changes.

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## Publications

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### IEEE Publications Strategy



Marj Yuhas

Marj Yuhas, filling in for Publications Vice President Don Yuhas, presented an oral and written report.

Don would like to add detail to VP Publications job description and will work with the Editor-in-Chief and Associate EIC to do the same for those positions.

### Publishing Status

Don summarized the Transactions status, indicating that in the middle of last year, there were 150 papers waiting for publi-

cation in the queue, many of them related to special issue editions. Now, one year later, the queue is down to 65. Thanks go to Jian-yu, Ron Keller, and Don for their focus on this.

Marj felt there is a clear benefit to using FASS. There is a cost for additional page content. There was a need to increase the page budget for 2006; we should be OK with a target of 2400 pages in 2007 and will use this for FASS contract. Don is keeping track of this status on a monthly basis and recommends continuing to manage the publication queue and work to reduce backlog to 2 months (~40 articles).

Jan Brown established the previous 3-year editing contract with FASS and it expires 12/31/06. Don requested an estimate from FASS. Three contract options were proposed: a 1 year with a 3.4% increase, a 3-year with 2400 pages, and a 3-year with fixed price per page. Don recommends the latter which has a charge of \$73.85 per page. Total should come to about \$177K plus \$12K for expenses. Don would like to see monthly updates to the printing charges, which Dan will send. Don is looking to see if we are getting the best deal. For the 2007 Budget, Herman used 2400 at this per-page charge. Jackie Hines moved and Herman van de Vaart seconded a motion which passed (15 in favor, 0 opposed): to sign a 3-year agreement with FASS at a per-page price of \$73.85.

## Xplore Issues

The presentation moved on to discussing the algorithm used in Xplore. The basic factors in the new surplus distribution algorithm are: Usage (55%), Content (35%) and Base (10%). Status: All Transactions and Proceedings are Xplore compatible from their inception. Thanks again to Jian-yu and Ron Keller for their efforts.

On matters concerning the UFFC website, Don made a recommendation that we establish a link to Xplore through our website to get rid of redundancy.

## Mailing Lists

Marj discussed and presented statistics on the e-mailing lists and announcements. A Master UFFC email list was created and a maintenance process developed. There are 15,477 unique email addresses. A procedure for email announcements was implemented at a cost of about \$100 per mailing. Don's recommendation is to continue with the current process for announcements and email management and to focus on data mining.

## Digital Archive



Ruyan Guo

Much discussion began regarding the Digital Archive and what is the appropriate way to distribute the CD ROM. We currently have all the UFFC Digital Archive content on Xplore. Ruyan suggested we distribute new content updates at the end of each year. Jan mentioned that AdCom already had passed a motion to distribute yearly updates, but that the 2005 update was put on hold due to the backlog issue. We are exploring switching to DVD format, where we

would only need 4 DVDs instead of the current 30 plus CDs. Jackie mentioned that there was an action item to look at rates, including a \$10 yearly charge for updates. Marj said that Don will have a proposal prepared for Vancouver.



**Mauricio  
Pereira da  
Cunha**

Jan has explored putting the EIA Kansas City Proceedings into the Digital Archive. It will cost about \$12K. Jan said that Roger Ward has clean copies and that EIA would assign the Copyright. EIA would get a digital copy. Gerry Blessing moved, and Jackie Hines seconded a motion to allocate funds to incorporate the Kansas City Crystal Conference Proceedings into the Digital Archive. The principal discussion topic revolved around whether or not this content should be Xplore available, since many presentations are not complete or missing. Lute asked if this information is of value now or more of historical significance. Art – largely historical. Mauricio thought we should just archive it on the web; others thought we could make it independently searchable. Marj questioned how we could keep this consistent with DVD updates. The motion came to a vote, passing (13 in favor, 2 opposed, 1 abstention): **to digitize EIA KCCC Proceedings and place on the web with an expense estimate of \$12K.**

### Panel of Editors Meeting (Montreal)

Don Yuhas, Jian-yu Lu, and Marj Yuhas attended the POE meeting in Montreal on 31 March - 1 April. Issues identified there were: multiple journal submissions of essentially the same paper, no migration to newer version of Manuscript Central, the need for metrics, and forward looking work from IEEE. Some recommendations were offered: Have copyright form signed at time of submission and wait until other journals have migrated to new MC.

### Transactions



**Jian-yu Lu**

Transactions Editor-In-Chief, Jian-yu Lu, gave a detailed presentation updating issues for the Transactions publication process. He reviewed many of the milestones accomplished in moving from a paper-based system to electronic submission and review to multimedia PDF-based manuscripts. The trend in publishing is increasing usage of multimedia. To date, since 1 August 2003, 59 multimedia manuscripts have been submitted and the rate of growth is increasing. Some people are submitting to other places so that they can use multimedia. Data from Manuscript Central shows the number of reviewers asked to review significantly exceeds the number who accept. Nine special issues have been identified with five already published and four in the review process. Manuscripts are withdrawn if a paper revision is “aging” with the author for more than three months. The PDF version of TUFFC is now compatible with Xplore. Authors are requested to suggest reviewers when they sub-

mit a paper. Ruyan Guo suggested that some feedback to the reviewer of how much work a reviewer has done might be good idea.



**John Vig**

John Vig mentioned that a double blind review process is being trialed by some societies and that some journals are using blogs to add to reviews of papers. The value of PDF is declining. Open Access is moving towards access for free. Examples include Google Scholar and MS. Both can go into Xplore and access to some can be for free. Some forces are pushing for government funded work to be made available for free. Jian-yu indicated that Int. J. Biomedical Imaging is an example. Moises Levy asked if we should be charging as the Physical Society Journals do. John mentioned that NIH is requesting authors to publish in open access one year after publication. Lute Maleki cited examples including the Los Alamos Archive. Optics Express is one of highest quality because it's totally free. It is displacing high-end journals. Benefits include immediacy - two weeks till publication. Certain Journals don't allow publication of papers presented at proceedings. Bob Lorenz suggested that Societies need to be entrepreneurial on this issue. Gerry Blessing feels immediacy will prove more important than peer review. John felt peer review to be more important to academics than to scientific community. Susan Trolrier-McKinstry agreed that peer review is important to academics, as is impact factor important. Publishing in highly revered journals is an important tenure factor. She does not want to see the society go to unfiltered content. Leo Reindl and Massimo Pappalardo agreed that impact factor is important. Ruyan suggested using blogs to help with peer review. John said we should keep the review process as it is now. After a review is completed and the paper posted in Xplore, Open Access posting would happen.



**Leo Reindl**

Jian-yu reviewed the general statistics of the TUFFC, including acceptance and rejection rates, performance of editors, reviewers and FASS. Various measures of impact factor show the TUFFC to be in the top 15% of acoustics journal and in the top 17% of EE journals. As of 1 June 2006, the total number of potential reviewers in MC is 2570 of which 1308 have been asked to review. There is solid growth in both of these numbers. The low rejection rate of TUFFC was a concern by IEEE, but the Associate Editors felt that we should not artificially increase the rejection rate and that timeliness and reputation are of more importance.

Jian-yu identified ongoing work to replace existing IEEE Xplore files with higher quality UFFC Digital Archive files that are more complete and contain context-sensitive PDF-based multimedia. The TUFFC is also working with IEEE to establish a new multimedia standard for all IEEE journals, similar to that already in place in TUFFC.

Since we started using MC about four years ago, the system has run smoothly.

## Newsletter



**Jan Brown**

Newsletter Editor Jan Brown suggested that, with the Ferroelectrics ISAF meeting now moving to an annual meeting, the Newsletter should be published three times per year. This will add about \$15-20K per year in expenses. Bob Potter moved, and Ruyan Guo seconded a motion: To publish the Newsletter 3 times per year. Discussion: Gerry Blessing was concerned that the total work is more. Jan said it was not. The motion passed (14 for, 1 abstain). Jan noted that the next deadline is the end of June. After that, the next deadline is 15 September, after ISAF. For the Newsletter, Jan needs pictures and captions. Jan will be digitizing photos. Any transmission to Jan that is >10MB, needs to be sent on DVD or CD.

## Web



**Kendall Waters**

Kendall Waters, the Society Web Editor-In-Chief, introduced himself and requested that if a request to modify the website is made to a web editor, please cc him. He will be working with the web editors to resolve this.

## Nominations Committee



**Bob Potter**

Bob Potter presented the Nominations Committee slate of candidates for 2007, as it stood. He needed some additional names for Frequency Control. Bob looked into E-voting and found that the services would be expensive. Bob also mentioned that the typical response rate was quite low. Marj Yuhás suggested we need to send out email notifications and reminders. John Vig suggested we may need to stimulate more involvement by identifying some controversial issues in the Newsletters.

## Conference Coordination Committee



**Mike Garvey**

Chair Mike Garvey presented information on running a symposium - "Daunting challenges for the General Chair." He proposed to include topics such as: responsibility matrix, how to improve, how to share experiences, proceedings process, IEEE Xplore issues, Scholar One (currently handles Manuscript Central), e-papers, the OASIS Ultrasonics 3-year contract,

(more efficient, lower cost than FASS), and revised IEEE conference policy.



**Sorah Rhee**

A motion was made by Sorah Rhee, which Lute seconded: "to send Mike Garvey to Panel of Conference Organizers in Montreal, with estimated costs of \$1K". The motion was amended: to increase number of attendees to one representative from each committee, the person to be selected by each VP, with estimated cost of \$1K per person. The amended motion passed unanimously (15 for, 0 against).

## Ultrasonics Committee



**Jackie Hines**

Jackie Hines, Ultrasonics VP, provided an oral and written report. An Ultrasonics Committee meeting was held on June 3, 2006, and another will be held with the 2006 IUS TPC meeting in Chicago on 16 June 2006. The meeting was split this time due to different groups attending the AdCom meeting and the TPC meeting.

## 2005 Symposium

Herman van de Vaart presented a one page preliminary financial report for the 2005 IUS. Social Functions were a large part of expenses. Short courses were a success with excellent participation. Herman expressed some concern with Symposium Management expenses. Total income was \$572.1K and total expenses were \$523.5K, leaving a surplus of \$48.6K.

## 2006 Symposium



**Victor Plessky, Clemens Ruppel, and John Kosinski**

The 2006 IUS will be held 3-6 October 2006 in Vancouver and the General Chair is Stuart Foster. Jackie Hines presented a breakdown of abstract submissions for the conference. A new company (Oasis) handled the abstract submission process, and was well received. They will manage the conference, including all aspects. Clemens Ruppel made a motion from the Ultrasonics Committee: That AdCom approve the budget for the 2006 Ultrasonics Symposium with corrections as discussed at the Ultrasonics Committee meeting. Susan Trolier-McKinstry asked that the motion be

tabled until we have copies of the first page including these corrections. Clemens withdrew the motion for budget approval, and indicated that we will vote later at this meeting or conduct an e-mail vote.

### 2007 Symposium



**John Kosinski**

For 2007, we plan for the conference to be in New York City. A conservative preliminary budget that meets IEEE guidelines was prepared. The budget is currently being reviewed by the Committee, and will be presented for a vote at the AdCom meeting in October. John Kosinski, General Chair, reported that everything is going well with planning for 2007 IUS.

The reception Monday night will be at the hotel due to excessive venue costs outside the hotel and there will be no banquet on Tuesday, to allow everyone to take advantage of the opportunities that NY provides.

### 2008 Symposium



**Jian-yu Lu**

Jian-yu Lu, General Chair, presented a report for the conference, which is to be held in Beijing, China, in the Beijing International Convention Center, which is located within the Olympic Complex that is being constructed. The dates of the conference are 2-5 November 2008 (Sunday through Thursday). Registration will start on 1 November and Short Courses and meetings will be on 2 November. Sessions

begin on 3 November.

A contract has been signed with a local organizing company CICCST for the Program and Social event. The rate is locked in Chinese Yuan. The USD is subject to exchange rate. CICCST will handle all events. A down payment was made. Total price is about \$192K, but is fixed in Chinese Yuan. Registration is in dollars, expenses in Yuan. Mauricio Pereira da Cunha asked if we will also have registration in the local currency and Ruyan Guo asked if Chinese locals pay the same rate as others. The answer was "yes" to both.

### 2009 Symposium



**Massimo Pappalardo**



**Victor Plessky**

Jackie Hines reported that the Ultrasonics Committee is actively considering Rome (Massimo Pappalardo, Chair), Warsaw (Victor Plessky, Chair), and Stockholm (Oliver Keitmann-Curdes, Chair) as possible venues for the 2009 conference.

A vote by the committee will be concluded at the committee meeting on June 16. Based on this vote, the committee will recommend one of these three venues along with a General Chair for an e-mail vote of approval

by AdCom. All three are good candidates for the meeting and some of the features of each site were presented. Jackie noted that due to the weak dollar, all the European venues will be more expensive than previously anticipated.

### 2010 Symposium



**Bob Potter**

For 2010, General Chair Bob Potter is looking in the US at Austin, Long Beach, and San Diego. He will gather more information on and prepare proposals for these venues for consideration at the Ultrasonics Committee meeting this fall in Vancouver.

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### Ferroelectrics Committee

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**Tom Shrout**

Tom Shrout, Ferroelectrics Vice President, provided an oral and written report. The ISAF now will be held every year.

There were two Ferroelectric meetings since the last AdCom, one at the US-Japan Seminar on Dielectric and Piezoelectric Ceramics; 8-9 November 2005 in Annapolis, MD and the other at the PoleCer Meeting: Piezoelectric Applications; 12 February 2006. Tom will

try to hold the standing committee administrative meetings 3 times per year, one each in North America, Asia, Europe.

### 2006 Meeting

The 2006 conference is scheduled for 30 July through 2 August 2006, at the Sea Trail resort in North Carolina with Jon-Paul Maria as General Chair. There are an estimated 325-350 participants with 300 papers and a projected 12.5% surplus. Jackie asked about the 12.5% surplus and Jan Brown stated that it was approved by AdCom previously. The projected surplus at this conference is lower than the recommended 20% in order to attract more students and broader participation from the wider ferroelectric community.

### 2007 Meeting

Tadashi Takenaka was proposed to be the general chair, with Susan as co-chair. It will be held in Nara, Japan from 27-30 May. A motion from committee passed unanimously (13 in favor, 0 opposed): to approve Nara, Japan as the venue for ISAF 2007 with Tadashi Shiosaki as General Chair. The Finance Chair is from Japan. Herman will send a financial template to Tom Shrout.

### 2008 Meeting

Bruce Tuttle and Paul Clem will be the General Co-Chairs for ISAF 2008, to be held 24-27 February 2008 at the Eldorado Hotel in Santa Fe, New Mexico. Tom Shrout reviewed some details regarding the Santa Fe area, transportation options and Companions' programs and side activities. He conveyed that the meeting preparations are in good shape.

## 2009 Meeting

The 2009 ISAF will be combined with IMF in China. An MOU needs to be worked out and some copyright issues need to be resolved. The venue will be at the starting point of Silk Road in the city of Xi'an and at the Xi'an International Conference Center. Transportation is good going there. There are direct flights from several Asian cities. Many other IEEE and other conferences have been there.

## Future Symposia

2010 - looking at U.K. Harrogate, England, possibly joint with ECAPD.

2011 - North America suggested by Gerry Blessing, since it's in the cycle.

Other sites for future: Tanzania, Australia, New Zealand. Art mentioned that someone from Africa suggested to him to avoid places other than South Africa and Egypt for conferences.

Tom wrapped up his presentation with a proposal for a "Young Investigator Award" ISAF would then be giving two awards at each conference. The Ferroelectrics Recognition Award was approved at the last AdCom. The YIA proposal was championed by Ahmad Safari and would need AdCom approval. Jackie said it would also need TAB Awards Committee approval and Jan said that TAB should be informed from AdCom awards chair. A motion was made by Tom Shroul and seconded by Lute Maleki to: **have a Ferroelectrics Young Investigator's Award with a \$2000 stipend.** Jan commented that Tom needs to get details (criteria) of the award finalized and they can then be forwarded to TAB ARC. The motion passed unanimously (11 in favor, 0 opposed).

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## Frequency Control Committee

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Lute Maleki

Lute Maleki, Frequency Control VP, presented an oral and a written report, and cited 2005 IFCS as having a great surplus.

## 2006 Symposium



Mike Driscoll

Mike Driscoll submitted a written report summarizing the conference status to date. Registration was the biggest unknown. At the time of the AdCom meeting, the attendance was short 39 full conference preregistrations. No way to tell the present status. Decisions were made: to add a Welcome Reception in addition to the Vendor Reception based on the food and beverage estimates from the hotel; to offer \$500

honorariums to all Tutorial speakers, in addition to other travel support in some cases; to give laptops to the student paper award winners; and to have wireless internet access in the exhibit areas. Mike noted that 50% of these wireless internet access fees were generously offset by a contribution from PSI. Exhibit booth rental is five short of expectations, offset by lower hotel charges for the exhibits. Invited speaker and student travel expenses were \$13K over budget. However, donations and AdCom matching income is projected to be \$10K over budget. Mike commented that the "Budget remains the Budget", but categories may change. Mike reviewed the TPC meetings, the decisions leading to the choice of hotel and some of the finances.

## 2007 Symposium

The 2007 Frequency Control Symposium will be joint with the EFTF in Geneva Switzerland, with all the work handled by our European colleagues. The role of the US co-chair, Bernardo Jadaszliwer, will be primarily ceremonial, and the responsibility for the technical program is shared about equally between FC and EFTF personnel. The joint meeting is being held concurrently with the European Navigation Conference under the designation TimeNav'07 and focuses on both the present status and future developments in navigation systems. IEEE & EFTF attendees can attend the T&N forum. There are a number of tutorials on the Galileo System. Lute reviewed the venue which is the International Conference Center in Geneva. The TPC will be held in two places, one here in Miami, and the second in Geneva. The first U.S. TPC is being held on Tuesday, 6 June. The call for papers will be generated after this. Paper selection will be done here as well as in Geneva.

Art Ballato noted that on Tuesday, 29 May 2007 the AdCom will be held in Geneva, preceding the EFTF and asked Lute to make arrangements for this. Lute identified that the cost is about \$28K to have this. A motion was made from committee to accept this budget. John Vig stated that income from hits on web will far exceed this expense. Herman asked if the Proceedings will be published by the IEEE? Lute- Yes. Jackie asked who pays for the Proceedings. Lute stated that they provide the whole thing. Our only cost is one coordinator. We will get an Xplore-compatible CD at no additional charge.

Jackie asked about what mechanism we should use to budget for AdCom expenses and how to handle this for Geneva. AdCom needs to make other arrangements. Lute agreed. Herman noted that we need to make an estimate and wire money in advance. Dan will need to make arrangements with another account. We need to set up an account with the hotel. Estimate about \$30K+/- . The motion from committee passed (9 for, 1 against): to accept the budget of \$30K for the Joint EFTF/FCS conference.

## 2008 Symposium

The 2008 FCS proposal is for Wakiki, Hawaii on 19-21 May. The first TPC meeting will be in Geneva and the second on the East coast. Kurt Gible will be the TPC chair. A motion from committee passed unanimously (10 for, 0 against) that:

Hawaii be approved for 2008 IFCS with Bernardo Jadaszliwer as General Chair.

## 2009 Symposium

The site for 2009 is not yet selected. A suggestion was Denver.

## 2010 Symposium



Sam Stein

The 2010 symposium will be held in China. Prof. Ji Wang, Ningbo University, sent in a summary and proposal for Shanghai.

Lute introduced Sam Stein as the new Vice-Chair of Frequency Control.

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## Awards



Bernie Tittmann

Art mentioned that Reinhard indicated that he would be transitioning out after Vancouver and Helmut Ermet will be taking over. Awards Vice-Chair Bernie Tittmann submitted a nomination from committee: for Tom Shrout to be the July 2007-December 2008 UFFC Distinguished Lecturer. The Distinguished Lecturer generally rotates societies. Bernie suggested that Tom Shrout be the sole Distinguished Lecturer candidate. There were no nominations from the floor. Sorah Rhee spoke on behalf of Tom Shrout. The nomination was approved, with 9 in favor and 1 abstention. The title of the Distinguished Lecture will be "Innovations in Piezoelectric Materials for Ultrasound Transducers."

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## Membership Services



Rajesh Panda

Chair Rajesh Panda gave an oral and written report, indicating that we now have 2047 members. Student membership is up 3.5%. Membership is down 1% and IEEE is taking steps to understand why. Terminator runs (non payment of dues by December) show 14% loss each year with about 20 new members per month. Membership seems to be stabilizing at around 2047 members. Rajesh described

the Ambassador program which was renewed for 2006 in September and includes half price membership for members earning less than \$10K. He asked if we should be looking at a list, including India.

Rajesh indicated that UFFC booth was successful in Rotterdam, with many students volunteering at the booth. He thanked Oliver, Asha, Manny and all the student volunteers for help with the booth. Some new people joined IEEE. There is a booth here in Miami and we need to coordinate

one in the upcoming ISAF. He asked Tom Shrout for booth space. Jackie Hines noted that we used to provide transactions, but now e-copies. We want to encourage new members and she suggested that we need to understand if the expense of providing hard copies is, in reality, a net drain to the Society.

Victor Plessky brought up a concern regarding how to make membership payments to IEEE given that the banking system is imperfect in some countries. He proposed the possibility of paying in Russia and somehow transferring the funds. Jan Brown volunteered to try to find out how to do this. Herman noted that the cost of membership is \$160 and this may be difficult for many people to pay.

Rajesh reported Chapter Activity updates from Elizabeth Schenk. All 8 chapters (Connecticut, Germany, Japan, Oregon, Phoenix, Russia Northwest, Russia, and Toronto posted UFFC meeting reports for 2005. So far in 2006, only Toronto and two of the U.S. chapters have reported meeting events. In response to an IEEE Corporate Strategy and Communications request last July on any UFFC planned or future activities in region 10, especially in China, Elizabeth noted that we have 12 members in Nanjing (location of China's major acoustics research institute) and 10 in Beijing (location of Tsinghua University).

Rajesh concluded by offering to continue to support requests from AdCom members for information, profiles, and other statistics from the SAMIEEE database.

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## Publicity



John Vig

John Vig, Publicity Chair, indicated that there are 300+ sections worldwide. It is our responsibility to populate conference databases. The President and Secretary get poled to update databases.

Email harvesting results in 15000 in database. IEEE Xplore source looks at email address on publications - Marj Yuhas does this. At conferences, more than 50% are not members and we should use this as source of members. There is a booth at this conference and John would like a booth at every conference, stocked with proper materials of IEEE and UFFC. We need volunteers to staff the booth. We are offering free access to IEEE Explore for this week. IDL (IEEE Digital Library) is the least expensive option for complete access to IEEE Xplore content and Enterprise is more expensive. If we get one or two subscriptions per conference we come out ahead, as the UFFC gets 20% of the subscription price. This brought in \$20K this year. Adjusting registration fee to "give away" free memberships doesn't seem to work.

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## Fellows

Chair, Fred Hickernell, reported that there were nine nominees from the UFFC society that were evaluated by the six-member Fellow's Committee of our society. The committee presently consists of an active member from each of the



**Fred  
Hickernell**

three divisions plus two independents and the Chair. The six-member committee ranks the nominees and also supplies comments for each candidate regarding their qualifications for the election to the Fellow category of the IEEE. The rankings and comments are submitted to the IEEE Fellows Committee for the final decision. Each society's report counts as 25 points out of a possible 90 points. The notification of elected Fellows of the IEEE for the class of 2007 will be made in November of 2006. Fred reminded us that the deadline for submitting Fellow nominations for the class of 2008 is March 1, 2007. The form for submission is available on the IEEE website. Moises Levy asked what percentage is usually approved. Fred answered that there were 3 out of 5 last year and that the UFFC percentage is higher than in many Societies.

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### Historical Committee

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**Fred Hickernell and Jan Brown with Mike Garvey in the background**

Chair, Fred Hickernell, noted that Jan Brown has continued to obtain from the IEEE History Center and include a "This Day in History" article into the newsletter. Additional historical articles are encouraged for inclusion in the newsletter from our membership. Remember to submit to Jan your historical photos of people and places to be archived.

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### Long Range Planning

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**Gerry  
Blessing**

Gerry Blessing would like to have us as a society define our positions - VPs, include Conferences and Finance. A month before Vancouver deliver position description to Gerry, including amount of time spent. He suggests we look at Society's "technical scope". There is overlap between conferences in some areas, especially sensors. There is some alignment with SAW and BAW, FCS and Ultrasonics, Medical.

Lute Maleki stated that we want overlap to be complementary, not in competition. For example, sensors are now in Frequency Control, but attending people want to go to Ultrasonics. Jackie suggests we need to get together to talk about this. Mauricio recalled that one past

idea was to align the two symposia in the same week.

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### Constitution and Bylaws Review Committee

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Chair, Gerry Blessing, stated that there is progress towards a complete overhaul of the UFFC Constitution and a lot of what's in it will carry over to the Bylaws. His vision is that this will be accomplished early next year and he invites representations from Europe and Asia. A second person from Japan has been invited.

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### UFFC-S Representatives

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#### UFFC Society Superconductivity Council



**Moises Levy**

Representative Moises Levy updated AdCom on activities within the IEEE Council on Superconductivity. IEEE established the Superconductivity Committee in 1990. Each of ten participating IEEE Societies contributed a start up amount of \$5,000 and two representatives. The IEEE Superconductivity Committee became the IEEE Council on Superconductivity, CSC, in January 2000 and publishes the IEEE Transactions on Applied Superconductivity, TAS, on a quarterly basis.

CSC is now closely associated with the Applied Superconductivity Conference, ASC, which is held on even years, and the Magnet Technology Conference, MT, which is held on odd years. The attendance at ASC is about 1,500; at MT, about 600. Fully refereed manuscripts submitted by authors from ASC conferences are published in TAS on odd years in the June Issue. The fully refereed manuscripts submitted by MT authors are published in the June Issue of even years. On odd years TAS publishes about 3,500 pages and on even years it publishes about 2,000. As of April 2006, CSC had reserves of about \$800K at the end of 2005, according to IEEE TAB Finance.

CSC created IEEE CSC Awards in Applied Superconductivity that are now being presented at opening plenary sessions of both ASC and MT. CSC initiated a program of matching funds to encourage students to attend and participate in both ASC and MT conferences and provides matching funds to help with editorial costs at both ASC and MT conferences. CSC has been appointing a yearly Distinguished Lecturer since 2001.

CSC is fully sponsoring MT 20, to be held in Philadelphia, PA, from 27-31 August 2007, at the Philadelphia Marriott Downtown Hotel. In order to commemorate the 40th Anniversary of the first ASC Conference, CSC and ASC have prepared a digital archive of all the ASC conferences, which will be distributed at ASC 2006, which is being held in Seattle, WA, from 27 August - 1 September 2006, at the Washington State Convention and Trade Center.

#### IEEE Sensors Council

John Vig reported that the Sensors conference is doing very well, with 600 attendees.

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## Old Business

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Digitizing the AdCom minutes – Presently, the only copy is a hard copy with IEEE. A motion was made and unanimously approved (9 votes in favor, 0 opposed): The archive of the UFFC Minutes shall be digitized and placed in the UFFC Digital Archive on the web for expenses of \$5K. FASS will do the digitizing and add the minutes to the UFFC Digital archive. Future minutes will be added to the digital archive once they have been approved by AdCom. Jan will arrange to have the minutes sent from IEEE to FASS.

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## New Business

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Nanotechnology Magazine – Art spoke about Meyya Meyyappan's activity of canvassing societies to see if there is interest in supporting this magazine. The impact is about \$4K per year. A motion was made by Art: to support this initiative. Lute Maleki seconded the motion, commenting that one of emerging areas is also MEMS. The motion passed unanimously (9 votes in favor, 0 opposed).

Lute Maleki brought up a request from the Smithsonian Institution looking for support of the Navigation and Time Exhibit - we will take an email vote on this. Moises Levy asked about the cost of the project as a whole and what \$10K

provides us. Lute responded that they asked this, and more questions will be asked. He noted that another Society gave \$15K. Jackie suggested that we want to be similar in scope. John Vig reminded us that we need IEEE approval for >\$25K. Jackie asked about logo issues and such. Rajesh Panda wanted to know where the exhibit will exhibit be. Lute – Space & Science. Art asked about who is actually running the exhibit. Lute will find out. Victor Plessky was concerned that this represents substantial spending compared to student awards. John Vig cautioned us to watch these little items, as they add up. Lute noted that the important thing to answer is if we want to support the content, not the dollar amount. John Kosinski suggested that we need to have a structured way of bringing up expenses so that we get judgments of pros and cons. Lute will send a description and what we will get in return.

Jackie Hines made and Dan Stevens seconded a motion that passed unanimously (9 votes in favor, 0 opposed): To adjourn the AdCom meeting. The meeting was adjourned at 5:15 pm, 4 June 2006.

THE NEXT UFFC-S AdCom MEETING will be held on Tuesday, 3 October 2006 in Vancouver BC in conjunction with the 2006 Ultrasonics Symposium.

**Daniel S. Stevens**  
UFFC-S Secretary/Treasurer

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# Ultrasonics, Ferroelectrics, and Frequency Control Society Administrative Committee & Associates

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## SOCIETY OFFICERS

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<b>PRESIDENT</b>	Arthur Ballato	US Army CERDEC, Fort Monmouth, NJ
<b>PRESIDENT-ELECT</b>	Susan Trolier-McKinstry	The Pennsylvania State University
<b>VP, FERROELECTRICS</b>	Thomas R. Shrout	The Pennsylvania State University
<b>VP, FREQUENCY CONTROL</b>	Lute Maleki	Jet Propulsion Laboratory, Pasadena, CA
<b>VP, ULTRASONICS</b>	Jacqueline H. Hines	Applied Sensor R&D Corp., Annapolis, MD
<b>VP, PUBLICATIONS</b>	Donald Yuhas	Industrial Measurement Systems Inc., IL
<b>SECRETARY-TREASURER</b>	Daniel S. Stevens	Vectron International – Hudson, NH

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## ELECTED ADMINISTRATIVE COMMITTEE MEMBERS

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2004 – 2006 Victor P. Plessky	GVR Trade SA, Bevaix, Switzerland
2004 – 2006 Nava Setter	Swiss Federal Institute of Technology, Lausanne
2004 – 2006 Peter M. Smith	McMaster University, Hamilton, Ontario, Canada
2004 – 2006 Daniel S. Stevens	Vectron International – Hudson, NH
2005 – 2007 Ruyan Guo	The Pennsylvania State University, University Park
2005 – 2007 Massimo Pappalardo	Università degli Studi de Roma Tre, Italia
2005 – 2007 Leonhard M. Reindl	Albert-Ludwigs-Universität, Freiburg, Germany
2005 – 2007 Mark E. Schafer	Sonic Tech, Inc, Ambler, PA.
2006 – 2008 Manfred Weihnacht	IFW Dresden (retired), Dresden, Germany
2006 – 2008 Sorah Rhee	Meggitt Endevco, San Juan Capistrano, CA
2006 – 2008 Amit Lal	Cornell University/DARPA, Arlington, VA
2006 – 2008 Tadashi Takenaka	Tokyo University of Science, Japan



## STANDING COMMITTEE CHAIRS & VICE-CHAIRS

### AWARDS

Awards Vice-Chair\*

### FELLOWS\*

### FINANCE

Finance Vice-Chair\*

### ULTRASONICS

Ultrasonics Vice-Chair\*

### FERROELECTRICS

Ferroelectrics Vice-Chair\*

### FREQUENCY CONTROL

Frequency Control Vice-Chair\*

### MEMBERSHIP SERVICES

Chapters Vice-Chair\*

### NOMINATIONS

Vice-Chair Nominations\*

### PUBLICATIONS

Vice-Chair Publications\*

### TRANSACTIONS EIC\*

Trans. Associate EIC\*

### NEWSLETTER EDITOR\*

### WEB EDITOR-in-CHIEF\*

### STANDARDS

Standards Vice-Chair\*

Reinhard Lerch  
 Helmut Ermert  
 Bernhard R. Tittmann  
 Fred S. Hickernell  
 Herman van de Vaart  
 Jan Brown  
 Jacqueline H. Hines  
 Mauricio Pereira da Cunha  
 Thomas R. ShROUT  
 Bruce A. Tuttle  
 Lute Maleki  
 Samuel Stein  
 Rajesh K. Panda  
 Elizabeth H. Schenk  
 Bob Potter  
 Ray Filler  
 Donald Yuhas  
 TBD  
 Jian-Yu Lu  
 Marjorie P. Yuhas  
 Jan Brown  
 Kendall Waters  
 William Hunt  
 Robert W. Schwartz

Universität Erlangen-Nürnberg  
 Ruhr-Universität Bochum, Germany  
 The Pennsylvania State University, PA  
 Motorola (retired), Phoenix, AZ  
 Honeywell (retired), Plymouth, MA  
 JB Consulting, West Whatley, MA  
 Applied Sensor R&D Corp., Arnold, MD  
 University of Maine, Orono, ME  
 The Pennsylvania State University, PA  
 Sandia National Laboratories, NM  
 Jet Propulsion Lab., Pasadena, CA  
 Timing Solutions, Corp., Boulder, CO  
 Philips Medical Systems, Andover, MA  
 STERIS Corporation, Mentor, OH  
 Vectron International – Hudson, NH  
 US Army CERDEC, Fort Monmouth, NJ  
 Industrial Measurement Systems Inc. IL  
 University of Toledo, OH  
 Industrial Measurement Systems Inc., IL  
 JB Consulting, West Whatley, MA  
 Volcano Corp., Cleveland, OH  
 Georgia Institute of Technology, Atlanta  
 University of Missouri – Rolla, MO

### Sr. Past President

### Jr. Past President

### Sr. Student Member\*

### Jr. Student Member\*

\*Non-voting position

Ahmad Safari  
 Gerald V. Blessing  
 Emanuel Gottlieb  
 Jennifer Ruglovsky

Rutgers University, New Brunswick, NJ  
 NIST (retired), Gaithersburg, MD  
 University of Southern California  
 California Institute of Technology

## AD HOC COMMITTEES

### CONFERENCES

### PUBLICITY

### EDUCATION

### HISTORIAN

### LONG RANGE PLANNING

### CONSTITUTION/BYLAWS REVIEW

R. Michael Garvey  
 John R. Vig  
 E. Koray Akdogan  
 Fred S. Hickernell  
 Gerald V. Blessing  
 Gerald V. Blessing

Symmetricom, Beverly, MA  
 US Army CERDEC, Fort Monmouth, NJ  
 Rutgers University, New Brunswick, NJ  
 Motorola (retired), Phoenix, AZ  
 NIST(retired), Gaithersburg, MD  
 NIST(retired), Gaithersburg, MD

## SUB-COMMITTEE MEMBERS

### Standards

Ferroelectrics  
 Ultrasonic ID Tags  
 Piezoelectric Crystals  
 Piezomagnetic Technology  
 Sensors, Actuators & Trans.  
 Surface Acoustic Wave Devices  
 Time & Frequency  
 UFFC Stds. Liaison to SCC-27

Susan Trolier-McKinstry  
 Clinton S. Hartmann  
 Lewis T. Claiborne  
 Bikash K. Sinha  
 Robert W. Schwartz  
 Fabien J. Josse  
 Pierre Dufilie  
 Eva Ferrè-Pikal  
 John R. Vig

The Pennsylvania State University, PA  
 RF SAW, Inc., Dallas, TX  
 RF SAW, Inc., Dallas, TX  
 Schlumberger-Doll Research, CT  
 University of Missouri – Rolla, MO  
 Marquette University, Milwaukee, WI  
 Thales Components, Vernon, CT  
 University of Wyoming, Laramie, WY  
 US Army CERDEC, Fort Monmouth, NJ

### Newsletter

Associate Editor for Freq. Control

Eric Burt

Jet Propulsion Laboratory, Pasadena, CA

Associate Editor for Ferroelectrics  
Associate Editor for Ultrasonics

Dwight Viehland  
Jan Brown

Virginia Polytechnic Inst., Blacksburg, VA  
JB Consulting, West Whatley, MA

## Awards

Associate for Frequency Control  
Associate for Ferroelectrics  
Associate for Ultrasonics

Thomas Parker  
David Cann  
John A. Hossack

NIST, Boulder, CO  
Oregon State University, Corvallis, OR  
University of Virginia, Charlottesville, VA

## Web

Web Editor for Ferroelectrics  
Web Editor for Freq. Control  
Web Editor for Ultrasonics

Ruyan Guo  
Leonhard M. Reindl  
Kirk Wallace

The Pennsylvania State University, PA  
Albert-Ludwigs Universität, Freiburg  
Washington University, St. Louis, MO

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## SYMPOSIA LEADERSHIP

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### Ultrasonics Symposia

2006 Vancouver, Canada  
2007 New York City, New York  
2008 Beijing, China

Jacqueline H. Hines – Chair  
Stuart Foster  
John A. Kosinski  
Jian-yu Lu

Applied Sensor R&D Corp., Arnold, MD  
University of Toronto, Ontario, Canada  
US Army CERDEC, Fort Monmouth, NJ  
University of Toledo, OH

### Ferroelectrics Symposia

2006 Sea Trail, North Carolina  
2007 Nara City, Japan  
2008 Santa Fe, New Mexico

Thomas R. Shrout – Chair  
Jon-Paul Maria  
Tadashi Shiosaki  
Paul Clem / Bruce Tuttle

The Pennsylvania State University, PA  
North Carolina State University, Raleigh  
Nara Institute of Science and Technology  
Sandia National Laboratories, NM

### Frequency Control Symposia

2005 Vancouver, Canada  
2006 Miami, Florida USA (joint PTTI)  
2007 Switzerland (joint EFTF)  
2008 TBD

Lute Maleki – Chair  
Michael M. Driscoll  
Michael M. Driscoll  
Bernardo Jaduszliwer  
Bernardo Jaduszliwer

Jet Propulsion Lab., Pasadena, CA  
Northrup Grumman Corp., Baltimore, MD  
Northrup Grumman Corp., Baltimore, MD  
The Aerospace Corp., Los Angeles, CA  
The Aerospace Corp., Los Angeles, CA

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## UFFC Society Representatives

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TAB NewTech - Biotech Council  
Educational Activities Board Liaison  
Journal of Lightwave Technology

Kathy Nightingale  
E. Koray Akdogan  
David L. Hecht  
John N. Lee

Duke University, Durham, NC  
Rutgers University, New Brunswick, NJ  
Xerox PARC (retired), Palo Alto, CA  
US Naval Research Laboratory, DC

Nanotechnology Council  
Sensors Council  
Superconductivity Council  
Transactions on Medical Imaging  
IEEE Prof. Activities Com. (PACE)  
TAB Finance  
TAB New Technology Directions  
IEEE WIE Liaison

Tadashi Takenaka  
John R. Vig  
Moises Levy  
Ahmed Amin  
Kirk Wallace  
Jan Brown  
Dennis R. Pape  
Asha Hall

Tokyo University of Science, Japan  
US Army CERDEC, Fort Monmouth, NJ  
Univ. Wisconsin – Milwaukee (retired), WI  
US Naval UWC, Newport, RI  
Washington University, St. Louis, MO  
JB Consulting, West Whatley, MA  
AlphaLaunch, Orlando, FL  
Rutgers University, New Brunswick, NJ

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## UFFC SOCIETY CHAPTERS

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Connecticut Joint Chapter  
Germany Section Chapter  
Japan Council Chapter  
Oregon Joint Chapter  
Phoenix Joint Chapter  
Russia NW Section Joint Chapter  
Russia Section Chapter

Charlotte Blair / Ray Zeitler  
Helmut Ermert  
Tadashi Takenaka  
Pradeep Kumar  
David Penunuri  
Yuri V. Filatov  
Georgy D. Mansfeld

Cheshire, CT / Phonon, Simsbury, CT  
Ruhr-Universität, Bochum, Germany  
Tokyo University of Science, Japan  
Schnitzer Steel Industries, Portland, OR  
Rockwell Collins, Scottsdale, AZ  
St. Petersburg Electrotechnical Univ.  
Inst. Radioengr. & Elx. RAS, Moscow

Toronto Joint Chapter

Bruno N. Di Stefano

Nuptek Systems Ltd., Toronto, Ontario

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### DISTINGUISHED LECTURERS

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July 2005 – December 2006  
July 2006 – December 2007  
July 2007 – December 2008

Ken-ya Hashimoto  
Andreas Bauch  
Thomas R. Shrout

Chiba University, Japan  
PTB, Braunschweig, Germany  
The Pennsylvania State University

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### DIVISION II DIRECTOR

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Director Division II

Robert Lorenz

lorenz@engr.wisc.edu

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### IEEE HEADQUARTERS

---

IEEE Executive Director and COO  
TAB Managing Director

Jeffry W. Raynes  
Mary Ward-Callan

j.raynes@ieee.org  
m.ward-callan@ieee.org

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## OTHER CONFERENCES

### IX International Conference for Young Researchers

### Wave Electronics and its Applications in Information and Telecommunication Systems, Non-Destructive Testing, Security and Medicine

### ST. PETERSBURG, RUSSIA 9–12 October 2006

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#### An Invitation to a Conference

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This conference is a continuation of our tradition to hold annual meetings for young researchers and specialists.

In the past, the conference topics were generally devoted to the problems of acoustic wave fundamentals and applications. This time, however, the organizers have decided to extend the meeting's program to a series of new topics. These will include varied wave processes and their applications not only in information and telecommunication systems, but in non-destructive testing, security and medicine as well.

The attendees of our meetings always have a chance to tour and enjoy all the beauties of Saint Petersburg—a cultural capital of Russia. We do everything we can to make sure that your visit is not only productive but also very pleasant.

We welcome all of you to our city!

– For information about St. Petersburg, its history and

culture, please visit <http://www.eng.gov.spb.ru>

For information about Saint Petersburg State University of Aerospace Instrumentation please visit <http://www.guap.ru>

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#### Conference Topics

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Topics to be considered include, but are not limited to:

- State-of-the-art of information processing methods based on wave phenomena;
- Optical information processing;
- Resonators and filters for information and telecommunication systems;
- Mathematical simulation of wave electronic devices;
- Image processing in information and telecommunication systems;
- Acousto-optic methods for information processing;
- Fiber optic communication systems;
- Fiber optic technology applications to varied sensors;

- Acoustic and acousto-optic methods for the investigation of material properties;
- Acoustic and acousto-optic methods for non-destructive testing;
- Acoustic methods and devices in medical applications;
- Wave phenomena and their applications in security systems;
- X-ray phenomena and their applications in non-destructive testing and medicine;
- Spin wave theory and applications;
- Wave electronics in space applications;
- Radio electronics in security systems;
- Wave processes outside of traditional electro-technical systems

Even though the conference is designed for scientists and specialists under 35 years old, the organizers are encouraging leading Russian and foreign scientists (without age

restriction) to give summary or overview lectures.

The time limit is 30 minutes for invited lectures and 20 minutes for oral presentations. In addition, a poster section and round table discussion will be organized.

The official conference language is English. In special cases, presentations in Russian will be allowed.

For further information please contact:

St. Petersburg State University of Aerospace Instrumentation

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E-mail: [weconf@home.ru](mailto:weconf@home.ru)

Website: <http://www.home.ru/weconf>

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## The 27th Symposium on Ultrasonic Electronics

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### Special Notes

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Organizing Committee Chair: Prof. Yoshiaki Watanabe

- Location: Nagoya Congress Center, Nagoya, JAPAN
- Dates: 15 - 17 November 2006
- International session: 16 November 2006 (whole day)
- <http://www.use-jp.org/>

### Welcome From the General Chair

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We cordially invite you to participate in the English Session of the 27th Symposium on Ultrasonic Electronics in Nagoya, Japan, on 15 - 17 November 2006.

The Symposium on Ultrasonic Electronics (USE) is the most important meeting on ultrasonic technology in Japan. Since the first symposium in 1980, innovations in ultrasound have been presented covering all the research fields of ultra-

sonics from basic theories to industrial applications.

Since USE 2004, the meeting has featured an international day where papers from all over the world are presented in English. The International sessions this year are scheduled for 16 November 2006. In addition, at USE 2006 all poster sessions on the three meeting days will be presented in English. Over 150 papers and 300 participants are expected at USE 2006, including an invited talk by the IEEE UFFC Society Distinguished Lecturer, Andreas Bauch.

This year the Symposium is being held at Nagoya Congress Center in Nagoya, one of the main cities of Japan. A new international airport Centrair is located within the vicinity of Nagoya.

I eagerly await your participation in this year's symposium.

**Prof. Yoshiaki Watanebe**  
Organizing Committee Chair

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## The 3rd Int. Conference on Precision Oscillations in Electronics and Optics: Theory and Applications (POEO-2006)

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### Special Notes

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**ABSTRACT DEADLINE: 31 August 2006**

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### Multiconference

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The 3rd Int. Conference on Precision Oscillations in Electronics and Optics: Theory and Applications (POEO-2006) will be held in **Guanajuato, Mexico, 7-11 November, 2006**. POEO - 2006 will be a part of the Multiconference on Electronics and Photonics with a common Organizing Committee.

Please visit <http://usic13.ugto.mx/electronicandphotonics/> for complete information on the combined conferences.

Connect with the most accomplished international scientists, researchers and engineers by submitting your paper to these three International Conferences.

- 3th International Conference on Advanced Optoelectronics and Lasers (CAOL 2006).
- 3th International Conference on Precision Oscillations in Electronics and Optics: Theory and Applications (POEO 2006).
- 1st International Workshop on Image and Signal Processing (ISP 2006).

**Yuriy Shmaliy**  
POEO Scientific Program Chair

# HISTORY

## This Day in History

### 2 July 1862

William Henry Bragg was born in Westward, England. In 1915, along with his son William Lawrence Bragg, he was awarded the Nobel Prize for Physics for developing a new scientific technique, X-ray crystallography. He died on 12 March 1942 in London, England.

### 3 July 1886

Radio pioneer John Howard Dellinger was born on this day in Cleveland, Ohio, U.S.A. His contributions included techniques of measurement and the development of the radiosonde, a balloon-borne device that radioed meteorological data to weather stations. Dellinger became the head of the Radio Section of the U.S. National Bureau of Standards, and was made an IRE Fellow in 1923. He also served as IRE president in 1925 and received its Medal of Honor in 1938. He died 28 December 1962.

### 5 July 1888

Herbert Spencer Gasser, co-winner of the Nobel Prize in Physiology or Medicine in 1944 for uncovering how nerve cells function, was born in Platteville, Wisconsin, U.S.A. He pioneered the use of the oscilloscope in medical research. He died on 11 May 1963 in New York, New York, U.S.A.

### 7 July 1752

Joseph-Marie Jacquard, the inventor of the Jacquard loom still used in the textile industry, was born in Lyon, France. Computer historians consider the Jacquard loom's mechanism using punched cards to control the movements of the loom as an important precursor to the use of punched cards in information processing equipment. He died 7 August 1834 in Oullins, France.

### 9 July 1859

Wilhelm Ludwig Franz Hallwachs was born in Darmstadt in what is now Germany. Discoverer of the photoelectric effect, where photons trigger the release of electrons, he died 20 June 1922 in Dresden, Germany.

### 10 July 1856

150 years ago, Nikola Tesla, one of the great inventors in electrical history, was born to Serbian parents in Smiljan, Croatia. He immigrated to the United States, where he became active in the American Institute of Electrical Engineers (AIEE), which awarded him the Edison Medal in 1916 and made him a Fellow in 1917. He died on 7 January 1943 in New York, New York, U.S.A.; in 1975, the IEEE, successor to the AIEE, established an award in his name.

### 13 July 1938

The first of many attempts to use television in theaters occurred in Boston, Massachusetts, U.S.A. About 200 people paid 25 cents each to watch the still-novel technology of "radio with pictures" on a 9-by-12 inch screen.

### 18 July 1853

Nobel Prize winner Hendrik Antoon Lorentz, elaborator of Maxwell's theory of electromagnetism and creator of an electron theory of matter, was born in Arnhem, The Netherlands. He died 4 February 1928 in Haarlem, The Netherlands.



### 6 August 1926

On this date, Western Electric and Bell Labs in collaboration with Warner Brothers and Vitaphone, showed the first successful commercial sound picture "Don Juan," which featured John Barrymore and Mary Astor.

### 16 August 1845

Gabriel Jonas Lippmann, physicist and winner of the 1908 Nobel Prize for Physics for producing the first color photographic plate, was born in Hollerich, Luxembourg. He was also the inventor of the capillary electrometer and of astronomical instrumentation, and was an investigator of piezoelectricity. Lippmann died 13 July 1921, at sea en route from Canada to France.

### 23 August 1806

200 years ago, Charles-Augustin de Coulomb, early investigator of electricity and discoverer of the force law for electric charges, died in Paris, France at the age of 70. He was born 14 June 1736 in Angoulême, France.

### 30 August 1871

Baron Ernest Rutherford was born in Spring Grove (now

Brightwater), New Zealand. A physicist who pioneered the investigation of electromagnetic waves and invented the radio magnetic-detector, Rutherford won his Nobel Prize in Physics for exploring the chemistry of radioactive substances. He died in Cambridge, England, on 19 October 1937.

## 2 September 1969

Professor Leonard Kleinrock and his UCLA Network Measurement Center (NMC) team connected their SDS Sigma 7 computer to an Interface Message Processor. This connection became the first node on the ARPANET, an event which Kleinrock refers to as “the day that the infant Internet took its first breath of life.”

## 10 October 1796

Today marks the traditional date the metric system was inaugurated. The 10/10 date was chosen in honor of base 10 measurements.

## 11 October 1745

In Kostin, today Kozsalin, Poland, Ewald Jürgen von Kleist performed his first electrical experiments using a nail and medicine bottle; this research led to his invention of the Leyden jar, the earliest condenser.

## 17 October 1985

Intel introduced the 386 microprocessor; it was on this platform that graphical operating environments began to seem workable.

## 22 October 1955

The Electronic Numerical Integrator and Computer, ENIAC, the first all-electronic computer, completed a decade of service; 22 October was its last day of operation.



# RAYMOND DAVID MINDLIN



**Professor  
Raymond D.  
Mindlin  
1906 – 1987**

In honor of the 100th anniversary of the birth of Raymond David Mindlin on September 17, 1906 we have chosen to reprint here a memoriam prepared for the 42nd Annual Frequency Control Symposium Proceedings in 1988 and a biographical sketch by Prof. Herbert Deresiewicz of the Mechanical Engineering Department at Columbia University as an introduction in the “The collected papers of Raymond D. Mindlin” published by Springer-Verlag in 1989.

s8810002.pdf]

Raymond D. Mindlin, Finch Professor Emeritus Applied Science at Columbia University died on November 22, 1987 at the Dartmouth-Hitchcock Medical Center in Hanover, NH after a prolonged illness. He was 81 years old and resided in Grantham, NH at the time of his death.

Professor Mindlin's active and prolific scientific career spanned more than half a century, during which he made significant contributions in solid mechanics and the peripheral fields of acoustics and optics. As a consequence of this work he was a world renowned authority in both engineering and scientific fields and a consultant to government and industry. In particular, his very important work on the mathematical theory of the vibration of elastic plates and its impact on the field of frequency control is the reason for the inclusion of this remembrance in these proceedings.

Raymond David Mindlin was born in New York City on September 17, 1906. He received four degrees from Columbia University, culminating in the Ph.D. degree in 1936. In the thesis Mindlin addressed and solved the prob-

## IN MEMORIAM: RAYMOND D. MINDLIN

[This memoriam appeared in the 1988 - 42nd Annual Frequency Control Symposium proceedings-  
<http://www.ieee-uffc.org/archive/fc/proceed/1988/proceed/>

lem of a force at a point in the interior of a semi-infinite solid, which is now and was shortly thereafter regarded as a classic. Mindlin began teaching at Columbia while still a graduate student and started graduate education in mechanics at Columbia in the thirties. Since his mentors were elsewhere, i.e., at Michigan and Harvard, he was in a very real sense the father of the graduate program in mechanics at Columbia.

After receiving his degree he continued on at Columbia until the war when he left to serve the government at the Applied Physics Laboratory of Johns Hopkins University. It is of interest to know that during that period Professor Mindlin was instrumental in getting an Italian Jewish scientist out of Italy and that subsequently this scientist was instrumental in getting others in the same boat out.

At the Applied Physics Laboratory Mindlin led a team which designed the firing element of the first proximity fuse, a very important device in World War II. For this he was awarded the Presidential Medal of Merit in 1946. After the work on the proximity fuse, Mindlin consulted for Bell Telephone Laboratories, where he worked on the design of spring systems to reinforce containers used for packaging electronic tubes so that they would not break when the packages were dropped from a certain height. This formed the basis of a publication entitled "Dynamics of Package Cushioning," which spawned an entire field.

After the war Mindlin returned to Columbia and became a full professor in 1947. However, he still consulted regularly at Bell Labs. During this period he was made aware of some of the problems associated with the proper functioning of the carbon microphone. This led to his pioneering work on the response of bodies in contact when subject to pressure and shear as a result of elasticity and friction. The results of this work have been applied by others in the design of relay contacts and ball bearings. Mindlin himself used the results in his work on the description of the behavior of granular media.

During this same period Mindlin was introduced to the field of frequency control by being asked some questions by people at Bell Labs about the loss of activity in AT-cut quartz thickness-shear resonators for certain ranges of aspect ratio of the plates. Mindlin was asked these questions even though he knew nothing about thickness-shear because he was an expert in the theory of elasticity and the flexure of thin plates. Although Mindlin had some difficulty communicating with most of the people, he found one, namely Irv Fair, who was able to educate him on what he did not know. This led to his work on the vibrations of crystal plates, in which he included the coupling of thickness-shear to flexure, which quantitatively described the behavior of the activity with aspect ratio and enabled AT & T to relax its tolerances in the fabrication of the plates. But, more importantly, this work led, in one way or another, to all work on the accurate analytical description of the three-dimensional modal behavior of quartz plates to this day.

Once having entered the field of crystal plate vibrations, Mindlin never left it. To be sure, he digressed into other fields at times but he always returned. For example, in the

fall of 1960 Rudolph Bechmann asked Professor Mindlin whether a new theory of elasticity with an asymmetric stress tensor and forty-five independent elastic constants that was proposed by two independent groups of scientists should be included in a revision of the IEEE Standards that was currently underway. After a brief investigation Mindlin recommended that the committee ignore the forty-five constant theory. His recommendation was based on the fact that both groups had neglected to satisfy the law of the conservation of angular momentum.

This investigation motivated Professor Mindlin to think of generalizing the theory of elasticity by including a couple-traction in addition to the usual force traction. This led to the work on couple-stress theory, which led further to work on even more general elastic continua, including microstructure theory. However, even though Mindlin worked avidly on these generalized descriptions during this period, he continued his work on crystal plate vibrations, to which his many publications in this field during the same period testify.

After originating and working in the area of microstructure theory for a number of years, Mindlin investigated ionic lattice theory in order to compare the long wavelength limit with microstructure theory. When he found that the systems of equations differed in certain respects, Mindlin halted his effort on microstructure theory and devoted his time to other productive research. From this it seems clear that just as specific physical considerations led Mindlin to investigate both couple-stress theory and microstructure theory, they caused him to abandon his effort on microstructure theory. This thread of intense concern with the description of physical reality in mathematical terms seems to pervade all of Mindlin's research.

Mindlin had remarkable physical insight and an uncanny ability to get to the heart of a problem, extract the essentials and construct a simple useful model that could relatively quickly yield the desired information. Partly for this reason he was extremely helpful to students he was advising when difficulties arose in their research. He was an excellent, clear and inspiring teacher who was sincerely appreciated by the students. This kind, mild-mannered, gentle man was admired by students and colleagues alike. All held him in great esteem and valued his counsel highly. In fact, a book dedicated to Professor Mindlin encompassing eight distinct subject areas to which Mindlin had made significant contributions was written by group of his former students and published in 1974.

Mindlin was a member of the National Academy of Sciences and the National Academy of Engineering. He was a fellow of the American Academy of Arts and Sciences, the American Society of Mechanical Engineers and the Acoustical Society of America. Honors and awards that are too numerous to mentioned were showered on him by such organizations as the American Society of Mechanical Engineers, the American Society of Civil Engineers, the Acoustical Society of America, the Society for Experimental Stress Analysis and, of course, his alma mater and the school where he spent his career, Columbia University.

Among his numerous awards was the C. B. Sawyer memorial award, which was presented to him at the 21st Annual Symposium on Frequency Control in 1967. The citation stated "For fundamental contributions to the theory of vibration in piezoelectric resonators leading directly to advancements in the art."

In recognition of his life's work, Mindlin received the National Medal of Science in 1979. Among the industrial organizations he served as a consultant to were Bell Telephone Laboratories, General Electric, General Motors and IBM. He served as an adviser to several government agencies, including the National Defense Research Committee.

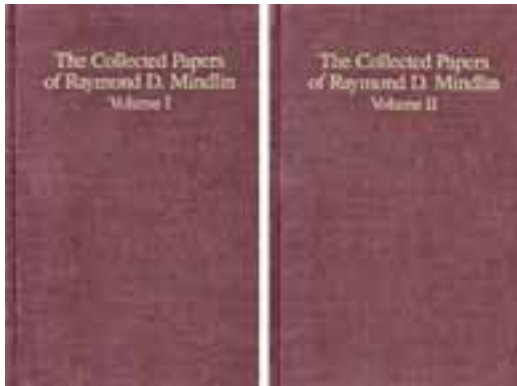
Mindlin's first wife, the former Elizabeth Roth, died in 1950; his second wife, the former Patricia Kaveney, died in 1976. A memorial service for Professor Mindlin was held on March 23, 1988 in St. Paul's Chapel on the Columbia campus. During the long illness prior to his death,

Professor Mindlin was struggling to complete the third section of a three section book on the vibrations of crystal plates, but he was very weak and could not find the energy to get the work done. Fortunately, Peter Lee is working to complete the third section of the book, which, thankfully, will now be finished.

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## Raymond David Mindlin: A biographical sketch

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[This biographical sketch was written by Prof. Herbert Deresiewicz of the Mechanical Engineering Department at Columbia University as an introduction in the "The collected papers of Raymond D. Mindlin" published by Springer-Verlag in 1989.]

Raymond David Mindlin was born on September 17, 1906, in New York City, the second of three sons of Henry, a prosperous businessman, and Beatrice (nee Levy). There are clear indications that the family, which subsequently came also to include a half-sister, was supportive and closely knit, and that Ray, as he came to be known to his friends and colleagues, enjoyed a tranquil childhood.

For his secondary education the young man was sent to the highly regarded Ethical Culture School, of which he had fond recollections in later years. Upon graduating in 1924 he enrolled at Columbia, beginning an association with the University that was to last for more than half a century. Four years later (during which time he distinguished himself as a

sprinter on the varsity track team) he received the first of his four earned degrees, a B.A. followed by a B.S. in 1931, and in 1932 by a C.E. and the Illig medal for "proficiency in scholarship."

The economic depression then gripping the land was a major reason why he remained for graduate work, funded by the modest stipend that accompanied the research assistantship to which he was appointed. Love's Treatise on the Mathematical Theory on Elasticity, the fourth and last edition of which had appeared not long before, came to his hand, and from then on the direction of his professional work was firmly set.

Applied mechanics was not strongly represented on Columbia's faculty; in fact there was little substantive research in it in the United States, and essentially no graduate instruction, until the advent on the scene of Stephen Timoshenko, exiled by the Bolshevik revolution in Russia. Some time after his appointment as professor at the University of Michigan in 1927, he organized a series of summer courses, in which each year one or another of the foremost names in this field, including L. Prandtl, R. V. Southwell, and H. M. Westergaard, participated. Mindlin attended in 1933, '34, and '35, and there is no doubt that the experience at Ann Arbor served to confirm him in his choice of his life's work.

His initial publication [I] (Numbers in brackets refer to corresponding entries in the list of publications) dates from the middle of this period, a solo, full-length paper describing a new type of polariscope for photoelastic analysis. April of 1935 saw the appearance of a lengthy discussion, written with Westergaard, of a paper on torsion of structural beams.

During the year, Mindlin spent all available time in his basement office struggling to master Love's grand opus, a massive, difficult, demanding book, from time to time having to contend with complaints, from a faculty lacking in theoretical training and outlook, that the young man was wasting time. It was James Kip Finch, his Department chairman (and in later years a noted historian of engineering as well as Dean of the Engineering School), who served both as his protector and source of encouragement by issuing an edict to his colleagues, "Leave him alone, maybe something will come of it." Mindlin, in his turn, never forgot Finch's kindness and support, and it was at his persistent urging that the University, 35 years later, created the Finch chair (with Mindlin its first occupant).

For his doctoral research Mindlin set himself a fundamental problem in theoretical elasticity: determining the stresses in an elastic half-space subjected to a sub-surface point load. Working without any guidance at Columbia, he succeeded in finding the solution by employing the method of nuclei of strain. The results, nowadays referred to as "Mindlin's problem," represent a generalization of the two classical 19th century solutions respectively associated with the names of Kelvin and Boussinesq, and have become the basis for analytical formulations widely employed in geotechnical engineering. At Timoshenko's urging, in order to establish the author's priority of discovery, a summary of the results was dispatched to the Comptes Rendus of the



Academie des Sciences in Paris, noted for almost instantaneous publication, where it appeared [3] in September of 1935. The full paper [4] was published in Physics (now the Journal of Applied Physics) in 1936, the year Mindlin received the Ph.D. degree. It was also the year in which he published his one and only paper to appear in a periodical devoted to pure mathematics, in essence a completeness proof of the Papkovitch representation in classical elasticity [5]. It is interesting to note that nearly twenty years later he returned to the problem bearing his name and offered a solution by means of a systematic procedure grounded in potential theory [42].

Academic advancement, it appears, proceeded at a rather leisurely tempo in those days.

Mindlin remained an assistant for another two years, at which point he was elevated to instructor in civil engineering, and only in 1940 did he receive promotion to assistant professor. His research in the six years following receipt of the doctorate was a mix of analytical and experimental endeavors, with emphasis on the photoelastic method of stress analysis. It included a work on three-dimensional photo elasticity [17], published jointly with D. C. Drucker, his first doctoral student, in which the method of oblique incidence was first suggested. An important part of current laboratory technique is based on this and a companion and two subsequent papers [18], [26], [27].

In 1942 Mindlin was co-opted by the Applied Physics Laboratory in Silver Spring (a Maryland suburb of the nation's capital), an institution engaged in naval ordnance work. There he played a significant role in the development of the proximity fuse, one of the major achievements in the scientific war effort. For his part in its success he was presented, shortly after the end of the war, with the Presidential Medal for Merit, the highest decoration awarded to civilians.

The swiftness of his climb up the academic ladder now made up for the earlier glacial pace: he came back to Columbia in 1945 as an associate professor, and two years later attained the rank of professor.

The year of his return to academia also marked the publication, in the Bell System Technical Journal, of a small monograph on the dynamics of package cushioning [21], which quickly became a vade me cum for designers of containers for protection of electronic equipment from mechanical shock and vibration. It was the first of several papers stimulated by his eight year association as consultant to the Bell Telephone Laboratories.

A most important paper arising from his symbiosis with the Bell Laboratories stemmed from a perennial effort toward rational design of the carbon microphone. Published in 1949, it gave new direction to research on frictional phenomena at surfaces in contact [28]. The work, its basic consequences first tested and verified experimentally [38] and then generalized [41], led to an understanding of the process of wear due to local sliding and gave a mighty impetus to worldwide researches, analytical and experimental, in the industrially vital areas of sliding and rolling contacts, ball

bearings, railway wheels, and the mechanics of granular media [ 56].

Shortly thereafter Mindlin began his trail-blazing studies, which he was to continue intermittently for more than two decades, on waves and vibrations in isotropic elastic plates [34] and, concomitantly, on high-frequency vibrations of crystal plates [35], soon extending his studies to account for the piezoelectric effect [39]. The method he had employed of reducing the exact, three-dimensional equations to describe the dynamics of plates, by expanding in series of the thickness coordinate (or in terms of selected functions thereof) and truncating the series, he also applied, suitably altered, to dynamical problems of bars [37], [60], [62], stimulating, as in the case of plates, an ever growing literature of the subject.

The work on isotropic bars and plates led to results in use world-wide in development and design of electromechanical filters and solid delay lines. But it was his studies on crystal plates that caused the greatest stir, for they were pioneering papers in a vexingly difficult mathematical field. In them, he elucidated a very complicated phenomenon of great technical importance and thereby pointed the way to major improvements in the design and performance of quartz crystals for filter circuits. The U.S. Army Signal Corps, long-time sponsor of the research on crystal plate vibrations, persuaded him to prepare a monograph on the subject by granting him a sole-supplier contract for the purpose. In 1955 the task was completed to the acclaim of the sponsor-it was in the form of a ca. 170-page-long report entitled "An Introduction to the Mathematical Theory of Vibrations of Elastic Plates." Yet even as its author was composing the text, better ways of doing the old were occurring to him and new ideas for what should, and could, be done were springing to his mind. Indeed, despite much subsequent work in other areas of mechanics, he kept returning to this subject to the very end of his life. The monograph seemed to haunt him, for he intermittently worked on a revision-more accurately, a complete reworking-of it. A few months before his death he spoke of plans to add yet another major part to what he had already written before he would consider the job done; ever the realist, he added, "But don't hold your breath!"

It is strikingly clear in retrospect that the period of the late '40s and early '50s was a particularly fruitful one for him. In addition to the basic papers on elastic contact and on high frequency vibrations of plates and bars, a pioneering article on the interpretation of optical birefringence in viscoelastic materials [27] and a seminal paper on the interaction of an elastic shell with a surrounding fluid [40], the second of these written in collaboration with his colleague H. H. Bleich, date to that time. Of evident importance to the Navy, the latter work triggered a great deal of subsequent research on the response of submarine hulls to shock loading. Also sandwiched into that period is the lengthy article on analogies [31], with another of his colleagues, M. G. Salvadori, as co-author, which appeared as a chapter in the Handbook of Experimental Stress Analysis.

Beginning in 1962, in response to what purported to be,

but were seen by Mindlin as erroneously based, expanded theories of anisotropic materials, he was led to construct, first, a theory that took account of couple-stresses [74], characteristically applying it immediately thereafter to a two-dimensional case that seemed simple enough to be susceptible of experimental validation [75]. Two years later, in a paper on micro-structure [78], he treated a continuum endowed at each point with an internal displacement field, and showed that the lowest order of this formulation results in a theory that includes the optical lattice modes at the long wavelength limit. In a paper published the following year [83], he formulated a linear theory of equilibrium of an elastic solid in which the stored energy depends on the strain and its first and second gradients. This proved to be the first continuum description capable of accounting for surface tension, without resorting to the artificial construct of a vanishingly thin surface membrane. The papers contributed to the start of lively activity in this field of generalized elastic continua, and stimulated applications to areas as diverse as the mechanics of laminated and of fiber reinforced materials, and of framed structures.

In 1967 he was appointed James Kip Finch Professor of Applied Science, the first holder of a chair named in honor of the patron and protector of his days as a graduated student. He was to hold this post until his retirement in 1975.

A series of papers initiated with [88] introduced the contribution of the polarization gradient (in addition to the strain and the polarization itself) to the stored energy of a solid. Mindlin was able to show that this augmented formulation of the elastic dielectric continuum accommodates the surface energy of deformation and polarization, predicts the experimentally observed anomalous capacitance of thin dielectric films [95], and accounts for acoustical and, when the magnetic field is included, optical activity [99]. (Shortly after making this observation, aware of the gravity of what proved to be his last illness, he entrusted the manuscript for completion (and, it is fervently hoped, timely publication) to P. C. Y. Lee, one of his last doctoral students.)

More or less concurrently came one other group of highly innovative researches, in which his aim was to bridge the gap between continuum and lattice theories. Thus, he was able to show [91] that a model of a continuum, formed by two or more interpenetrating media, in which the stored energy depends not only on the strains of the individual constituents but also on their relative displacements, and simulating a (non-Bravais) lattice with a basis, contains optical as well as acoustical branches in the vibrational spectrum. In [95], a paper mentioned above, he demonstrated that his augmented theory of the elastic dielectric continuum yields the correct long-wave limit of a monatomic lattice theory with a shell model, and in [101], by endowing the model of [91] with individual polarizations, that the resulting continuum can yield the long-wave limit of a diatomic lattice with shell model.

The steady stream of his research was interrupted early in 1969 by illness, and he was obliged to submit to cardiac surgery. (This was before the coronary bypass operation became part of clinical procedure.) As he made amply clear

at the time, he resented the lengthy convalescence because it was inhibiting his work. But by the end of that year he was back at his desk, and a glance at his list of publications after that date shows that he was able to resume his enviable scientific productivity.

His last hurrah, just a year before his death, came in the form of two papers, one dealing with free vibrations of a rectangular parallelepiped [128] and the other, with vibrations of a rectangular plate with all four edges free [129], classic problems against which he had butted his head, in vain, decades earlier. At long last he managed to construct solutions, apparently by inspired guess-work, reminiscent of the tour de force of his doctoral dissertation 50 years earlier.

He was manifestly elated, particularly by what turned out to be his final publication, characterizing the accomplishment in the following words: "It's a pity there aren't many around, anymore, who would appreciate what an extraordinary feat that solution is." His letter, accompanying a photocopy of the work in holograph and dated January 9, 1986, continues, in evident allusion to the 19th century origin of the problem, "I'm reminded of Tony Biot [Maurice Anthony Biot] who was frequently a generation ahead of his time. I, on the other hand, seem to be some generations behind."

The preceding narrative, though sketchy, has, I hope, given some indication of the breadth and depth of Mindlin's scholarship. Those who worked with him, and those others who knew him and his work, quickly came to appreciate his profound insights into the physics of any given situation, his surefootedness in discerning what is central and what is peripheral, and his multifaceted analytical and experimental skills. Nevertheless, a disservice would be done the subject of this account (as well as its reader) if nothing were said about him as colleague, mentor, and human being.

His professional colleagues treated him with deference at times bordering on awe. He was secure in the knowledge of his own worth, but wore the mantle of his eminence with genuine modesty. He was generous in giving or sharing credit, and unfailingly courteous to peers seeking his opinion or advice. Basically a shy, reserved person, he was, invariably and unexceptionally, the consummate gentleman.

His many disciples revered him and, one suspects, in his quiet way he enjoyed being the father figure. To celebrate his 60th birthday, his former doctoral students tendered him a dinner in Minneapolis, where most had journeyed ostensibly to attend a professional meeting. In 1974, in anticipation of his imminent retirement, he was presented with a published book, entitled R.D.

Mindlin and Applied Mechanics. In eight substantial chapters, by fifteen of his erstwhile students, this novel kind of Festschrift contains summaries of those areas on which Mindlin's own endeavors have exercised a profound and lasting effect.

But it was by no means a one-way relationship. Whenever a former student of his was being feted, as such things tended to occur with increasing frequency as the years passed, Ray Mindlin would be inconspicuously present among the well-wishers. Perhaps the loyalty and affection made up to some extent for not having any children of

his own. He married twice, each time losing a beloved mate by untimely death due to illness.

He served with devotion the profession which he made his life's work, through his research, his teaching, his advisory capacity to numerous government agencies, and his activities in various scientific and technical societies. Among the latter, mention is warranted of the following positions he held at various times: In the American Society of Mechanical Engineers (ASME), chairman, Applied Mechanics Division; member, Publications Committee, Engineering Societies Monographs Committee, Advisory Board of Applied Mechanics Reviews. In the American Society of Civil Engineers (ASCE), chairman, Committee on Applied Mechanics of the Structural Engineering Division (precursor of the Engineering Mechanics Division). In the Society for Experimental Stress Analysis (SESA), co-founder and president; member, executive committee. In the American Institute of Physics, associate editor, Journal of Mathematical Physics. Also, he was member of: the U.S. National Committee for Theoretical and Applied Mechanics; the General Assembly of the International Union of Theoretical and Applied Mechanics; the American Physical Society.

To be sure, his remarkable intellectual fecundity and gentle personality did not go unappreciated by his peers, and recognition came in the form of copious honors and awards. He was elected Fellow of the American Academy of Arts and Sciences (1958), of the ASME (1962), and of the Acoustical Society of America (1963); member of the National Academy of Engineering (1966) and of the National Academy of Sciences (1973); and Honorary Member of the ASME (1969).

He received the Research Prize (1958) and the von Karman Medal (1961) of the ASCE; the Timoshenko Medal (1964) and the ASME Medal (1976) from the ASME; the Trent-Crede Award of the Acoustical Society of America (1971); the Frocht Award of the SESA (1974); the Great Teacher Award (1960) and the Egleston Medal (1971) from Columbia University; and an Honorary D.Sc. degree from Northwestern University (1975); also, a Naval Ordnance Development Award (1945) and the C. B. Sawyer Award of the Army Electronics Command (1967). Remarkably, prestigious as these are, all but one were sandwiched between his most noteworthy honors, both bestowed by the U.S. Government: the Presidential Medal for Merit (1946), as noted earlier the highest civilian decoration of the Second World War, and his ultimate accolade, the National Medal of Science, which he received in 1979.

Mindlin died on November 22, 1987, at age 81, in consequence of a debilitating illness that lingered for about a year. And yet, to the last, his mind remained acute and active, almost as it divorced from his frail body. His passing was mourned by all who knew him, but his name will live through his work.

Chaucer's lines, written about another scholar, of days long gone, might just as aptly have been indited for Raymond Mindlin:

*Of study took he utmost care and heed  
Not one word spoke he more than was his need  
And that was said in fullest reverence  
And short and quick and full of high good sense  
Pregnant of moral virtue was his speech  
And gladly would he learn and gladly teach.*

## IEEE PRESIDENTIAL ELECTIONS

### Answers to 10 Questions by the two Candidates for 2007

#### IEEE President-Elect

19 March 2006

How the IEEE is run is dependent, in part, on the member elected President of IEEE. You should be receiving your ballots in early September. We encourage you to participate in the election.

This year UFFC leader and colleague, John Vig, will be running for IEEE President along with Lew Terman. We have included below a question and answer session with the candidates conducted by the TAB Newsletter Committee and a reprint article from the IEEE newspaper, The Institute, which contains a more personal look at the candidates to help you in your voting decisions.

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#### TAB Newsletters Committee

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IEEE Board of Directors selected Lew Terman and John Vig to be the two candidates for 2007 IEEE President-Elect. In

an effort to better present their platforms and in connections with the upcoming elections, Lew and John, assisted by the TAB Newsletters Committee have prepared for the readers the following "Answers to 10 Questions by the two Candidates for 2007 IEEE President-Elect".

Lew Terman ([www.terman.org](http://www.terman.org)) can be contacted at [l.terman@ieee.org](mailto:l.terman@ieee.org), and John Vig ([www.JohnVig.org](http://www.JohnVig.org)) can be contacted at [j.vig@ieee.org](mailto:j.vig@ieee.org).

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#### Questions and Answers

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#### QUESTION: What are IEEE's strengths?

**Lew Terman:** The volunteers are perhaps the most important strength; it is their enthusiasm, expertise, and time which is key to the success of the Institute.

Another major strength is the IEEE's generation and dispersion of high quality Intellectual Property, including archival publications, conferences/meetings, and standards. It is this IP which produces the revenue streams that financially enables the IEEE and create the information flow which is so valuable to the technical community. The IEEE publishes over 30% of the published material in IEEE's fields of interest, and its conferences/meetings around the world enable rapid dispersal of new results, as well as networking and face-to-face discussions.

A third major IEEE strength is globalization: RAB's structure of geographical based entities extends around the world in over 150 countries, allowing networking and the interchange of technical information at the local level.

Fourth, the IEEE has recovered from the recent downturn to a strong overall financial position. Reserves are at an all-time high, though some problems remain for specific O/Us. The financial performance of the Societies and Councils has been very important.

Finally, the IEEE has an excellent staff supporting the volunteers and working with them for the Institute and its goals.

**John Vig:** The IEEE's main strengths include:

- 1) That we are a non-profit membership organization; we have ~50,000 volunteers who contribute to the IEEE's >350 conferences, >100 journals, >300 sections, >900 standards, >40 societies and councils, etc.
- 2) The breadth and quality of products & services: publications, conferences, workshops, standards, educational products and services, sections, chapters...
- 3) Our diversity – i.e., that we have ~360K members, in 150 countries. The membership includes not only engineers but also computer/IT professionals, scientists...; men and women; members of all cultures..., and that our activities transcend national borders.

### **QUESTION: What are the major challenges facing the IEEE?**

**Lew Terman:** Membership has been essentially flat in recent years, and the number of higher grader members has been decreasing. A major problem has been the retention of new graduates, now below 25% three years after graduation. Society membership continues to decline, and the fraction of IEEE members without society membership is now over 43%. Much of this can be attributed to a perceived lack of value of IEEE membership relative to its cost. Increased support of member career development is important. IEEE membership will be 50% in Regions 7-10 within 10 years with current trends; the implications (and opportunities) need to be thoroughly examined. The long-term impact of IEL on membership could become significant.

Open Access is the major long-term question for publications - if all publications are available for free on the web, the IEEE publication business could collapse. Publication timeliness has been a problem, new publications are launched too slowly, and there is a strong need for practical publications to engage the practitioners/"bench-top engi-

neers". Finally, there is the impact of going to full electronic publishing and on what schedule it might occur.

While the overall IEEE financial position is good, there are specific units with problems; further reduction of the infamous Infrastructure Charge is needed through continual evaluation of the efficiency of our operations. With the continuing growth of reserves, long term financial plans/goals for the reserves and their use must be developed.

Finally, the IEEE needs to react to new technologies faster to claim leadership positions in these technologies as they emerge. We must continue our search for effective and fair governance.

**John Vig:** How to provide sufficient value to justify the membership dues is a major challenge. A growing number of members who work for institutions which provide "free" access to IEEE's publications and conferences are asking, "I get everything I want from IEEE for free, so, why should I be a member?"

About 80% of IEEE members don't read IEEE journals on a regular basis. "The articles are by academics, for academics." Half of IEEE members work in industry. Providing more practical content without diluting the quality of our publications is a major challenge.

Half of IEEE's revenues result from the sale of publications. "Open access," the worldwide movement to disseminate scholarly research literature online, free of charge, threatens these revenues.

### **QUESTION: What are the major changes IEEE needs to be making?**

**Lew Terman:** Membership: increase (and actively market) membership benefits around the world, broaden the base of membership such as aggressively moving into software, services, applications and solutions. Follow up the China initiative with similar efforts for India and Eastern Europe.

Publications: establish a faster track for new publications, pilot new publications that are more practically-oriented, and establish a reward system for reducing the submission-to-publication time. Develop the best search capability for technical material, and make it a membership benefit.

Education: the Expert Now program for continuing education is off to an excellent start; aggressively push it and make it available to members.

Financial: drive good financial behavior for Operating Units with reserves by giving them more access to those reserves – as the ratio of the O/U's reserves to expenses increases, allow access to an increased percentage of the reserves. Continue to work on decreasing the Infrastructure Charge and increasing revenues, though not at the cost of making IEEE's prime goal increased surpluses/reserves. Develop a long-term financial plan/goals for the IEEE reserves.

Governance: the current governance structure is not egregiously broken; continue to work towards streamlining operations and governmental efficiency.

Finally, work across the IEEE major Boards to establish a spirit of working together, understanding each others prob-

lems, and working with staff on identifying and solving tactical and strategic problems.

**John Vig:** To improve the IEEE's agility, e.g., with respect to entering new technologies, I have proposed that we establish an IEEE Venture Capital Fund. Any person could propose an idea, and, if the idea is judged to be worthy, receive up to \$100,000 to implement, or show the feasibility of, the idea.

To provide practical content, I have proposed that we create a new category of peer-reviewed publications, "application notes" - which would include "how-to's," and case studies; and that we digitize many of the ~600 IEEE Press books and make them available to members, and members only, for free.

The IEEE should be more willing to take prudent risks, and it should be more willing to terminate unsuccessful activities.

To explore new ideas, the IEEE should experiment more - with new membership models, dues structures, publication models (e.g., new forms of peer review), etc.

The IEEE needs to improve its communications with members. The Institute should become a real newspaper, i.e., it should report both the good and the bad, and it should publish controversial views, even when such views may displease the leadership.

The IEEE should join with other engineering and scientific organizations to establish a public relations campaign to improve the image of engineering and science.

### **QUESTION: What are some of the important challenges facing IEEE as a publisher in service to its membership?**

**Lew Terman:** Issues raised by Open Access will need to be anticipated and managed. A major implication is to at least maintain the revenue stream which our publications generate. IEEE needs to help members navigate the mass of data available from IEEE, other technical publications, and on the web. Practical publications need to be developed with the collaboration of RAB and TAB. Goals for article publication timeliness must be set, and rewards established for publications to meet or exceed the goals. Establish a fast approval track for new publications. Maintain the importance of peer review. Keep monitoring the possibility of going to all electronic publishing, and establish when or if it should occur well before any critical point occurs.

**John Vig:** Open access, the worldwide movement to disseminate scientific and scholarly research literature online, free of charge is a serious challenge because half of IEEE's revenues result from the sale of publications. Google, at [www.scholar.google.com](http://www.scholar.google.com) and similar services, now make it easier to find the free copies of publications. Papers can be read without having to pay the publishers.

Delayed open access, e.g., making publications open access two years after publication, would not be as damaging. It would allow the IEEE to maintain most of its publication revenues while fulfilling its mission of being "for the benefit of humanity and the profession."

A frequently heard criticism of IEEE publications is that

they are primarily "by academics, for academics;" they are not useful for practitioners. About half of our membership is from industry. If our publications are not useful for the majority of our members, then we have a serious problem.

I have proposed three solutions to this problem. One is to ask authors to provide, voluntarily, a "practical impact statement" with their papers. The second is to create a new class of peer reviewed publications, "application notes," and the third is to digitize IEEE Press books and make them available to the membership.

The mean time between an author's submission and the date of publication of an article is too long for some of our journals; the delay for five of our journals has been >120 weeks. This must not be allowed to continue, and it need not continue, as evidenced by the fact that the mean is <50 weeks for 31 of our journals.

### **QUESTION: Do you see IEEE in future years as an organization based on its strong membership base, or do you foresee other models?**

**Lew Terman:** IEEE should remain a membership-based organization. Membership is critical - it is the members through whom we serve our technical communities, and who provide the volunteers that are critical to the success of IEEE. Members also provide a means of measuring how relevant we are to the technical world, and provide the mechanism for engaging emerging technical and geographic areas.

**John Vig:** I see the IEEE continuing to be a membership-based organization - with its tens of thousands of volunteers and its membership diversity as its pillars of strength.

I do, however, see a need to experiment with membership and dues models. Some members, for example, may be willing to receive Spectrum and The Institute electronically if the dues were lowered by the costs of producing the paper copy of those publications. We have >\$160M in reserves. Therefore, we can afford to experiment.

The success of our IEEE Electronic Library (IEL) is hurting membership recruitment and retention. (IEL subscribing institutions, which include many of the largest universities and corporations, provide "free" access to IEEE publications.) I hear more and more "I get everything I want from IEEE for free, so, why should I be a member?" Therefore, another experiment I would propose is to offer reduced dues to those working or studying at a few IEL organizations and measure the effects on membership numbers.

### **QUESTION: What changes in IEEE would you advocate in response to quick industrialization and potential IEEE presence in large Asian countries?**

**Lew Terman:** The two major Asian countries of interest are quite different in technical environment and social structure. I believe the current China initiative is appropriate; we need to understand the environment and the current approach seems a good first step. We need a deeper understanding of the specific needs and opportunities and how to involve that community to effectively stimulate IEEE membership and volunteerism.

India is also a key growth area in the 21st century, and currently has more IEEE members than any country outside the US. We need to understand why they join, and focus on the appropriate member and technical services to support their interest. India has a strong university structure with which we should be working.

**John Vig:** IEEE's presence in large Asian countries is actual, not just "potential." For example, in 2005, we held 59 conferences in China, and a total of 129 in China, India, Japan and Korea. Our publication sales, in China alone, amounted to ~\$5M in 2005. Total sales to the four countries was ~\$20M. In 2005, our combined membership in these four countries was ~45K.

Although the IEEE has made inroads in China and India, it is a long way from realizing the potential presence in these and other countries. Membership is too expensive for many in Asia, Latin America, Eastern Europe... We need a membership strategy for potential members who can't afford our dues, not just in Asia, but, throughout the world.

### **QUESTION: What do you see as the power of the IEEE President and how would you exercise this power?**

**Lew Terman:** The IEEE President has three major responsibilities/opportunities:

- a) Running the Board and ExCom meetings effectively, including setting up the meetings. This is important as the members of the governing bodies of the IEEE meet for only a short time, and it is important the meetings be efficient for the most effective interaction.
- b) Providing leadership to the Institute: setting directions, establishing committees and study groups to get information and sift through alternatives, work with the staff, work with the IEEE Boards and governance levels. It is in this area that the President can have the most effect. I would focus on bringing the various groups in IEEE together, and on listening to their input, getting an open airing of issues and suggested solutions, and generating and following through on new ideas.
- c) "Showing the flag" around the world, to both IEEE geographies/groups and non-IEEE entities - geographical, technical and political. The interactions with IEEE groups are very important to generate mutual understanding, and the interaction with non-IEEE entities is important to present the IEEE and the technical community it represents, and to understand their needs, views, and to understand possible opportunities.

**John Vig:** The president's duties are to: chair the meetings of the IEEE Board of Directors, Executive Committee and Assembly; perform ceremonial functions such as meeting with dignitaries, presentation of awards, opening remarks at conferences, etc.; promote the objectives of the IEEE; and be "the Chief Executive Officer of the IEEE."

I would make maximum use of the presidency to advocate the IEEE's agenda, both within and outside the IEEE.

I would set at least one lofty (man-on-the-moon-like) goal for the IEEE, aimed at inspiring and mobilizing the volunteers and staff.

The Board of Directors has been too inward-focused. I would propose the establishment of a council of advisors – consisting of prominent, mostly outside experts and leaders – to advise the IEEE leadership.

### **QUESTION: In the 2005 IEEE elections, only 14% of the membership voted. What, if anything, would you do to increase members' participation in IEEE elections?**

**Lew Terman:** I think what we are doing this year is pretty good – talking to the Regions and other entities which invite us (with Q&A sessions where time permits), sending these 10 questions to the Newsletters, participating in the Philadelphia debate and making available recordings of the debate and presentations of the candidate platforms on the IEEE web site, and making additional information available on our personal web sites.

**John Vig:** In 1975-77, when a controversial candidate, Irwin Feerst, ran for IEEE president, 36% voted. In those days, the membership was more involved in IEEE issues than they are today.

Today, the membership is rarely informed of controversial issues. For example, last year, I received reports of meetings where readings from the Koran and Christian prayers were parts of the program. Why not report such events and ask the membership whether or not such religious expressions should be allowed as parts of IEEE events?

"THE INSTITUTE is the newspaper of the IEEE" claims The Institute's website but, The Institute is more a "house organ" than a newspaper. As president, I would propose to the Board of Directors, and The Institute's Editorial Board, that The Institute become a real newspaper of the IEEE.

The office holders in IEEE, especially the President and the other members of the Board of Directors, make decisions about matters that are important to the membership and the future of IEEE. Voting in the annual IEEE election is the chance members have to choose the decision makers. With only 14% voting, 7+% of the members can decide the fate of IEEE.

### **QUESTION: What have been your three most important contributions to IEEE?**

**Lew Terman:** In the late 1990's, I was instrumental in the conversion of the Solid-State Circuits Council to the Solid-State Circuits Society. This was very successful; the SSSC is now the 5th largest Society in the IEEE, and the Journal of Solid-State Circuits records the highest number of hits in IEL. I served as the first SSSC president elected by the Society.

In the mid 90's, IEEE and TAB were going through financial difficulties. I was appointed TAB treasure, stabilized the situation and improved the communication with TAB, and served a second term as Treasurer.

In 2001, I was on the Board as the bottom fell out of the IEEE financial situation. As part of a team effort, we were

able to put in place a number of changes which arrested the slide.

**John Vig:** My three most important contributions are:

The IEEE Sensors Council, i.e., I proposed it, shepherded it through the approval processes, and was elected its founding president, in 1999. In 2005, the Council's journal published 1500 pages, and its conference had >500 registered participants.

Between 1999 and 2002, the IEEE's reserves declined >\$50M (>40%), due, in large part, to the decline in the value of IEEE's investments. Up to this point, the IEEE had no formal investment policy. I wrote the first draft of the Investment Operations Manual (IOM), then worked with investment professionals, volunteers and staff to finalize it and get it passed by the Board. Contained in the IOM is an

investment policy which has reduced the risks and increased the transparency of IEEE's investments.

I brought what is now the IEEE Int'l Frequency Control Symposium into the IEEE. I negotiated the takeover of this conference by an IEEE society (UFFC). This conference is now the premier international conference in its field.

**QUESTION: What would be your single and most recognized contribution that will distinguish your IEEE Presidency from those of others?**

**Lew Terman:** I would like my presidency to result in the elimination of any silos between IEEE operating units, and attacking IEEE problems with coordinated efforts across IEEE.

**John Vig:** The president under whose leadership innovation flourished in IEEE.

## Getting to Know Terman and Vig: Up Close With the Candidates for President-Elect

By Kathy Kowalenko

The IEEE elections will be taking place in barely three months. To help members get to know Lewis M. Terman and John Vig, The Institute spoke with the two president-elect candidates about a range of professional and personal topics.

Each of these first-time candidates retired this year after a long and distinguished career with a single employer. Terman, an IEEE Life Fellow, ended his 45-year career in January with the IBM Research Division in Yorktown Heights, N.Y. He retired as associate director of the Research Systems Department, and during most of his career worked with circuits, devices, and technology for advanced MOS memory and logic.

Vig, an IEEE Fellow, retired in February after 36 years with the U.S. Army Communications–Electronics Research, Development, and Engineering Center, in Fort Monmouth, N.J. He was a researcher and program manager working on the experimental aspects of frequency-control and sensor devices.

Besides being recent retirees, the two candidates have other things in common. Both were drawn to physics in college. Terman attended Stanford University, in California, got interested in electrical engineering while an undergraduate, and effectively moved into that area when he had finished the minimum physics and math courses for his bachelor's degree in physics. He stayed at the school to earn master's and doctoral degrees in electrical engineering.

Vig received his bachelor's degree in physics from



Lewis M. Terman and John Vig

the City College of New York, and went on to earn master's and doctoral degrees in solid-state physics from Rutgers University in New Brunswick, N.J. Even though he does not have an engineering degree, Vig says his job title has always been "electronics engineer" or "supervisory electronics engineer."

Today, when it has become rare for a member to spend an entire career with one company, how did these two each manage to stay with one employer for so long?

Vig says that if you want to maintain career longevity, it's absolutely essential to interact with colleagues. "Most of my best ideas came out of brainstorming sessions where together we thought up how to

solve a problem," he says. "Oftentimes we tried to beat each other to the punch with a solution."

Vig was assigned to the government research facility in 1972 to fulfill his military obligation to the U.S. Army. He eventually rose to the rank of captain and, after his military service was over, he was offered a temporary job at the lab. He took it "until something better came along," he says with a chuckle.

"I was fortunate that I had almost complete freedom in deciding which projects I was going to do and how I was going to carry out the work," Vig says. "That was one reason I stayed, because it certainly wasn't for the money. Working for the government will not get you rich, but it will give a young person a stable environment."



**Lewis Terman**

Like many other IEEE members, Terman wasn't particularly interested in moving up the managerial ladder; what he really wanted was to climb the technical ladder. He joined IBM straight out of college and says staying technically current was the key to his long career.

"Your technical understanding should extend beyond the specific area you are working in today so that your knowledge becomes broader and you can move into a new area,"

he says. "Fortunately, in the IBM Research Division one could do that, but you have to make sure you are the best you can be technically. You don't have to start with a deep knowledge of the new areas—just be aware of what is going on."

He recommends reading IEEE Spectrum and similar publications, which are good sources of introductory information on new areas. He also says that IEEE conferences, workshops, and tutorials are great ways to find out what is happening outside of one's field, where technologies are heading, and what changes are in store.

**INVENTORS** Terman and Vig are both inventors. Terman holds 24 patents, most of which deal with semiconductor devices, circuits, and technology. Vig's 55 patents are in the areas of frequency control and sensors.

They both say that seeing their inventions working in the field brings them the most joy. "I got a lot of enjoyment out of inventing new things, getting them patented, and then seeing them used," Vig says. Terman agrees, saying that "it is really great to see your ideas coming out in products." He adds that seeing his inventions inspire the technical work of other engineers is "the best feeling."

Who inspired these two to take up physics and engineering? For Vig, it was his father. A successful businessman in Budapest, Hungary, his father survived a German concentration camp during World War II and, later, 18 months of prison under the Communist regime. The family fled during the Hungarian Revolution in 1956 and immigrated to the United States in 1957, eventually putting down roots in New York City.

"My father survived a lot of adversity. He came to the United States without much and became a successful jewelry manufacturer," Vig says. "He was a very smart man, but in Hungary there was no chance for him to further his education, so when I had the opportunity, I took it."

For Terman, it wasn't his father, Frederick Terman—the legendary Stanford University electrical engineering professor, dean of engineering, and provost—who most motivated him. It was his 12th-grade physics teacher at Palo Alto High School, in California.

"My father would have been happy with anything I studied as long as it was technical," Terman says laughing. "He never pushed me or my two brothers toward engineering."

His high school physics instructor, Henry Martin, knew how to teach physics at the appropriate level to make it an interesting subject. "Physics was just a very fascinating thing," Terman says. "Back then, they didn't talk about engineering in high school, but I knew it existed because of my father. I went to college to study physics, took a class in electrical engineering, and never looked back."

When the two candidates were asked if there is another career they might have considered, Vig didn't hesitate: orchestra conductor. "That's the most powerful job in my opinion, because you give many people pleasure, and you don't have to do any harm to anybody," he says.

Terman says that in his early years, his dream job was sports broadcasting, but today being a historian and author has more appeal. He's fascinated by mysteries set in historical times. "It's interesting how writers can take historical facts, tell a story, and give readers insight into what it was like in a particular era," Terman says.

What will these two retirees be doing with their time besides campaigning for office?

Whether or not Terman ends up as president like his father, who was president in 1941 of one of the IEEE's predecessor societies, the Institute of Radio Engineers, he says he will increase his volunteer work with the IEEE. He'll also travel with his wife, Barbara, as well as continue as president of Twin Lakes Water Works Corp., the water system for his community. And he'll remain involved in environmental issues in his hometown of South Salem, N.Y., and may do some consulting for IBM, with which he holds an emeritus position.

Vig says he will continue with his volunteer activities, plus stay involved with the Colts Neck, N.J., Environmental Commission, on which he has served for the past 34 years. And he'll work on polishing his dance moves with his wife, Arianna. Both are avid ballroom dancers.

He'll also continue to earn wages. Systems Planning Corp., of Arlington, Va., has hired Vig as a consultant to provide technical advice about the applications of micro- and nanotechnology, especially in sensors, to the U.S. Defense Advanced Research Projects Agency. In addition, he is joining the technical advisory board of a start-up company that is developing miniature oscillators and clocks based on MEMS technology.

"I plan to enjoy myself," Vig says. "I'm retiring from my current position, not from life."



**John Vig**



## EDITOR'S COMMENTS

### Voting



**Jan Brown**

In this issue there are two articles on elections, namely the UFFC AdCom elections( see the UFFC ADCOM section) and the IEEE Presidential elections. All IEEE policies and procedures are determined by volunteers in either elected or appointed positions. Once a year we have the opportunity to influence our

Society and IEEE by exercising our right to vote. Please do vote when your ballots arrive!

### IEEE Senior Membership

While I am encouraging action, if you have not applied for Senior membership and you are qualified please refer to the end of the HONORS section of this Newsletter to find the qualifications and procedures for nominating yourself or others for Senior Membership. You cannot become an IEEE Fellow without first becoming a Senior Member. Self nomination for Senior membership is allowed and encouraged.

### Photo Contributions

If you do not see yourself in the photos in this issue, you do have the opportunity to be seen in future issues. Photos are a way to get to know each other in the UFFC community. Your photo contributions to the Newsletter are always wel-

come. It is helpful if the photos are sent as separate .jpg or .tif files. The quality in print is degraded if we have to extract the photo file from a word document.

### Newsletter Copies

Many of you have expressed an interest in receiving extra copies of the UFFC Newsletter. You may request extra copies by contacting Loretta Oleksak, UFFC Publications Assistant, at [loleksak@imsysinc.com](mailto:loleksak@imsysinc.com).

### Thank You

Thank all of you who sent articles and photos for this issue of the newsletter. The photos capture what words cannot and provide a way for us to see each other. Thanks to the photographers and photo contributors of this issue: Ken-ya Hashimoto, Mike Garvey, Fred Hickernell, John Vig, Eric Burt, Stuart Foster, Bob Potter, Andreas Bauch, Ken P. Chong, Rui Huang, Sandra Tenuto, Tom Shrout, Jackie Hines, and Jan Brown.

We extend special appreciation to Paul Doto at IEEE Headquarters for the design and production work.

Please continue to send me information and photos as events occur so that we may post them on the web and include them in the next newsletter.

**Jan Brown**  
UFFC-S Newsletter Editor  
[Jan.brown@ieee.org](mailto:Jan.brown@ieee.org)

1<sup>st</sup> circular

## The 16<sup>th</sup> International Symposium on the Application of Ferroelectrics (ISAF2007)

*Nara-ken New Public Hall, Nara city, Japan  
May 27-30, 2007*

We are pleased to inform that The 16<sup>th</sup> International Symposium on the Application of Ferroelectrics (XVI ISAF 2007) will be held at Nara-ken New Public Hall, Nara city, Japan, May 27- 30, 2007. The meeting is sponsored by the Ultrasonics, Ferroelectrics and Control Society (UFFC-S) of the IEEE. Topic areas will focus on the physics, processing, and applications of ferroelectric materials. The format of the conference will follow previous meeting, with plenary and oral presentations, parallel sessions, and poster presentations. The conference format will be arranged such the participants will be able to enjoy the technical sessions and the sightseeing.

Nara city is belonging to Nara prefecture and located in the 30 km-east of Osaka. It takes almost 1.5h from Kansai Airport by train or by bus and 45min from Kyoto Station by train. Nara (Nara city and Nara prefecture) occupies an important position in the history of Japan, it is said that the first state was located in Nara. Nara is also a home of various World Heritage sites such as Todaiji Temple, Horyuji Temple, and others including numerous Buddhist art and architecture classified as National Treasures and Important Cultural Asset.



**Nara-ken New Public Hall**



**Todaiji Temple (World Heritage)**

(within walking distance from Nara-ken  
New Public Hall)

General Chair, ISAF2007

Prof. Tadashi Shiosaki

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<http://fma.naist.jp/isaf2007>

## FUTURE UFFC SYMPOSIA

Please check the UFFC website for symposia details:  
<http://www.ieee-uffc.org>

### IEEE International Ultrasonics Symposia

#### 2006 IEEE Ultrasonics Symposium

General Chair: Stuart Foster  
s.foster@ieee.org  
Vancouver, Canada  
3 – 6 October 2006

#### 2007 IEEE Ultrasonics Symposium

General Chair: John Kosinski  
j.a.kosinski@ieee.org  
New York City, New York, USA  
28 – 31 October 2007

#### 2008 IEEE Ultrasonics Symposium

General Chair: Jian-yu Lu  
Jilu@eng.utoledo.edu  
Beijing, China  
1 – 5 November 2008

#### 2009 IEEE Ultrasonics Symposium

General Chair: Massimo Pappalardo  
pappalar@uniroma3.it  
Rome, Italy  
19 - 23 September 2009

### IEEE Frequency Control Symposia

#### 2006 IEEE Frequency Control Symposium

General Chair: Michael Driscoll  
Michael.driscoll@ngc.com  
Miami, Florida USA  
4 - 7 June 2006

#### 2007 IEEE Frequency Control Symposium

2007 will be the joint conference with EFTF  
Time Nav '07  
Co-General Chair: Bernardo Jaduszliwer  
Jaduszliwer@aero.org  
Geneva, Switzerland  
29 May – 1 June

#### 2008 IEEE Frequency Control Symposium

General Chair: Bernardo Jaduszliwer  
Jaduszliwer@aero.org  
Location: TBD

### IEEE International Symposia on Applications for Ferroelectrics

#### 2006 IEEE ISAF

General Chair: Jon-Paul Maria  
Jpmaria@ncsu.edu  
Sunset Beach, North Carolina, USA  
30 July – 2 August 2006  
<http://www.mse.ncsu.edu/isaf2006/index.html>

#### 2007 IEEE ISAF

General Chair: Tadashi Shiosaki  
shiosaki@ms.naist.jp  
Nara City, JAPAN  
27 – 30 May 2007  
<http://fma.naist.jp/isaf2007>

#### 2008 IEEE ISAF

Co-Chairs: Paul Clem and Bruce Tuttle  
pgclem@sandia.gov  
Sante Fe, New Mexico, USA  
23 – 27 February 2008

#### 2009 IEEE ISAF

Co-Chairs: Tadashi Takenaka and Wei Ren  
tadashi@ee.noda.tus.ac.jp  
Xi'an, China  
May 2009



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