Volume 26, Issue 2: Summer 2016 Summer 2016

Vibrations

Powering Sound Ideas

Sound Solutions 21-22 Sept. 2016: Ames, Iowa

The 2016 Sound Solutions will be held at Iowa State University on Wednesday, 21 September – Thursday, 22 September.

This 8 hour focused session on Ultrasonic Non-Destructive Evaluation and Food Processing is cosponsored by Center for Industrial Research and Service, Iowa State University and is chaired by David Grewell, Professor, Director, NSF Industry & University Cooperative Research Center for Bioplastics and Biocomposites, Agricultural and Biosystems Engineering, Iowa State University.

This mid-year meeting on a focused subject provides an additional opportunity for UIA members and other individuals interested in ultrasonics to meet with their colleagues to focus on in-depth exploration of specific ultrasonic topics.

Registration is $199 for UIA members and $249 for non-members. Registration is now open!

Schedule

Wednesday Sept 21 (Sukup Hall-Davison)
12:00-1:00 Registration
1:00-5:00 Presentations on NDE
5:00-7:00 Tour of NDE labs
7:00-9:00 Dinner (Atrium Sukup Hall)

Thursday Sept 22 (Sukup Hall-Davison)
7:00-8:00 Breakfast
8:00-12:00 Presentations on ultrasonics and food processing and packaging
12:00-1:00 Lunch/boxes to go
1:00-3:00 Tour of Food Science labs

Visit the new UIA website for schedule details and updates in the coming weeks.

Hotels

Best Western Plus University Park Inn & Suites
2500 University Boulevard
Ames, IA 50010
(515) 296-2500

Gateway Hotel
2100 Green Hills Drive
Ames, IA 50014
(515) 292-8600

Holiday Inn Ames
2609 University Boulevard
Ames, IA 50010
(515) 268-8808

Hilton Garden Inn Ames
1325 Dickinson Ave
Ames, IA 50014
(515) 233-8000

Travel Information

Des Moines International Airport (DSM)
42 miles from meeting location

Special Points of Interest

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UIA46: Dresden, Germany 24 – 26 April 2017

The UIA Board of Directors have selected Dresden, Germany for the location for the 2017 UIA Symposium.

"With the Fraunhofer Institute and several other companies doing exciting things in Dresden, we are looking forward to a broad-ranging program of presentations and ultrasonic tours during UIA46," says Tony Crandall, UIA President.

The Dresden Hilton Hotel will be the headquarters for UIA46.

Guestrooms are available for 127€/ single and 152€ double, which includes breakfast. Reservations need to be made **prior to 24 February 2017**.

Symposium chairs will include: Industrial: Rasmus Lou-Moeller, Meggitt Aerospace, Denmark and Leo Klinstein, Dukane, USA. Workshop: Dominick DeAngelis, Kulicke & Soffa Ind., Philadelphia.

More information and earlybird registration will be available in October.

Check www.ultrasonics.org for updated information.
Dresden Cathedral
www.thousandwonders.net

Inside this issue:

The Last Word...

From the Outgoing President

Dan Cotter
Outgoing UIA President

When Mark Hodnett first asked me to consider being President of UIA, I really had to assess my situation at work at Integra and within the organization of our society, given the fast pace and complex demands of surgical solution projects. My team at work certainly was mature and executing and their support, Integra's backing, and the board members and Planning Committee we were forming convinced me to make a 2 year commitment.

It was an absolute privilege and honor to be president of UIA. The Planning Committee's energy, board members contribution, and Fran's ever dependable organization enabled inroads in publication with Physics Procedia, update in membership portal tools, a new web site, new approaches to sponsorship that aided in improved financials, the first Sound Solutions as a fall meeting, and continued successful symposiums.

It is the engagement of the membership in the committees and board and volunteerism in symposium organization that makes UIA the great society it is, and has been for many years. I thank you folks for all your efforts over the past two years.

The new President Tony Crandall has been a friend and colleague for more than 10 years now, and he has been a key contributor to the UIA Board of Directors from the early days of the organization. Tony blends an industrial, medical, R&D, and academic interest in ultrasonics, so he has a unique perspective across the full scope of emerging technologies and our society.

Tony chaired the highly successful UIA Symposium in Boston, Mass. I relied on Tony often for feedback on ideas, and he was active in all committees and the board as VP throughout my tenure.

I am so excited about the entry of many new members to the board from the planning committee, and the continued energy from the board in symposium organization.

My call for action is to fully support Tony, and I am glad to continue as a board member and ad hoc committee member on what will be the great tenure of Tony Crandall, President of UIA.

The First Word...

From the Incoming President

First, I want to thank Dan for the kind words, but more importantly, I want to thank him for the hard work he's done the past two years to put UIA in the position it is in today. He's put energy and thoughtful planning into transforming UIA into a dynamic and growing organization. He has set up a three year planning committee, launched a mid-year meeting, and presided over two exceptionally successful symposia.

Dan has positioned UIA very well and I hope to be able to continue the path of improvement and growth UIA is on. Fortunately, Margaret Lucas has agreed to be Vice-president and I'm sure her support and help will be invaluable. Also, Fran's continued organization and cat-herding skills will keep things heading in the right direction.

The most recent UIA Symposium in Seattle was a tremendous success. The meeting was well attended. The Industrial and Medical sessions were both great and the Tuesday workshop was exceptional. Tom Matula and Dominick DeAngelis did an outstanding job in organizing the symposium.

The coming year should be interesting. We've got a mid-year one and a half day workshop planned for September at Iowa State University. Dave Grewell is heading up organizing a great program for this event. In the Spring of 2017, we'll be off to Dresden, Germany for our annual symposium. The plans for this are taking shape with the help of Rasmus Lou-Moeller and Klaus Vithold Jenderka. More information can be found page 1 of this newsletter.

In closing, I'm excited to be in charge of such an amazing organization. I think we who are closest to it sometimes fail to appreciate what a great organization it is. UIA is exceptional in many ways, but it needs member involvement to remain so. This is your organization. Please, get involved. Let's make it the best organization it can be.

UIA is exceptional in many ways, but it needs member involvement to remain so.

Tony Crandall, new UIA President

UIA45: 4-6 April 2016, Seattle, Washington

The 45th Ultrasonics Industry Association Symposium was held at the Seattle Motif Hotel from April 4 – 6 2016, and attracted over 70 delegates. Our chosen location enabled a great collaboration with the nearby University of Washington (UoW), and we were delighted that Dr. Tom Matula, Director of the Centre of Industrial and Medical Ultrasound (CIMU) at the UoW Applied Physics Laboratory, was our Symposium co-Chair, alongside UIA Board Member Dominick DeAngelis.

Monday, April 4th

Day 1 of the Symposium comprised our Industrial Session, and following an introduction and welcome from UIA President Dan Cotter, commenced with Tomasz Zawada from Meggitt (Denmark). Tomasz presented the motivation, realisation and results from developing high frequency transducers for industrial inspection of structures such as welds and thick films. Manufacture is based on a screen-printed method of depositing thick PZT films (in the 10 μm to 100 μm thickness range), producing transducers of low acoustic impedance, frequency around 26 MHz, and bandwidths >100%, perfect for imaging applications. The technique has also been extended to arrays, operating at >10 MHz.

Our next speaker was UIA Past President **Mark Hodnett** (National

Physical Laboratory, UK) who described an advanced hybrid cavitation facility under development at NPL for developing new measurement methods. Using Q-switch laser-nucleated and 29 kHz acoustically-initiated cavitation clouds, the facility provides a stable and repeatable platform for initiating and studying fluid cavitation characteristics, and underpins evolving standards in cavitation metrology.

Maintaining the strong European presence, Matt Moles (Loughborough University, UK) described results from a collaborative Innovate UK project (ULTRAMELT) to examine ultrasonic assistance in polymer moulding. The project aim was to enhance melt flow, hence enabling cost-effective reductions in the existing required thermal and pressure stimuli. Matt's work used Abaqus FEM to study the theoretical response of a 20 kHz sonotrode system, and also perform CFD and Fluid-Structure analyses, to inform the flow system prototype design.

Longtime UIA contributor **Andrew Feeney** (University of Glasgow) was

up after the coffee break, describing ultrasonic compaction methods for the oil and gas industry, specifically for the Badger Explorer sub-sea evaluation tool, where drill spoil is the material of interest. Using a modified Sonic Systems L500 sonotrode with an Abaqus-designed head, compacting effectiveness was assessed in terms of cross-head speed, tool amplitude and particle type, using sample materials ranging from slate to limestone.

Taking us up to lunch, UIA Board Member **George Bromfield** (Piezo

Innovations LLC) presented a PiezoTran analysis of the high power performance of Langevin transducers, examining in particular the effect of piezo stack location, the mechanical Q of system components, and the piezo material selection, with advanced configurations of single crystal PMN-PZT showing potentially superior performance.

Post-lunch, our invited Industrial Session speaker was George Keilman (Sonic Concepts). George's career in ultrasound transducer, system and application design spans four decades, and so he presented a selection of his vast commercial network and experiences in the industry. In particular, he focused on acoustic pyrometry tomography to characterise furnace gases; acoustic fractionation of fibres in pulp and paper industries; lamb wave-originated material property measurements in paper, and acoustic scintillation as a means of measuring fast flows in hydroelectric turbines.

George Keilman

Symposium co-Chair and UIA Board Member Dominick DeAngelis (Kulicke and Soffa) then updated us on his ongoing investigations into transducer design for application in wire-bonding. Comparing PZT4 with PZT8 elements, using Bode plots, thermal imaging (FLIR) and ANSYS finite-element modelling, he showed that PZT4 can work as an alternate, albeit needing higher preload conditions, and that it runs slightly cooler due to lower internal heating.

Dominick DeAngelis

Christopher Hunter from CIMU, UoW then described the design of an ultrasonic caliper, intended to improve the available database of ultrasonic properties of tissue, knowledge of which are becoming increasingly important for modelling, and for quantitative imaging. His particular area of interest is in characterising transplant livers, where fat characterisation is of particular importance. Early results were shown of simulations using Burgers' equation, and measurements made in water and a glycerol phantom, at low and high drive levels to determine harmonic levels.

Taking up the reins after coffee, Dr Klaus Witold-Jenderka (HoMe, Germany) gave the first of two presentations in the late afternoon session on the use of optical methods to characterise ultrasound fields. In this case, Klaus was measuring the transducer surface velocities and then the field (via refracto-vibrometry) emitted by a 40 kHz airborne source, using a Polytec PSV-500-V. The

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transducer under test was interesting in itself, consisting of three separate elements allowing focused or unfocused fields to be generated. Examples were given of air-coupled NDT at 200 kHz and 400 kHz for examining defects in carbon fibre honeycomb panels.

Hafiiz Osman (Sembcorp Marine) presented his research on high flow processing using ultrasound cavitation, with an ultimate specific application in disinfecting ballast water. His transducer design comprised a radial horn, with additional orifices to increase the surface area of exposure (without increasing structural mass) and hence treatment, and a range of slots and cylindrical sub-apertures were tested. Varying the drive frequency was found to favour particular treatments through mode selection, and acoustic pressures of a few kPa were measured in early prototypes.

Our penultimate presenter was **Eric Lawrence (**Polytec), who gave an

overview of the new capabilities within laser vibrometry. He focused on applications in ultrasonic imaging using PMUT's (airborne uses up to 900 kHz, and fluid-borne to 40 MHz), scanning areal displacement profiles and analysing mode shapes. Surface acoustic wave (SAW) characterisation was also shown, with a nanofluidics chip vibrating at 19.75 MHz.

UIA Board Member Leo Klinstein (Dukane Corp) rounded out Day 1, describing a new round energy director developed for ultrasonic welding of plastic parts, which gives consistent pull test strength results, and often exceeds 90-degree energy directors; it has the additional benefit of minimising part-to-part variations and reduces mould tooling costs.

Delegates then enjoyed a beer, wine and cheese reception, sponsored generously by Integra LifeSciences

Tuesday, April 5th

UIA Board Member Prakash Manandhar (Integra LifeSciences) took on Session Chair responsibility for Emerging Ultrasonic Applications, and the first presenter was our invited speaker, Jack Tuszynski (University of Alberta). He gave a fascinating insight into the biological markers and conventional treatment modalities for cancer, and then described the ongoing research and future possibilities for ultrasound intervention, examining specifically its effects on microtubules. In a 24-cell well plate, under 1 MHz ultrasound exposure, cell disruption was clearly seen, with microtubules distorted, and in vitro, seen to be broken up. The mechanism is as yet unknown, however, with accompanying theoretical calculations suggesting that ultrasound intensities and frequencies of several orders of magnitude greater than applied would be required to effect the damage observed.

UIA Past President Mark Hodnett then spoke on an emerging method for medical imaging, under development in an Innovate UK project at the National Physical Laboratory. It harnesses the *pyro*electric properties of *piezo*electric polymers, and hence uses phase-insensitive methods to detect ultrasound over a large area sensor. The approach has been used previously for ultrasound power determination, and is now being applied in an advanced prototype breast disease diagnosis platform, which will undergo its first clinical trial in 2017.

Following a refreshment break, UoW's Tom Matula took on the challenge of chairing a new type of session for UIA – Commercialisation Experiences of new technologies. Due partly to the strong culture of innovation and fast track route into patient take-up in the Pacific Northwest, several manufacturers and start-ups were able to attend, and contribute their valued experiences in taking ultrasound medical technologies from the bench to the clinic. Many common themes ran through the presentations given, with **Jens Quistgaard** (Mirabilis Medica) in particular benefitting us

with his wealth of knowledge. He clearly emphasised the need to understand and minimise risk, to be sure that any product has a clear purpose, route to market, freedom-to-operate and isn't too disruptive as to not be accepted by consumers or regulators. Jimin Zhang (Kona Medical), in describing a renal denervation system, emphasised the need to be aware of regulatory standards (general, electrical and acoustical) throughout the product design and testing process, leading to FDA approval and CE marking for European sales, and spoke of over 200 animal procedures being carried out with their prototype product prior to pilot clinical studies.

The session was clearly stimulating for delegates, with open discussions continuing during the presenter slots,

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and feedback from delegates afterwards indicated that in the main, the session was very worthwhile.

Sampling their boxed lunches, delegates then listened to a series of brief elevator pitches from our exhibitors (CeramTec, E and I, Harris, PZFlex, and Sonic Concepts), and were then encouraged to visit the exhibition area for networking discussions.

Many delegates then opted to visit the nearby UoW Ultrasound

Laboratories, with Tom Matula and his colleagues providing an entertaining and stimulating series of demonstrations and exhibits across the CIMU portfolio, including histotripsy, acoustic manipulation, 3D -printed transducer housing design, and ongoing enhancements to the clinical effectiveness of lithotripsy. Of particular interest to many medical attendees was the animal testing facilities, where UoW works closely with local regulatory and welfare groups to ensure effective and responsible pre-clinical trials.

Tuesday evening saw delegates journeying by monorail to attend the Symposium dinner, at the world-famous Seattle Space Needle. Our delicious buffet meal coincided with the sunset, and after dark, delegates were able to journey to the observation deck, 520 feet up, to take in the panoramic views of Seattle by night, and enjoy some downtime with colleagues old and new.

Wednesday, April 6th

A very full Medical Session was chaired jointly by Tom Matula (UoW) and Andrew Mathieson (University of Glasgow). Our first speaker, in a sequence of three presentations from UoW CIMU, was Mike Bailey, who described a method to reposition kidney stones using ultrasound. Kidney stones are a growing problem (9% of Americans suffer from them), creating a healthcare financial burden of $10b annually. Established lithotripsy procedures leave as much as 65% of stone fragments unpassed, which means potential nuclei for future stone growth. Using 2 MHz, 50 ms pulses at 50 W cm^{-2}, stones can be moved to preferred locations for passing. The technique uses a conventional probe, and has been tested successfully on 15 subjects, with stones of up 10 mm relocated successfully.

Tatiana Khokhlova then spoke about her work on haematoma liquefaction using cavitation histotripsy, in which high amplitude, short duration pulses are generate to cause mechanical, non-thermal, therapeutic effects. Boiling histotripsy, in which longer ultrasound bursts are used to elevate local tissue temperatures to 100 °C, was also tested, and found to more effective in generating tissues cavities. In both cases, fine needle aspiration is then used to remove the liquefied tissue. 1 and 1.5 MHz multi-element array transducers were used, and in porcine tests, under clinically-applicable timescales a combination of boiling and cavitation histotripsy methods was the most successful for high thrombolysis.

Next, Tom Matula described an innovative platform developed for preparing biological assays. Central to the problem is the need to remove bottlenecks during sample preparation for genomics and epigenetics, in which DNA or chromatin shearing is essential for sequencing and mapping. Current sample preparation methods require several transfer processes, and arduous shearing procedures which may take 8 hours or more, requiring expert intervention, and even then, irreproducibility is a key issue. Tom's so-called Pixulated Ultrasound (PIXUL) approach attaches small 1 – 2 MHz transducers directly the underside of 96-unit wellplates, removing almost all of the preparation steps. Positive results were seen on salmon DNA, fragmenting down to 300 base pairs within 12 minutes, in comparison to hours of processing needed for conventional protocols. The next steps are to commercialise the technology.

Following refreshments, **Dong**

Wang (Loughborough University, UK) described his Innovate UK project (ULTRATOME) which is developing ultrasonic devices for assisted microtomy. Conventional microtomy suffers from blade wear, progressing rapidly from dulling to edge damage, resulting in inconsistent slice thickness and sample damage. A 2D finite element model was set up, and a cutting head operating at 36 kHz was built, characterised using a laser vibrometer. Adding ultrasound to the cutting process showed a 25% reduction in required cutting force for wax samples of 250 micron thickness.

Taking us up to lunch, Andrew Mathieson (University of Glasgow) took us through a multi-centre research project, to develop ultrasonic methods for conducting bone biopsies. These are required for tumour and leukaemia diagnosis and are typically taken from the sternum

Tom Matula, Symposium Co-Chair

Andrew Mathieson, Medical Session Co-Chair

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or upper pelvic bone. Conventional approaches, rather unpleasantly, require a corkscrew-like motion to core and remove samples, which typically result in a conical tool orbit and large forces, and subsequent post-procedure pain and soft tissue damage. Three types of ultrasound-equipped needle were tested, including resonant, free-mass and flextensional designs, and all were tested on animal bones, showing comparable trabecular bone and superior cortical bone sample extraction for than the conventional trephine method. A single crystal transducer was also used, and shows promise for reduced packaging size.

Following lunch, again taken in the exhibition room, delegates returned for the Medical Session invited

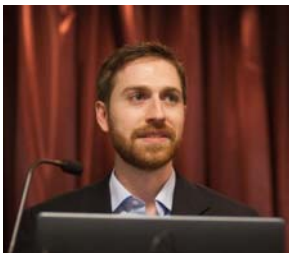
speaker, **Dr Elisa Konofagou** (Columbia University, NY), who described the current state of the art in applying focused ultrasound to open the blood-brain barrier (BBB). Research has shown that non-inertial cavitation (stably oscillating bubbles) causes BBB opening, with acoustic pressures of less than 500 kPa at 1.5 MHz being effective. Increasing acoustic output to above the inertial cavitation threshold (closer to 1 MPa) dictates the molecular size take-up threshold, and also generates thermal effects. In recent primate studies, a colinear focused transducer and cavitation detector were used to monitor the generated cavitation in real-time *in situ*, with this being taken as a measure of BBB opening. The technique offers a wide range of therapeutic possibilities, particularly for neurogenerative conditions, and so ongoing research is fast-moving.

Wayne Kreider (UoW CIMU) was our next speaker, describing the design of HIFU transducer specifically for controlling focal nonlinear propagation effects, to improve treatments such as boiling histotripsy. Hypothesising that the predominant parameter for controlling focal pressures is the f-number, he showed results from 3D Westervelt equation and KZK equation modelling, with suitable boundary conditions. This enabled relations to be made between transducer parameters and the equivalent source, and formed the basis of a design of a 1.5 MHz 256-element HIFU array transducer, arranged in a 16-fold spiral arm configuration.

Continuing the therapeutic

transducer theme, **Tong Li** (Kona Medical) then spoke on her research to characterise a phased array for treating hypertension, which works by regulating blood pressure via disrupting sympathetic nerves to and from the kidney. Target power levels of around 300 W are required, and these were measured using a radiation force balance of custom design. Element-element variation was better than 2.5%, determined across the 14 sources in the treatment head. She then described hydrophone scanning in orthogonal planes relative to the applicator (operating at low intensities), which showed very good agreement with simulation, in terms of field distribution and orientation, with a controllable focal depth between 8 and 16 cm.

After refreshments, two further presentations from the UoW CIMU group followed. The first of these was given by Julianna Simon, who spoke on ultrasound 'twinkling artefacts' seen in colour Doppler scans. Julianna's motivation is space exploration healthcare, driven by the increased risk of astronauts suffering from kidney stones. The twinkling artefact is believed to originate from trapped gas on the irregular calculi surfaces, and to test this, a simple hydraulic rig was built to demonstrate that overpressure of up to 4 atmospheres suppressed the phenomenon, although with a degree of variability. The converse was also seen, with twinkling enhancement demonstrated with an underpressure of 0.2 atmospheres. Porcine tests were then carried out using implanted stones, under simulated space conditions (where CO_2 levels are up to 20x greater), and human testing in a hyperbaric chamber is now underway. An important finding from the work is that trapped stable gas bodies can exist over long time durations in the human body, which has interesting implications for contrast and therapeutic agent research.



Adam Maxwell described burst wave lithotripsy, an evolution of historical techniques, in which a 10-cycle sinusoidal burst of around 7 MPa is used, rather than a 40 MPa shock. It is delivered using a 170 kHz focused transducer with a 30 mm x 8 mm focal region. Real and simulated stones were tested, with communition times of around 10 minutes, and a test of increasing frequency showed a smaller resulting fragment size (<1 mm). The mechanism of fracture was investigated by modelling the stone with conventional linear simulations, assuming tension in the stone, and as expected, the frequency trend with fragment size is likely to be due to

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surface waves and in-stone reverberations. Animal tests were used to show minimal peripheral thermal/mechanical damage (with the twinkling artefact approach described above used to detect cavitation with high sensitivity), although effectiveness was apparently reduced with 1 cm sized stones. The method is now being taken forward in combination with the ultrasonic propulsion work described by Mike Bailey earlier in the session, to move towards a new generation of kidney stone treatment.

David Nelson (Kona Medical) spoke next: in a complementary presentation to Tong Li's earlier work on reference acoustic characterisation methods for Kona's renal denervation system, he described field-test methods which will ultimately be accessible to users. The main challenge is to develop techniques which can be applied at clinically-relevant powers (in excess of 300 W) and to rapidly test targeting accuracy. Present procedures use a radiation force balance, considered too delicate for field use, and the non-quantitative burning of a thin plastic disk. So, the proposed approach uses a Micro Epsilon TIM 160 thermal camera, in conjunction with a series of layers of acoustical absorber, which will enable both QA tasks to be carried out. A bespoke absorber material was developed, with performance independent of temperature, and this has enabled output power configurations of up to 100 W to be measured so far. Ongoing work is intended to improve the field test system to accommodate the full power range and clinically-relevant on -times.

Our final speaker was UIA Board

Member **Prakash Manandhar** (Integra LifeSciences), who demonstrated an automated method for determining the excursion of a surgical tip. With reference optical methods costing $10,000+, the need is clear for a simpler technique. In an approach somewhat analogous to laser Doppler velocimetry (presented earlier in the Symposium), a $100 USB microscope and fast-frame CCD camera was used to capture the tip excursions of a typical surgery device, and then process these as spatial 2D Fourier transforms. The results show an almost perfect correlation with manual data, even up to amplitudes of 350 microns, and so the netx steps are to implement the method onto a low-cost computing platform, and to generate a database of 'problem probes' to further validate the method, and to characterise different excursion types.

Following completion of the Symposium technical programme, UIA President Dan Cotter thanked UIA's Executive Director, Fran Rickenbach, for her tireless efforts in ensuring the smooth running of the Symposium – thank you, Fran! In a closing speech, he thanked delegates and Board member colleagues for their support, and formally passed on the Presidential responsibilities to Tony Crandall (BioSonix, Salt Lake City, UT). Tony is a longstanding contributor to the UIA, and will continue the good work carried out by Dan and his predecessors, to provide a stimulating and effective forum for discussion, networking and knowledge exchange which is unique in the ultrasound industry worldwide.

Mark Hodnett, Margaret Lucas, Isla Lucas, Andrew Feeney and Dong Wang with the E&I mascot at the Space Needle

The view of Seattle from the Space Needle

UIA45: 4-6 April 2016, Exhibitors

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UIA thanks the many companies who sponsored and exhibited at UIA46

Photo credits for UIA46:

Mark Hodnett

Dong Wang

Dominick DeAngelis

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Ultrasonics Industry Association

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How can ultrasonics enhance the value of your business?

UIA is the international business forum for users, manufacturers, and researchers of ultrasonics. Our members use acoustic vibrations to improve materials, industrial processes, and medical technology. We call this "powering sound ideas."

Let's work together to power your sound ideas. Contact a member consultant or company through our online Referral Network, learn about ultrasonics with our online primer, or meet industry leaders at our next symposium.

Important Dates

21-22 September: 2016 Sound Solutions in Ames, Iowa
Registration now open!

14 October: Abstracts due for UIA46

31 December: Earlybird registration deadline

24 February 2017: Deadline for reservations at the Dresden Hilton

24-26 April 2017: UIA46 in Dresden, Germany

UIA Elects New Officers

Tony Crandall, BioSonix, has been elected by the UIA Board of Directors to serve as President. Margaret Lucas, University of Glasgow, will serve as Vice President. Janet Devine, Sonobond will continue for one more year as Secretary and Ron Staut, APC, will complete his term as Treasurer this year.

Andrew Mathieson, University of Glasgow, has also been appointed to the UIA Board of Directors.


Tony Crandall
UIA President


Margaret Lucas
UIA VP


Andrew Mathieson
UIA Director