

Ultrasonic Industry Association

UIA Symposium 16–18 April 2012—San Francisco, CA, USA

Discover how ultrasound is being used in therapeutic treatments of diseases such as cancers, removal of bone in approaches to tumors and aneurisms in the brain, drilling and sampling of soil and rock in extraterrestrial applications such as exploring planets for life, improving efficacy in sustainability applications such as creating biofuels, and advancing methods of joining and welding of semiconductors and polymers. UIA Symposium technical programs often highlight scientific and engineering methods **utilizing ultrasonic power to change materials in very positive ways.** Novel applications of ultrasound and the systems, instruments, transducers, horns, and materials used in realized products or processes are described in theory and practical application by contributors from industry, life sciences, medical professions, physics laboratories, and colleges and universities around the globe.

Technical Sessions

TIME Magazine has recognized focused ultrasound as one of the 50 “most inspired

ideas, innovations and revolutions” of 2011, as detailed by the Focused Ultrasound Surgery Foundation Newsletter, December 2011. Magnetic resonance imaging guided HIFU (High Intensity Focused Ultrasound) is already employed in treatment of some cancers, such as breast and prostate cancer. Many researchers continue effort to improve the application of HIFU to therapy via thermal medicine, plans for more effective delivery of chemotherapy, and treatments of cardiac and vascular disease.

Keynote speaker of the Medical Session, **Dr. Thomas J. Matula**, will focus his presentation on **Therapeutic Ultrasound and the Contribution of Bubbles.** Ultrasound contrast agents (microbubbles) are being developed for many diagnostic and therapeutic applications, from molecular imaging to drug and gene delivery. For therapy, it has been shown that microbubbles can increase vascular permeability, but they also generate microvascular damage leading to rupture of blood

vessels and leakage of red blood cells. Their research center has designed and developed a technique to visualize the real-time dynamics of microbubbles inside blood vessels using high speed photomicrography. Using images and video of microbubble dynamics, such as in Figure 1, (on page 3) within vessels, this presentation will discuss the various potential mechanisms, showing how microbubbles may generate bioeffects.

Additional Medical Session papers related to response of biologic tissue to ultrasound include Mayo Clinic researchers’ work on elasticity imaging methods that have been used to study tissue mechanical properties. It is demonstrated that tissue elasticity changes with disease states. Other presentations regarding HIFU development include treating disease in the liver and thermal medicine applications under development. Characterization of high intensity focused fields used in therapeutic ultrasound will be

Continued on page 3



Dr. Thomas J. Matula is Director, Center for Industrial and Medical Ultrasound and Co-Director, Center for Ultrasound-based Molecular Imaging and Therapy, Applied Physics Laboratory University of Washington.

Inside this issue:

San Francisco	2
Medical Sessions	8
Workshop Schedule	9
Industrial Sessions	10
President’s Letter	11
Tour Information	12
Registration Form	14

San Francisco Welcomes UIA



Photos courtesy of San Francisco Convention and Visitors Bureau

San Francisco is often called "Everybody's Favorite City," a title earned by its scenic beauty, cultural attractions, diverse communities, and world-class cuisine. Measuring 49 square miles, this very walk-able city is dotted with landmarks like the Golden Gate Bridge, cable cars, Alcatraz and the largest Chinatown in the United States. A stroll of the city's streets can lead to Union Square, the Italian-flavored North Beach, Fisherman's Wharf, the Castro, Japantown and the Mission District, with intriguing neighborhoods to explore at every turn.

Views of the Pacific Ocean and San Francisco Bay are often laced with fog, creating a romantic mood in this most European of American cities. The city has a colorful past, growing from a small village

to a major city nearly overnight as a result of the 1849 Gold Rush. The writers of the "beat" generation, the hippies of the Summer of Love in the late 1960's and the large gay/lesbian population have all contributed to making San Francisco the fascinating place it is today.

The city is home to world-class theatre, opera, symphony and ballet companies and often boasts premieres of Broadway-bound plays and culture-changing performing arts. San Francisco is one of America's greatest dining cities. The diverse cultural influences, proximity of the freshest ingredients and competitive creativity of the chefs result in unforgettable dining experiences throughout the city.

HISTORIC GRANDEUR ON THE CREST OF NOB HILL

As splendid now as when it opened to great fanfare in 1926, InterContinental Mark Hopkins San Francisco is one of the city's finest hotels. The headquarters for the 41st Annual Symposium is located at the crossing of three cable car lines, the venerable landmark is minutes from Union Square, Chinatown and the Financial District. Fisherman's Wharf and the Golden Gate Bridge are short drives away.

To make your reservation at the [InterContinental Mark Hopkins San Francisco](http://www.intercontinentalsanfrancisco.com), just click! The special UIA rate is just \$189 plus tax. **Make your reservations prior to 21 March to ensure you receive this special rate.**

Read about the Sunday Sonoma County Wine Tour on page 12.



Alamo Square is a good place to see the Victorian homes of "Postcard Row," with the skyline of San Francisco in the background. Credit: Christine Krieg, San Francisco Convention & Visitors Bureau

To plan the rest of your stay in San Francisco, visit http://www.welcometosf.com/standard_microsite.asp

Symposium Technical Program, Continued

presented by Klaus-V. Jenderka and M. Schultz. Klaus is visiting from University of Applied Sciences Merseburg, where he has a professorship of "Physics, Sensor and Ultrasound Technology" this year.

Systems

From industry, Versatile Power Company developers will present a new system for medical and other ultrasonic applications that enables a digitally controlled AC source to operate over a broad range of frequencies, overcoming limitations of traditional drives by resonant circuits that must operate over a relatively narrow frequency range. The controller performs both frequency scanning and phase tracking in real-time and has been validated in surgical applications.

Horns, Horns, Horns

Some of the earliest mathematics and physics of wave motion came from scientists studying musical instruments and acoustics, such as by Philip M. Morse, where sound traveled within the open body of a metallic horn. Today, horn bodies vibrating at ultrasonic frequencies are often used to provide mechanical gain and amplification of piezoelectric transducer vibrations. These horns are solid or hollow and cylindrical and tapered to unusual geometries depending on applications.

From the Life Sciences, Integra Neurosurgery, and other developers will present on use of horns as surgical instruments, such as for ultrasonic aspiration of bone in approaches to brain tumors and aneurysms. Design of horns using finite element methods, wave mechanics, cavitation, and representative clinical interactions and surgeries are presented. **FDA (Food and Drug Administration) filings are demanding more quantitative measures of response to ultrasound, and driving advancement in characterization methods.** Infrared thermal imaging and real-time power monitoring during ultrasonic aspiration in cadaver sections and more statistical evaluation in cranium sections are methods utilized for assessing capability of thermal management, and this work is discussed in detail.

Additional presentations on ultrasonic horns include David Wuchinich, a leader in the field with pioneering publications and patents on ultrasonic aspiration instruments. He will discuss high strength thermosetting plastic composites properties. It was found some of these materials, although more costly than metals, may serve well as replacements for metal horns for output displacements in the range of 50 microns (2 mils),

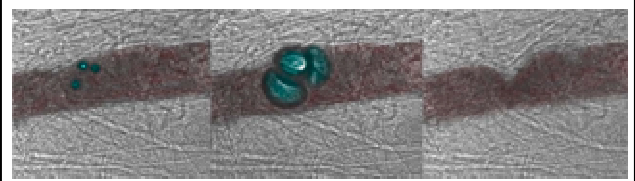


Figure 1. Bubbles in a Blood Vessel. Small bubbles are driven by a 1 Megahertz focused ultrasound pulse with a pressure of 7 MPa. Color has been added to the bubbles and lumen of the actual vessel in order to highlight the process. The first cycle is shown in Frame 1 at time zero, and three bubbles are seen near a vessel wall. In Frame 2, at time equal to 0.6 μ s, the vessel wall distends in response to the bubbles expanding against it. In Frame 3, at time equal to 1.8 μ s, the bubbles have collapsed. The surrounding tissue, acting like a fluid, flows into the void left by the collapsed bubbles. This inward motion is termed invagination. The strains felt by the invaginated tissue appear to be much greater than during distension, signaling a potential new mechanism for drug and gene delivery applications.

peak-peak at 20 kHz, particularly in applications requiring low weight and an increase in lateral span. Ultrasonic horns also find use in joining and drilling applications, and even extraterrestrial use in investigating planets for life.

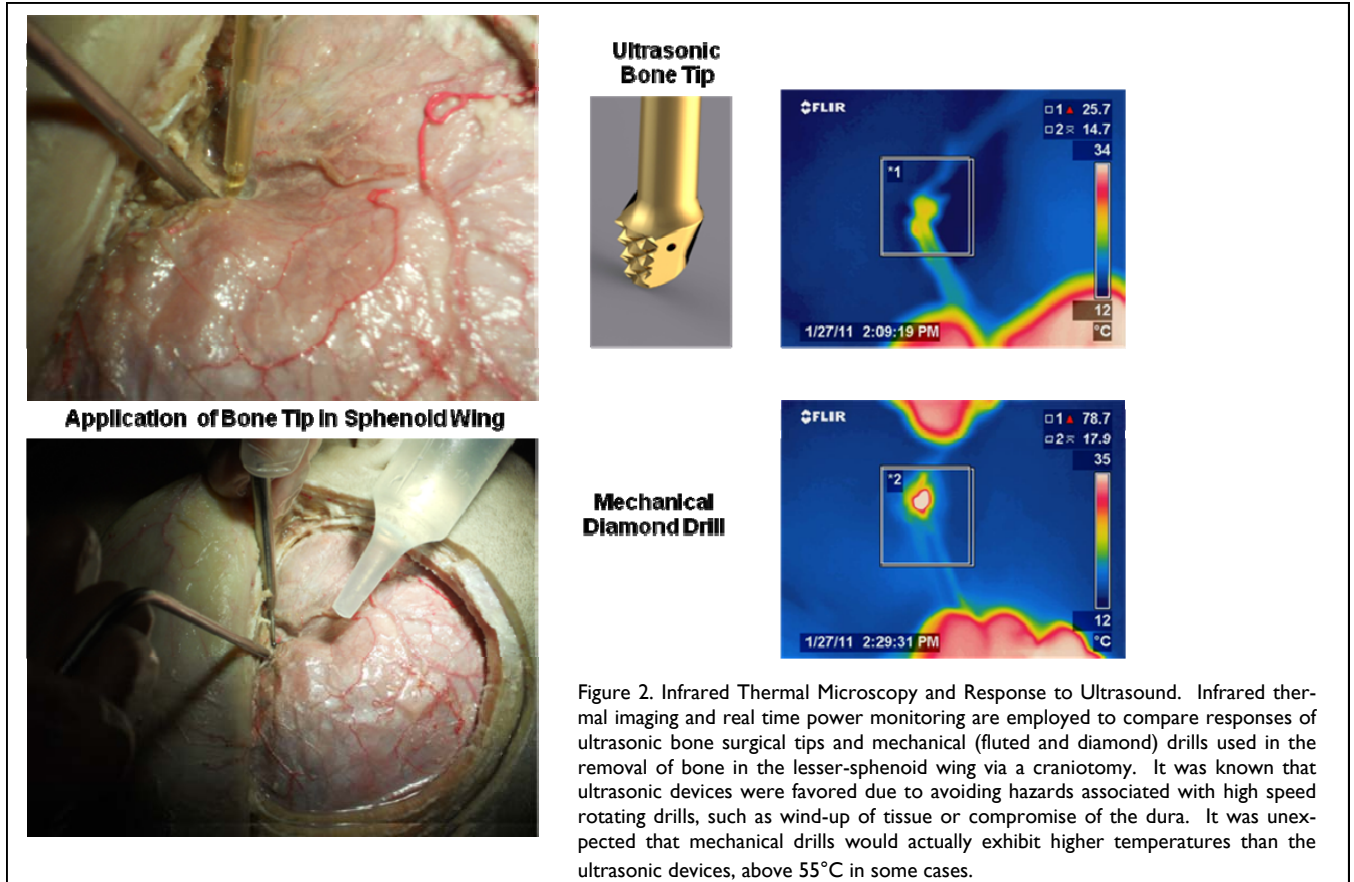
Keynote speaker of the Industrial Session, **Dr. Stewart Sherrit**, will present **Novel Ultrasonic Horn Designs for Extraterrestrial Applications**, and his abstract follows.

The search for present or past life and information about the formation of the solar system is one of the most important objectives of NASA's exploration missions. Drills as subsurface samplers of rocks, ice and permafrost are an essential tool for



Dr. Stewart Sherrit is a Senior Member of Technical Staff at JPL's Advanced Technologies Group.

Symposium Technical Program, Continued



astrobiology and mineralogical studies on other planets. Ultrasonic horns have proven to be very useful in a variety of medical and industrial applications. Over the last decade we have developed innovative modifications to apply this technology to extraterrestrial applications. One of the first innovations was the development of the USDC or Ultrasonic/Sonic Driller/Corer. This device used a standard stepped horn to drive a free mass at lower frequencies to create impulses in the drill stem that were shown to be very ef-

fective at drilling a wide variety of materials including basalts.

Tools for space applications are constrained in ways that standard industrial or medical systems may not be. The standard constraints for space applications include mass, volume, power, preload; however there may also be environmental constraints (Temperature, Pressure, and Chemical environment) that are also imposed. These constraints and the aim of optimizing performance have led us in the past to develop novel

horn designs (e.g. Flipped, Folded, Inverted, Dog-bone etc.) that may prove useful in terrestrial applications. Other recent innovations include ultrasonic horns without stress bolts that use a soft flexure to produce pre-stress and our recently developed asymmetrically slotted horn that produces vibration and rotation of the bit. This talk will focus on the sampler designs and horn development in the NDEAA lab and what led us to imagine some of these innovations. Figure 3 and 4 are illustrative of horns to be discussed.

UIA Blown Away, continued

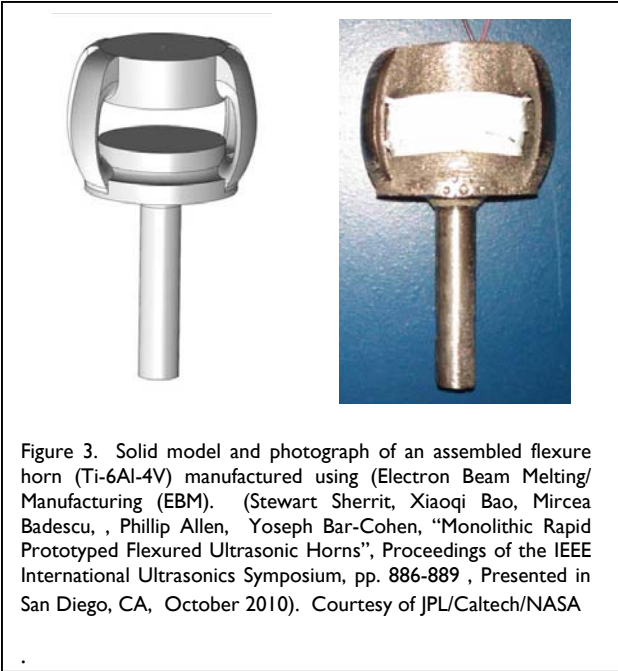


Figure 3. Solid model and photograph of an assembled flexure horn (Ti-6Al-4V) manufactured using (Electron Beam Melting/Manufacturing (EBM)). (Stewart Sherrit, Xiaoqi Bao, Mircea Badescu, , Phillip Allen, Yoseph Bar-Cohen, "Monolithic Rapid Prototyped Flexured Ultrasonic Horns", Proceedings of the IEEE International Ultrasonics Symposium, pp. 886-889 , Presented in San Diego, CA, October 2010). Courtesy of JPL/Caltech/NASA

We are fortunate this year to be able to form a segment of papers related to novel horns, as these are **enabling technologies for both extraterrestrial and terrestrial applications**. Often, the basis modeling techniques and technologies are of general interest to ultrasonic industry participants, and presently alternate wave modes such as longitudinal-torsional and transverse motion are of great interest.

University of Glasgow will present two papers on topics related to research of Dr. Stewart Sherrit on planetary drilling. Dr. Sherrit's systems use longitudinal-torsional vibration to provide rotation to a cutting bit during ultrasonic-sonic drilling, and Mr. Hassan Al-Budairi will describe his work on optimization of degenerate longitudinal horns which produce precisely this output. The horns developed by Mr. Al-Budairi generate this vibration by developing the path of the longitudinal resonant wave, which means that simple Langevin transducers can be used instead of more complex tangentially-poled or mode-coupling approaches. Dr. Patrick Harkness will describe an adap-

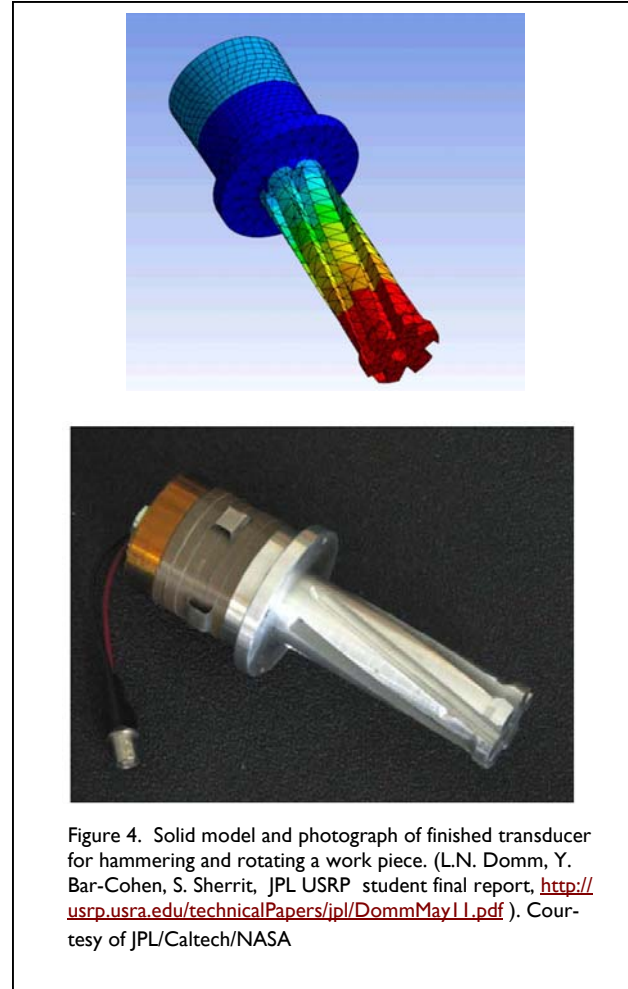


Figure 4. Solid model and photograph of finished transducer for hammering and rotating a work piece. (L.N. Domm, Y. Bar-Cohen, S. Sherrit, JPL USRP student final report, <http://usrp.usra.edu/technicalPapers/jpl/DommMay11.pdf>). Courtesy of JPL/Caltech/NASA

tation of this technique which separates the longitudinal and torsional outputs into two separate output surfaces of a specialist horn. This is significant because, if successful, it provides a mechanism by which rotation and percussion can be separated in ultrasonic-sonic drilling, which would in turn enable switchable outputs and a potential reduction in systemic problems such as bit-walk during coring operations.

Figure 5 on page 6 shows an ultrasonic drill on trial by University of Glasgow.

Symposium Technical Program, Continued

Ultrasound in Sustainability Applications

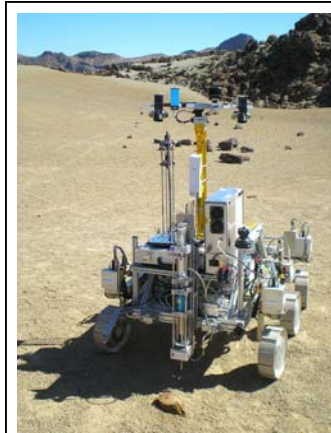


Figure 5. Ultrasonic-sonic drilling on trial, courtesy of University of Glasgow, Dr. Patrick Harkness, Lecturer School of Engineering.

Ultrasound systems are being investigated in improved efficiency in sustainability applications, such as in cleaning water, treating biomass, and creating biofuels. Dr. David Grewell has presented on ultrasound in sustainability at several UIA Symposiums, and is expected to provide an update on projects.

Novel Transducers and Advanced Materials

Transducers and advanced materials are typically discussed at UIA Symposium, and this year is no exception, with planned presentations on **Piezoceramic**

thick film deposition technology, by MEGGITT A/S and other researchers working on improved array transducers with reduced cross-talk.

Effects of Piezoelectric Ceramic Dissipation Factor on the Performance of Ultrasonic Transducers will be presented by Dr. Dominick A. DeAngelis and Gary W. Schulze. Several metrics are investigated such as impedance, displacement gain, capacitance, quality factors, and electro-mechanical coupling factor. The experimental and theoretical research methods include Bode plots, admittance loops, equivalent circuits, scanning laser vibrometry, and coupled-field finite element analysis.

Workshops on Tuesday Morning

It is clear to today's graduating scientists and engineers that traditional engineering technology now extends to biological materials and biotechnology, especially in life sciences, biomedical fields, and biotechnology. Bridging these interests, the field of technology that is based on inspiration of nature is known as Biomimetics. Dr. Yoseph Bar-Cohen, Senior Re-

search Scientist and Group Supervisor, Jet Propulsion Laboratory will present a 1 hour workshop on **Biomimetic Sensors and Actuators**, and his abstract is provided below.

Nature is effectively a giant laboratory where trial and error experiments are taking place thru evolution and the successful results are implemented, self-maintained and continually evolve to address the changing challenges. For its experiments, nature is using principles of physics, materials science, chemistry, mechanical engineering and many other fields of science and engineering. Nature inventions inspired human achievements in developing effective methods, materials, processes, algorithms, mechanisms, tools, structures, and systems. The field of technology that is based on inspiration of nature is known as Biomimetics and it offers enormous potential for many exciting future capabilities. There are numerous examples of biomimetic successes including making simple copies, as the use of fins for swimming, as well as the use of nature inspiration and models to enable flying. Commercial implementations of biomimetics are increasingly appearing and behaving lifelike and many applications are emerging that are important to our daily life. The

Symposium Technical Program, Continued

focus of this workshop presentation is on biomimetic sensors and actuators, which are critical components of any mechanically active system including robots and other smart systems.

BIOGRAPHY

Dr. Yoseph Bar-Cohen is a Senior Research Scientist and Supervisor of the Advanced Technologies Group at JPL. He received his Ph.D. in Physics (1979) from the Hebrew University, Jerusalem, Israel. His research is focused on electro-mechanics including planetary sample handling mechanisms, novel actuators that are driven by such materials as piezoelectric and EAP (also known as artificial muscles) and biomimetics. In his NDEAA lab (<http://ndeaa.jpl.nasa.gov/>) he led the development of many novel methods and mechanisms. In the materials called composites, he discovered the ultrasonic wave phenomena polar backscattering (1979) and leaky lamb waves (1983). He co-edited and co-authored 7 books, co-authored over 340 publications, made numerous presentations at national and international conferences, co-chaired 42 conferences, and has 22 registered patents. He initiated the SPIE conference on artificial

muscles, which he has been chairing since 1999. Dr. Bar-Cohen challenged engineers and scientists worldwide to develop a robotic arm driven by artificial muscles to wrestle with humans and win. He organized the first contest in 2005. For his contributions to the field of artificial muscles, Business Week named him in April 2003 one of five technology gurus who are "Pushing Tech's Boundaries." His accomplishments earned him two NASA Honor Award Medals, two SPIE's Lifetime Achievement Awards, the SPIE's President's Award and many other honors and awards. Also, he is a Fellow of two technical societies: ASNT and SPIE.

Medical ultrasonics research and development and delivery of realized devices to the hospital and operating room typically require FDA 510k process or other paths to approval. FDA (Food and Drug Administration) filings are demanding more quantitative measures of response to ultrasound, and driving advancement in characterization methods. Evidence based statistical approaches to verification testing are often necessary. A 1 hour

workshop is being organized with a visiting scientist from the FDA, Dr. Liu, as well as panel participants from the medical device industry, to discuss new perspective and experience of the process of approval, test approaches, and characterization methods.

Fundamentals of the Ultrasonic Plastic Welding and Practical Equipment Demonstration

Leo Klinstein of Dukane Corporation will provide an overview of the ultrasonic plastics welding process in a 1.5 hour workshop session. This is a presentation and hands-on use of a system. Ultrasonic pneumatic-driven plastics welders and advanced servo-driven welders are discussed. Participants are provided opportunity to view practical ultrasonic welding with an industrial servo welding system on-site at the symposium.

For the tentative schedule for presentations, please go to pages 8 - 10.



Dr. Yoseph Bar-Cohen

Monday 16 April Medical Sessions

- 7:30 Registration and Continental Breakfast
- 8:15 Welcome—Mark Hodnett, UIA President; Dan Cotter, Symposium Chair; Robert Muratore and Dr. Damien Walmsley, Session Co-Chairs
- 8:30 Human Liver Cystic Echinococcosis Safely Ablated With High Intensity Focused Ultrasound (HIFU)
Prof. Imankulov S. B., Zhampeisov N. K., Yerlan M., Narbaev A. E., Alimov B.K.
- 9:00 Infrared Thermal Imaging during Surgical Ultrasonic Aspiration of Bone *Daniel J. Cotter and Saurav V. Gupta*
- 9:30 Optimisation of a Cymbal Transducer for its Use as a Driver for a High-Power Ultrasonic Cutting Device For Bone Surgery *Fernando Bejarano, Margaret Lucas*
- 10:00 Coffee
- 10:30 Invasive/Non-invasive Ultrasound Effects on Adipocytes and Adipose-Derived Stem Cells *Mark Schafer*
- 11:00 Acoustic Radiation Force Creep and Shear Wave Dispersion Method for Elasticity Imaging *Carolina Amador Carrascal*
- 11:30 Networking Unconference - see *page 9 for more information*
- 12:00 Lunch
- 13:00 Keynote Speaker Dr. Tom Matula - Therapeutic Ultrasound and the Contribution of Bubbles
- 14:00 Characterization of High Intensity Focused Fields Used in Therapeutic Ultrasound *Klaus-V. Jenderka, M. Schultz*
- 14:30 A Novel Dual-Sensor Approach for the Determination of Cavitation In-vitro
Ian Butterworth, Mark Hodnett and Christian Baker
- 15:00 Coffee
- 15:30 A Wideband Non-resonant Driver for Hi-Q Ultrasonic Transducers *David Brubaker*
- 16:00 Cross-talk response Analysis on an Ultrasonic Matrix Array Using Different Materials for the Backing *Israel Sánchez Domínguez, Pedro Acevedo Contla, Fabián García Nocetti, Manuel Recuero*

Tuesday Workshops and Poster Session

- 8:20 Welcome - Dominick DeAngelis, Workshop Chair
- 8:30 Biomimetic Sensors and Actuators, *Dr. Yoseph Bar-Cohen*
- 9:30 FDA 510 k Process Evolution, *Dr. Liu, FDA*
- 10:00 Industrial perspective and experience of 510 k process, test approaches, and characterization methods, *Industrial Panelists and Discussion*
- 10:30 Coffee
- 11:00 Fundamentals of the Ultrasonic Plastic Welding and Practical Equipment Demonstration *Leo Klinstein*
- 12:30 Lunch
- 13:30 Ultrasound Field Measurement Solutions for Cleaning Tank Applications, *Petrie Yam*
- 14:15 Laser Vibrometer Applications in Ultrasound
- 15:00 Poster Session
- 18:00 Depart for Dinner and Chocolate and Champagne Tour of San Francisco *This event is **included** in the full registration fee—you just need to check the box on the registration form.*

Unconference

For many years people who attend conferences – including scientific conferences – noticed something interesting: the best discussions were those that occurred outside of lecture halls. Conversations that happened in the hallways, at the hotel bar, on a bus going to see a local attraction, or, if you are lucky with the location, on the beach, were informative, exciting and useful. This is where real information got exchanged, where younger members learned the “lore” and “tacit knowledge” from their elders in the field, where people started real connections, even friendships, where plans got hatched to start new collaborative projects, and more.

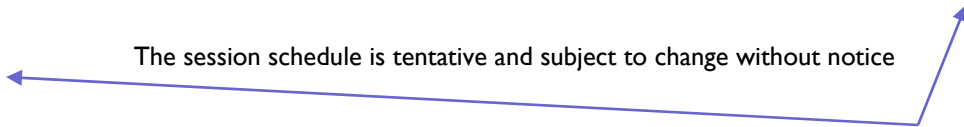
Experienced conference-goers can rarely be found in the actual conference rooms, or, if that would sometimes happen, they could be seen dozing off in the back row, or amusing themselves with the technology of the day (doodling on their notepad, later laptops, later iPhones/iPads). The speakers would prepare slideshows, the student presenters would all dress up and then sweat, the organizers would do their best to promote the sessions, only to see the rooms half-empty because everyone is having much more productive conversations out in the hallway.

*So, some smart people a few years back decide to do something about this. Why not scratch most or all of the boring lecturing from the program, and instead move the hallway discussions into the conference rooms? Thus, the **Unconference** format was born.*

Wednesday 18 April Industrial Sessions

- 8:20 Welcome - Leo Klinstein and Dr. Patrick Harness, Session Co-Chairs
- 8:30 Dynamics Characterisation of Cymbal Transducers for Power Ultrasonics Applications *Andrew Feeney, Fernando Bejarano, Margaret Lucas*
- 9:00 Acoustic Properties of Selected High Strength Thermosetting Plastic Composites at Ultrasonic Frequencies *Dave Wuchinich*
- 9:30 UAM (Ultrasonic Additive Machining) *EWI*
- 10:00 Coffee
- 10:30 Ultrasonic extraction of oil form oleaginous yeast *David Grewell*
- 11:00 The Effects of Piezoelectric Ceramic Dissipation Factor on the Performance of Ultrasonic Transducers *Dominick A. DeAngelis and Gary W. Schulze*
- 11:30 Piezoceramic thick film deposition technology integrated self- sustained systems for industrial applications *Rasmus Lou-Moeller and Wanda W. Wolny*
- 12:00 Lunch
- 13:00 Keynote Industrial: Stewart Sherrit, Novel Ultrasonic Horn Designs for Extraterrestrial Applications
- 14:00 Optimisation of the longitudinal-torsional output of a half-wavelength Langevin transducer *Hassan Al-Budairi, Margaret Lucas, Patrick Harkness*
- 14:30 Development of a switchable system for longitudinal and longitudinal-torsional vibration extraction *Patrick Harkness, Margaret Lucas*
- 15:00 Coffee
- 15:30 Miniature thermoacoustic engines *Myra Flitcroft, Moog Medical Group and Orest G. Symko, University of Utah*
- 16:00 Experimental analysis of rock fragmentation by focused ultrasound *Eimear Neeson, Margaret Lucas*
- 16:30 Symposium concludes

The session schedule is tentative and subject to change without notice



A President's Letter

To talk, to shout, or to sing?

Recent research and experiences in industrial and medical marketplaces have demonstrated just how broad ultrasound's application base is becoming – and hence its bright future – and it seems that as customers demand more control and refinement over the way in which ultrasound may be applied to their processes, some equipment manufacturers are being forced to re-examine their design principles. Put simply, shouting loudly at liquids and solids used to be enough to get the job done ok: but newer medical therapies are demanding a quieter, tonal song; and novel chemical manufacturing methods require that tune to change from bombast to lullaby as structures evolve.

At the root of this change is an ever-improving assessment of how ultrasound and materials interact, over short and long time and space scales. This increased fundamental understanding means that specifying and controlling ultrasound device outputs by power, or by power density, is no longer sufficient. Many processes are driven by a combination of thermal and mechanical stimuli, and these intimately woven phenomena need examination and control to optimise scaled-up lab processes to commercial reality.

Several ISO Committees – some of which have been dormant in recent times – are beginning the task of agreeing the definitions to better describe modern high power ultrasound systems, applied in both medicine and industry. UIA occupies an eminent commercial position in the application of these systems through its diverse membership, and is strongly placed to contribute to, and influence how new standards take shape. We are therefore developing a liaison link with the ISO committees, and will have a strong voice in these new documents, which should power all of our sound ideas to the next level of understanding.

Mark Hodnett



Mark Hodnett

2011 - 2012 UIA Board of Directors

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Grapes & Bubbles: Sonoma County Wine Sunday Tour



We will travel north of San Francisco on Highway 101 to California's beautiful Sonoma Wine Country. Sunday's wine tour will include a tasting and tour at a renowned sparkling wine vineyard, Gloria Ferrer, along with a tasting and lunch at Buena Vista.

A pioneer of sparkling wine from California's Sonoma Carneros region, Gloria Ferrer Champagne Caves has nurtured a dynamic relationship of discovery with the land for more than 20 years. The Ferrer family's uncompromising commitment to experimentation, research and education has inspired a winegrowing team at the forefront of Pinot Noir and Chardonnay clonal research—the rewards

of which are revealed in balanced wines of expressive terroir and varietal character.

Before there were vineyards in every valley north of San Francisco, before Napa and Sonoma were household names, before there was a California wine industry at all, there was Buena Vista. Founded in 1857, Buena Vista is California's oldest premium winery, and its history is as colorful as it is proud. Just outside the town of Sonoma, the original winery is now a California Historic Landmark, and home to the Tasting Room & Visitor's Center.

Today, the working winery is located in the heart of Carneros, and Buena Vista is the largest landowner in

Carneros; investments in new rootstock clones and a new winemaker are helping to ensure Buena Vista's rich tradition of world-class wines endures another 150 years. Your guests will enjoy a private historic tour in addition to an Estate Tasting featuring Buena Vista's most popular award winning wines. As we take in the gorgeous surroundings of the historical grounds our private wine expert will guide us through each wine. The experience will conclude with a gourmet picnic box lunch before heading back to San Francisco.

Note: This tour involves minimal to moderate walking through vineyards and wineries. This tour is not available for anyone under 21.

Cost: \$150 per person

The tour departs at 9:00 am and will return to the city by 3:00 pm. Please plan your arrival in San Francisco accordingly. Tour is limited to 30 people.

Tuesday Evening Dinner and Champagne and Chocolate Tour

Boudin Sourdough French Bread has been a San Francisco culinary treasure for more than a century and a half, sought after – and often carried home – by visitors from all over the world. On Tuesday, we will be dining at the flagship Boudin Bakery and Restaurant.

It all began in 1849, when members of the Boudin



family, master bakers from Champigny-sur-Yonne, France, arrived in the city that had been known as Yerba Buena. The Boudins knew how to take simple ingredients –just flour, water, and salt–and create the classic loaf of French bread: soft and light in the center with a golden, crunchy crust.

We will enjoy an array of historic photos, artifacts, and interactive exhibits; the Museum & Bakery provides a unique and engaging overview of the history of San Francisco through the lens of a company that has evolved

with the city since its earliest days. Your guests can observe the art and science of the Boudin baking from the glass-walled catwalk that provides full views of the working bakery. A buffet dinner will be served in the Boudin private Museum as we enjoy the views of the bay. This evening is sure to offer dining and sensory experiences for all that attend.

Nothing says San Francisco like the view of Alcatraz, sourdough bread and the art of preparing fine foods!

After dinner we will enjoy a City Tour like no other. Glittering and exciting at any time of the day, San Francisco is



especially magical at night. This exclusive evening is a rare experience.

So sit back, sip champagne and treat yourself to truffles while exploring the City's eclectic neighborhoods from the comfort of a luxury motorcoach.

San Francisco's skyline is absolutely stunning in the night. Each new hill brings a different view of the city with its lights spread below like a sparkling tapestry. Gazing at the City's lights from Twin Peaks is unforgettable as are the sleeping neighborhoods perched on the slopes above the Bay.

We know all the best places, and will guide you through San Francisco's exciting and famous streetscapes. With a pop of the champagne cork, fill your glass and toast a beautiful San Francisco evening!

This event is included in your full symposium registration. Additional tickets are available for \$180 per person.

Make your reservations at the [Mark Hopkins Hotel](#) before 21 March to guarantee the [UIA](#) rate of \$189 per night, plus tax.



4 1st Annual UIA Symposium Registration
16-18 April 2012
Mark Hopkins Hotel, San Francisco, CA, USA

First Name

Last Name, Designation

Nickname for badge

Position/Title

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For mailing purposes, I prefer my

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Please register me in the following manner:

Full Registration includes, Tuesday evening event - please check boxes to confirm your participation

- Full conference registration
 YES, I will attend Tuesday Evening

Select for which category you are registering:

- Member Nonmember Exhibitor
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Daily Registration

Tuesday does NOT include Tuesday Evening Event

Select which day: Select your category:

- Monday Member
 Tuesday Nonmember
 Wednesday Speaker
 Student

Special Events

- Sunday Wine Tour # of Tickets _____
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Payment Summary FIN for voucher use only: 13-6130371

Fee Schedule

Full conference (Monday - Wednesday)

Full conference - Member	\$875
Full conference - Nonmember	\$995
Speaker - Full conference	\$750
Student - Full conference	\$495

Daily fees (Monday, Tuesday or Wednesday)

Daily Rate - Member	\$295
Daily Rate - Nonmember	\$400
Speaker - Daily	\$295
Student - Daily	\$195
Student - Poster Presenter	\$75

Exhibit Levels - Members

I - 1 table, 1 full registration	\$1,450
II - 1 table, 2 full registrations	\$1,845

Exhibit Levels - Non members

I - 1 table, 1 full registration	\$1,795
II - 1 table, 2 full registrations	\$2,545

Sponsorship Levels

I - Refreshment Sponsor	\$1,500
II - Breakfast Sponsor	\$1,995
III - Lunch Sponsor	\$2,750

Special Events

Sunday Wine Tour	\$150
Tuesday Evening Event	\$180

NOTE: Tuesday evening is included in the FULL conference registration fee. Additional tickets may be purchased for companions.

Conference Registration \$ _____
 Sunday Wine Tour \$ _____
 Tuesday Evening Event \$ _____
TOTAL DUE \$ _____

Method of Payment

- Payment enclosed. Make check payable to UIA.
 Charge Credit Card: MasterCard Visa

UIA accepts only these two credit cards!

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Exp Date ____ / ____

Person's name on card: _____

- Business Personal

Signature

You may register on-line at www.ultrasonics.org

MAIL registration form and payments to UIA, PO Box 2307, Dayton, OH USA 45401-2307

FAX registration form to +1.937.586.3699

Address for express mail only: 11 W Monument Avenue, Ste 510, Dayton, OH USA 45402