



# Vibrations

Ultrasonic Industry Association

## We're Going to Glasgow, Scotland, UK 23-25 May 2011

The 2011 UIA Symposium will be held at the University of Glasgow, Scotland, UK. **Margaret Lucas**, Professor of Ultrasonics, Head of Systems, Power and Energy Research Division in the School of Engineering at the University of Glasgow, is the Symposium Chair.

Industrial Session Co-Chairs are **Tony Gachagan**, Deputy Director of CUE, and a Senior Lecturer in the Electronic and Electrical Engineering Department, at the University of Strathclyde, and **Leo Klinstein**, Dukane Corporation.

Medical Session Co-Chairs are **Sandy Cochran**, Deputy Director and Team Leader (Medical Ultrasound), Institute for Medical Science and Technology, University of Dundee, and **Daniel J. Cotter**, Principal Ultrasonics Engineer, Integra Neuro Sciences.



**Margaret Lucas,**  
Symposium Chair

## 40th Symposium Invited Speakers

**Professor Damien Walmsley**, BDS MSc PhD (VU Manchester) FDS RCPS (Glasgow), Professor of Restorative Dentistry, School of Dentistry, The



University of Birmingham will be the invited speaker for the Medical Session. Damien tells us, "I started off studying dentistry but very soon after finishing my clinical training, I commenced my PhD studies on the topic of 'Biological effects of ultrasound in dentistry'. One of my supervisors was Roy Williams, Reader in Medical Biophysics at Manchester University who was interested in potential

research collaborations into the use of dental ultrasound. It was his enthusiasm for the subject that stimulated my interest in this area of research.

Ultrasound in Dentistry is primarily used for cleaning teeth by means of an oscillating probe working at kHz frequencies (around 25 to 40kHz). The chipping action of the tip removes the attached deposits and is partially assisted by the cavitation activity in the cooling water supply. My early research looked at cavitation and its ability to remove material from the tooth surface. However it quickly became apparent that dental ultrasonic instruments had not been properly calibrated in spite of their widespread use. Also

**Juan A. Gallego-Juárez**, is



a Research Professor at the Spanish Council for Scientific Research (CSIC) where he founded the group of Ultrasonics and is Former Director of the Institute of Acoustics and of the Center for Physics Technologies. His research work has always been related to ultrasonics,

### Inside this issue:

Glasgow	<b>2</b>
39th Annual Symposium	<b>3</b>
President's Letter	<b>9</b>
UIA Forum	<b>9</b>
Call for Papers	<b>10</b>

*continued on page 6*

*continued on page 7*

## Glasgow Welcomes UIA



University of Glasgow,  
site of UIA Symposium

Glasgow is one of Europe's most vibrant and cosmopolitan cities, home to the art nouveau architectural treasures of Charles Rennie Mackintosh, and on the doorstep of Scotland's glorious countryside.

The former ship-building powerhouse has undergone an economic and cultural renaissance and in 2004 it was re-branded as **Glasgow: Scotland with style**. The editor of US travel magazine Frommer's voted Glasgow one of the top ten, 'must-see' up and coming destinations for 2006. Glasgow has been voted the UK number one destination by Conde Nast Traveller magazine readers.

More than £1 billion is being invested to transform the riverfront into a stylish business, residential and leisure area, including the world-famous Kelvingrove Art Gallery and Museum recent renovation.

Glasgow is a shopper's paradise and was voted Britain's top retail destination in 2007. The main shopping thoroughfare, Buchanan Street, has been voted one of the world's top retail destinations.

such as Royal Troon and Turnberry are just an hour away from the city. Sample a dram in some of Scotland's celebrated whisky distilleries, or visit some of our hauntingly beautiful castles – all within easy access of Glasgow.



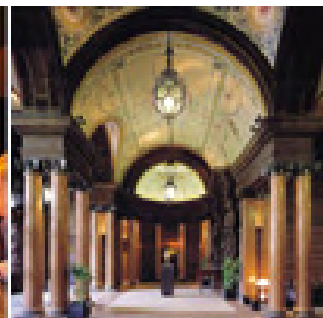
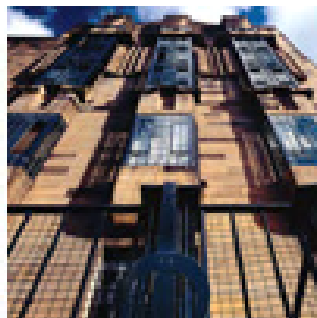
SCCC and Bells Bridge at night

The splendor of the Ayrshire coast and Robert Burns country, and Loch Lomond and the Trossachs - the gateway to Scotland's world-famous Highlands – are less than an hour's drive from Glasgow.

Scotland is the home of golf, and some of the world's finest Open championship courses

Glasgow International Airport, serving more than 100 destinations, is 8 miles from the city centre. There are 17,000 rooms to suit all budgets and the Scottish Exhibition and Conference Centre is the UK's largest integrated meeting venue and is located near the city centre.

Glasgow is brimming with confidence and style and is the host city for the 2014 Commonwealth Games.



L-R: Art Gallery & Museum Kelvingrove, Glasgow School of Art, Eating out in Glasgow, Glasgow City Chambers interior

## 39th Symposium: Powering Sound Ideas, Cambridge, MA, USA

April 12<sup>th</sup> to 14<sup>th</sup> 2010 saw the 39<sup>th</sup> Ultrasonic Industry Association Symposium, held at the Royal Sonesta Hotel, Cambridge, MA. Despite the slow recovery in worldwide economic conditions, over 80 delegates were in attendance, from more than 20 countries.

### Industrial sessions – April 12<sup>th</sup>

Following a continental breakfast generously sponsored by Dukane Corporation, UIA President Robert Muratore opened the Symposium, welcoming delegates, and recognising in particular the prodigious attendance from Integra Life Sciences, headed by Dan Cotter. The Industrial session kicked off with Dominick DeAngelis from Kulicke & Soffa, describing recent work on varying PZT8 piezoceramic stack configurations, comparing and contrasting the advantages of more crystals vs. electrical drive and power characteristics.

David Grewell then spoke on some ongoing offshoot studies arising from the successful biofuels work at Iowa State University, showing the strength advantages in using ultrasonic cutting techniques over mechanical means for bioplastics.

In the first of several presentations from Karl Graff's team at EWI, Ohio State, Matt Short brought us up to date on the application of ultrasonic welding machines up to 9 kW for rapid prototyping, in which weld strength is assessed via monitoring the power draw during the welding process itself.

After the morning refreshment break, Mark Norfolk, from EWI, built upon Matt Short's presentation, describing manufacturing processes for multi-layer metal-matrix smart composites, also using the Ultrasonic Additive Manufacturing (UAM) process. Matt Short then concluded the morning session with an update to EWI's work on ultrasonic drilling, demonstrating the comparatively higher penetration depths into titanium and enhanced durability, of an ultrasound-assisted tool over conventional methods.

Following an excellent buffet lunch, delegates returned early to the auditorium to hear about the location and facilities for the chosen location of the 40<sup>th</sup> UIA Symposium in 2011 – Glasgow, UK, from Symposium Chair-elect Professor Margaret Lucas.

The Industrial Session keynote speaker was Avraham Benetar, from Ohio State University, who spoke at length on servo-driven welding processes. He showed some intriguing high speed videos of plastic flow during welds, and demonstrated the studies executed to arrive at the optimum process velocity for given tip displacements.

Next up was Sakthi Vijayakumar, a student in David Grewell's group, who presented results on the application of combined thermal and ultrasonic treatments to inactivate protease in milk, and investigated the effects of the treatment on flavours, showing success, but also that certain sonication regimes can cause off-flavours for higher fat content samples.

Taking us up to the afternoon refreshment break, John Yen from Cheng-Cheng Ultrasonics, a fairly new Chinese manufacturer of power ultrasound equipment, told us about some design innovations, modelled and manufactured, to improve transducer efficiency for applications from surgery to industrial processing.

In the fourth presentation from EWI, Shankar Srinivasan discussed the latest developments in airborne ultrasonic brazing, focusing on using a 30 kHz horn at temperatures up to 600 °C, and using flat and tubular metallic and ceramic samples. The process is being developed as an enhancement to existing ultrasonic soldering techniques.

The penultimate presentation of the Industrial Session was given by Professor Margaret Lucas,

University of Glasgow, in which she demonstrated the acoustic softening effect by comparing a finite element model with stress-strain experimental results.

Day one of the Symposium was then closed by a second appearance from Mark Norfolk, EWI, who presented a critical analysis of the VHPUAM processes described earlier in the session, using techniques such as transmission electron microscopy to investigate bond structures at interfaces. Monday evening saw the traditional UIA Wine and Cheese Reception, sponsored generously by Sonobond Ultrasonics, with delegates enjoying a rather good Cabernet, along with a broad variety of meats and cheeses.

### Workshops and posters – April 13<sup>th</sup>

Delegate feedback from recent UIA Symposia had requested a more fundamental approach to the material covered at workshop presentations, and this was reflected in the topics covered in Cambridge. The first of the two workshops was prepared and delivered by Jay Sheehan (JFS Engineering), who drew upon his wealth of industrial experience with Branson and Omnisonics to cover the fundamentals of transducer concepts, and design analysis, examining and interpreting in a practical sense the data provided by manufacturers.

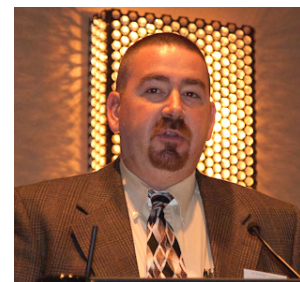
Jay's material then dovetailed perfectly into the second workshop, which was the first of its kind: a collaborative effort from three research groups to compare and contrast the inputs, methods and outputs from commercially-available finite-element transducer modelling packages. Material was contributed by Joseph Luis (Moog Medical Devices Group), Pierre Gélât (National Physical Labora-



Avraham Benetar, OSU



Dave Grewell, University of Iowa



Matt Short, EWI

## 39th Symposium Highlights, continued



**Rich Meyer,**  
Penn State University

tory), Jay Sheehan, and **Rich Myer** (Penn State), who also presented the workshop. A standard transducer and horn design was meshed and modelled by all groups, based on a real surgical device, the design of which was contributed by Mark Schafer (Sound Surgical Tech).

Attention then turned to the poster session, held amongst the exhibits. A broad range of medical and industrial posters were shown, ranging from the use of lead-free piezoceramics, to the development of ultrasonic bone drills for dentistry. Amongst the dozen posters on display, four were entered for the Student Poster Competition, for a cash prize and certificate donated kindly by Ethicon Endo-Surgery, Inc (a Johnson and Johnson Company). The entered posters were of a very high standard, covering subjects such as the role of cavitation in tissue aspiration, through to using ultrasound imag-



*Jay Sheehan presents Student Poster Award to Andrew R Draudt, BU*

ing for motion compensation in MRI. Following assessment by the judging panel, the winning poster was "Real-time Monitoring of HIFU Lesion Formation with Combined Acoustic Force Elastography and Opto-Acoustic Imaging" by

Andrew R. Draudt and colleagues from Boston University.

After a buffet lunch, Symposium delegates were transported to the Physical Acoustics Labs at nearby Boston University. One of the tour guides was Robin Cleveland, who was the invited speaker for the following days' Medical session.

Robin provided an in-depth and enthusiastic tour of the maze of labs at PACLAB, notable highlights being their work on extracorporeal shock wave lithotripsy, the detection of free gas bubbles in flowing mercury, the investigation of applications for HIFU and the imaging of cavitation events at 200 million fps. Further information can be found at: <http://www.bu.edu/me/research/research-laboratories-and-groups/acoustics-and-vibrations/aaui/>.

At 5pm, the assembled throng were taken to the campus of MIT,



Delegates pause outside some of the AI labs, MIT campus

## Symposium Highlights, continued

for a fascinating tour of the esteemed site, by Joost Bonsen. Taking a leisurely journey across the complex, Joost explained the evolution of the University and the business start-ups that have evolved as a result of the innovations and discoveries there, and patiently answered questions ranging from the legendary MIT hacks, through to the unique design of some of the campus' new accommodation.

UIA delegates were in surprisingly good company too, as our visit coincided with that of Prince Rainier of Monaco, whose entourage mingled briefly with our own.

### Medical sessions – Wednesday April 14<sup>th</sup>

The final day of the Symposium commenced with a continental breakfast kindly sponsored by Moog Medical Devices Group, and the paper session itself chaired expertly by Dan Cotter (Integra Life Sciences).

The keynote speaker was Professor **Robin Cleveland** from Boston University. Robin spoke in fascinating detail on the diverse applications of high amplitude ultrasound waves in healthcare, ranging from the established practice of extracorporeal shock wave lithotripsy (ESWL), through to new research in diagnostic imaging, tennis elbow treatments and bone fracture healing.

Perfusion Technology's Al Kyle then provided an update to their research on the successful use of controlled 300 kHz ultrasound exposures to open reversibly the blood-brain barrier, tested on a primate model, paving the way ahead for drug delivery therapies. David Constantine then described work carried out to develop ultrasound treatments for ischemic stroke, in which a vibrating wire is deployed to emulsify clots, overcoming the tortuous anatomical challenges in brain vasculature, literally firing sound around tight corners by using high transmission frequencies.

After morning refreshments, lan Butterworth from NPL, UK, described a simple optical approach for quick assessment of HIFU fields, employing the acousto-optic effect (a change in optical refractive index due to the passage of an acoustic signal), demonstrating the effects of a range of backing patterns to visualise the transducer field, passing on demonstration sheets to delegates for them to try with their own systems.

The final presentation of the morning programme was given by



**Klaus-Witold Jenderka** from PTB, Germany, on the progress in a European Metrology project to develop

standardised HIFU field measurement methods, including the early results of an intercomparison exercise determining powers up to 150 W. Wednesday's lunch was the local delicacy - a delicious lobster salad – and the final opportunity for delegates to visit the exhibition stands, representing manufacturing and technology expertise from the USA, Europe, India and China.

The final afternoon of the symposium commenced with a presentation from Ferroperm Piezoceramics, discussing a new design for a high frequency transducer fabricated from lead-free piezoceramic. UIA President Robert Muratore then presented some collaborative work with J & W Medical on the development of a new variant of ultrasound imaging, with particular application to breast cancer – synthetic structural imaging, showing accurate phantom lesion volume estimation. Taking us up to the refreshment break, Andy Mathieson from the University of Glasgow discussed the evolution of trans-

ducer and handpiece technology in ultrasound dentistry, considering established scaling applications, into bone cutting, comparing experimental realisations with finite element models.

Robert Muratore then carried out his last duty as UIA President – passing over the presidential reins to his voted successor: Mark Hodnett, from the National Physical Laboratory, UK. Accepting the prestigious responsibility, Mark's first task was to pass on a commemorative plaque to Robert, recognising his inspiring leadership and achievements during his 2-year term, particularly in forging strong links with IEEE UFFC.

After a brief coffee break, UIA Vice-President Mark Schafer described a detailed programme of measurements to test and validate the performance of ultrasonic surgical devices, posing and answering questions on the importance of cavitation, the dynamic balance between efficacy and safety, and the user's perspective of understanding device output. In the final paper of the Symposium, Prakash Manandhar from the University of Massachusetts described the development of new models and algorithms for improved intravenous imaging.

In closing a diverse and successful Symposium, new UIA President Mark Hodnett thanked the delegates for their papers, posters and useful discussions of the latest technologies and engineering developments, both in and out of sessions. Symposium chair Tony Crandall was commended on putting together an excellent programme, with strong support from the session chairs, and delegates were warmly invited to travel to Europe for UIA's 40<sup>th</sup> Symposium, to be held in Glasgow, 23<sup>rd</sup> -25<sup>th</sup> May 2011.

*Mark Hodnett*



*Robin Cleveland, Boston University*

## Damien Walmsley, Medical Session Speaker, cont'd

whilst it was accepted that cavitation might occur during the scaling process little was known about its occurrence and effectiveness. My early research not only covered these aspects but also investigated the use of ultrasound in wound healing and the potential thrombolytic effect on platelets contained in the blood system.

After finishing my PhD, I joined the University of Birmingham where my work in ultrasonics in dentistry increased. Whilst continuing my work on the use of the ultrasonic scaler, I also moved into the area of endosonics. This is where a thin metal file is introduced into the root canal of teeth with the aim of removing infected debris. This enables the interior of the tooth to be cleaned prior to the filling of the space with a suitable filling material. The use of both types of ultrasonic instruments is widespread in dentistry and the majority of patients will come into contact with an ultrasonic instrument of one sort or another when visiting the dentist.

My work has attracted indus-

try interest especially in the standardisation of the tip oscillation. Over the last ten years I have built up interdisciplinary collaborations most notably with the Wolfson Engineering Unit at Cardiff University and the Chemistry Department at University of Bath. Furthermore funding from the EPSRC has allowed our group to purchase a scanning laser vibrometer, which has increased our ability to measure the output from commercially available ultrasonic instruments and look to new instrument designs. We are very interested in where cavitation occurs and whether it is possible to harness such energy to remove bacterial biofilm. Why is the biofilm such an important structure to disrupt and remove? A biofilm is a tenacious adherent bacterial commune which if left will lead to disease such as inflammation of the gum around the tooth. This may be followed by bone resorption and subsequent tooth loss. Part of our work is to use cavitation and acoustic streaming to disrupt the biofilm and leave a cleaner root surface allowing tissue resolution to take place. The

main outcome will be improved patient treatment with the aim of assisting in promoting oral health. Understanding how cavitation may be optimised in order to remove such bacterial biofilms will enhance the present range of dental instruments, leading to new opportunities for instrument design.

The future direction of ultrasonic instruments includes their use as a bone-cutting device and also as an alternative tool to clean metallic implants of which the latter is increasingly being used as a replacement for lost teeth. Interest in the use of ultrasound is also extended to powered electric toothbrushes where manufacturers attempt to mimic the action of ultrasonic instruments in the slower speed designs used for brushing teeth. When I started off researching into ultrasound, I was interested in the potential biological effects and this has been rekindled as we investigate the use of ultrasound in stimulating pulp cells inside the tooth with a view to repairing any damage caused by decay. So there are still a lot of good vibrations in dentistry, which I will be able to tell you about in my lecture to the forthcoming conference!!"

*Plan now to join UIA in Glasgow 23 - 25 May 2011*


## Juan Gallego-Juarez, Industrial Session Speaker, cont'd

particularly high-power ultrasonics, transducers and applications. He is the author of over 200 publications and 40 patents and holds an honorary doctorate from the University of Santiago de Chile. He was a member of the Board of the

International Commission on Acoustics and Chairman of the 19th International Congress on Acoustics. He is a member of the Steering Committee of the World Congress on Ultrasound and of the Board of the Spanish Acoustical Society. He

is a Fellow of the Acoustical Society of America and of the British Institute of Acoustics. He is Associate Editor for Ultrasonics of the European Journal Acta Acustica/Acustica.

### Ultrasonic Industry Association

PO Box 2307 . Dayton OH 45401-2307 USA  
tel  +1 937 586 3725 . fax +1 937 586 3699  
email [uia@ultrasonics.org](mailto:uia@ultrasonics.org)

---

#### UIA Members' Forum

[Register](#) | [Login](#) | [Search](#)

[Ultrasonic Industry Association](#) > **Message Board**

Username:   
 Password:   
  Remember Me?

---

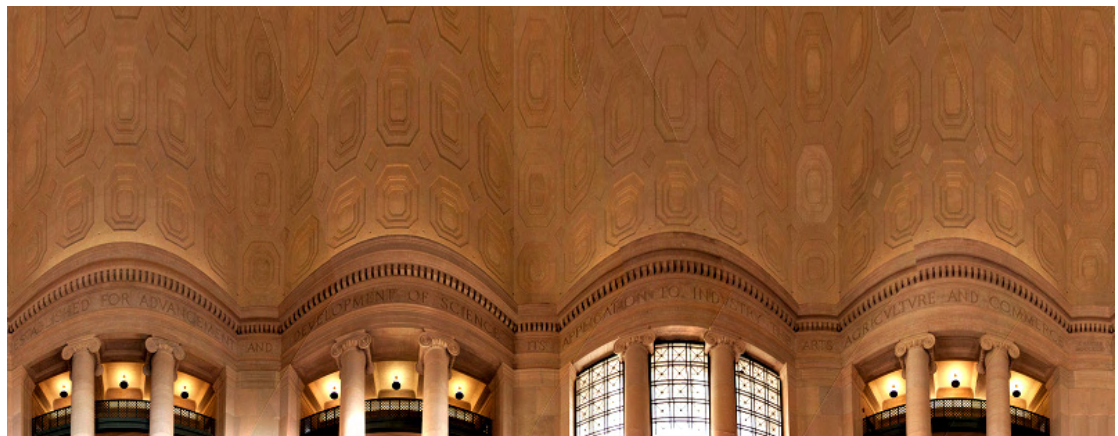
Forum Tools New Topic

Message Subject	Author	Views	Replies	Last Post
<div style="border: 1px solid #ccc; padding: 10px; margin: 10px auto; width: 80%;"> <h3 style="margin: 0;">Using the UIA Forum is as easy as 1-2-3</h3> <ol style="list-style-type: none"> <li>(1) Go to the forum -                UIA home page (<a href="http://www.ultrasonics.org">www.ultrasonics.org</a>) &gt; Online Activities &gt; Forum                (forums.ultrasonics.org)</li> <li>(2) Register                Choose a screen name and password. Wait a day or so for approval.</li> <li>(3) Login                Start posting. Post a job, ask about a new material, discuss a new process, or promote a new product. Create your own topic. Submit your profile to MEMBER PROFILES: describe yourself and your business and provide links to your website, LinkedIn account, etc.</li> </ol> </div>				

## 2010 Symposium Photos



Official UIA 39<sup>th</sup> Symposium team photo, outside the Great Dome, MIT



MIT main reception building ceiling, the Charter unwrapped



## A President's Letter

It was with surprise, and great pride, that I succeeded Dr Robert Muratore when voted in as your UIA President during the 39<sup>th</sup> Symposium in Cambridge this year. It is an enormous privilege, and an honour to be the first non-US president of this great association.

I first became aware of UIA in 2001, attending the post 9-11 Symposium in Atlanta, GA, and what struck me immediately from the delegates there was the open accessibility to the vast amount of knowledge and expertise residing with the members and attendees. This inviting atmosphere stands UIA apart from other groups and societies, and is something which draws in new businesses and experts, from which we can all learn. So I say to you all: spread the word about what we do - and how beneficial you find it - to your collaborators, customers and contacts!

I may be President, but this is not my UIA – it's our UIA. I invite you to tell me, and the board of directors, what you think, about what we might do differently, perhaps building on the foundations laid by our excellent Symposia to provide you with networking opportunities, learning materials, collaborations and joint research. We are in an industry which is showing double-digit business growth year-on-year, and is technically advanced and challenging, driven by innovation and ingenuity, and I think there is much to be gained from proactive knowledge exchange.

Plans are already well in-hand for next year's symposium, which will be a special occasion in itself – UIA's 40<sup>th</sup> – and also the first time in Scotland, where Symposium Chair Professor Margaret Lucas is putting together a strong programme. I look forward to seeing familiar and new faces there, and to continuing to raise UIA's profile in the scientific, engineering and business communities alike.

*Mark Hodnett*



Mark Hodnett

## 2010 - 2011 UIA Board of Directors

### President

Mark Hodnett  
National Physical Laboratory  
Teddington, Middlesex, UK

### Vice President

Mark Schafer  
Sonic Tech, Inc.  
Ambler, PA, USA

### Secretary

Janet Devine  
Sonobond Ultrasonics  
West Chester, PA, USA

### Treasurer

Ron Staut  
APC International, Ltd.  
Mackeyville, PA, USA

### Past President

Robert Muratore  
Quantum Now LLC  
Huntington NY USA

### Symposium Chair

Margaret Lucas  
University of Glasgow  
Glasgow, Scotland, UK

### Directors

George Bromfield  
Piezo Innovations  
Salt Lake City, UT, USA

Sunita Chauhan  
Nanyang Technical University  
Singapore

Tony Crandall  
Moog Medical Devices  
Salt Lake City UT, USA

David Grewell  
Iowa State University  
Boise, ID, USA

Leo Klinstein  
Dukane Inc.  
St Charles IL, USA

Ronald Manna  
Misonix, Inc.  
Farmingdale, NY, USA

G. Adam Morris  
Better UltraSonic  
Technologies  
North Salem, IN, USA

Jack Sliwa  
St. Jude Medical Corp  
Sunnyvale CA, USA

Jay Sheehan  
BAE Systems  
Wilmington, MA, USA

Foster Stulen  
Ethicon Endo-Surgery  
Cincinnati, OH, USA

Alan Winder  
J&W Medical LLC  
Westport, CT, USA

## 2011 UIA SYMPOSIUM CALL FOR PAPERS

The Ultrasonic Industry Association invites you to submit a 200 word abstract for consideration of presentation or poster on 23 – 25 May at its 40<sup>th</sup> Annual Symposium in **Glasgow, Scotland, UK**, at the University of Glasgow Wolfson Medical School. Plan now to join UIA for this international conference featuring the best of ultrasound from around the world. For more information, please go to <http://www.ultrasonics.org>

Please note the appropriate category and preferred format of your proposed presentation:

- Industrial Applications:** NDE, Measurements, Cleaning, Atomization, Materials Processing, Effluent Processing, Joining and Fastening, Welding and Cutting, Sonochemistry, Underwater Applications, Remote Sensing, Transducer Design/ Materials.
- Medical:** Surgical, Therapeutic, HIFU/LIFU, Bioeffects, Tissue Characterization, Bio-Acoustic Microscopy, Transducer Design/Materials

Preferred Presentation Method:  **Paper Presentation**     **Poster Session**

**Deadline: 30 September 2010**

**Important Information:** Papers will be no longer than 25 minutes; final abstracts must be submitted via e-mail. Bio-sketches and presentation suitable for inclusion in electronic handout must be submitted to the UIA office no later than **22 April 2011**. The session chair will contact you directly to discuss your proposed presentation. Final papers will be due shortly after symposium, at a date to be announced. **Accepted presenters receive a discounted registration fee.**

**Please type or print your information below**

Presentation Title \_\_\_\_\_  
 Authors \_\_\_\_\_  
 Presenters \_\_\_\_\_  
 Main Contact Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State/Prov \_\_\_\_\_ Country \_\_\_\_\_  
 Phone \_\_\_\_\_ Email \_\_\_\_\_

### Symposium Chairs:

Symposium: Prof. Margaret Lucas ▶ [Margaret.Lucas@glasgow.ac.uk](mailto:Margaret.Lucas@glasgow.ac.uk)

Industrial: Dr Tony Gachagan ▶ [a.gachagan@eee.strath.ac.uk](mailto:a.gachagan@eee.strath.ac.uk); Leo Klinstein ▶ [lklinstein@dukcorp.com](mailto:lklinstein@dukcorp.com)

Medical: Dr. Sandy Cochran ▶ [S.Cochran@dundee.ac.uk](mailto:S.Cochran@dundee.ac.uk); Daniel Cotter ▶ [daniel.cotter@integra-ls.com](mailto:daniel.cotter@integra-ls.com)

Workshop: Jay Sheehan ▶ [james\\_sheehan@comcast.net](mailto:james_sheehan@comcast.net)

Poster: Sunita Chauhan ▶ [MCSunita@ntu.edu.sg](mailto:MCSunita@ntu.edu.sg)

Please submit this form to [uia@ultrasonics.org](mailto:uia@ultrasonics.org)

Ultrasonic Industry Association ☎ PO Box 2307 ☎ Dayton, OH 45401-2307 ☎ USA

Voice +1.937.586.3725 ☎ Fax +1.937.586.3699 ☎ E-mail [uia@ultrasonics.org](mailto:uia@ultrasonics.org) ☎ Web [www.ultrasonics.org](http://www.ultrasonics.org)

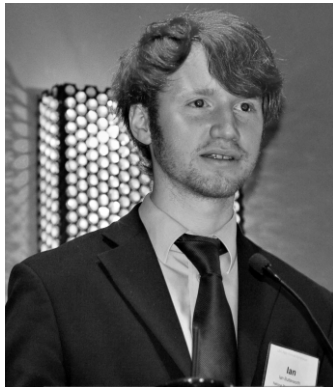
P O Box 2307  
Dayton, OH 45401-2307 USA

Phone: +1.937.586.3725  
Fax: +1.937.586.3699  
Email: [uia@ultrasonics.org](mailto:uia@ultrasonics.org)

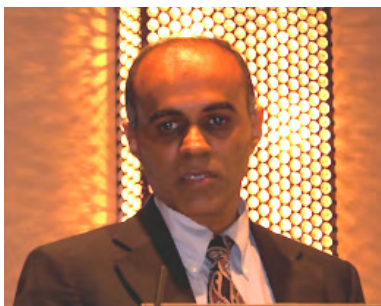
How can ultrasonics enhance the value of your business?

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."

## More 39th Symposium Photos



**Ian Butterworth, NPL**



**Shankar Srinivasan, EWI**



**Dominick DeAngelis, Kulicke & Soffa**



**Dan Cotter, Integra NeuroSciences**



**John Yen, Cheng-Cheng Ultrasonics**



**David Constantine**



**Sakthi Vijayakumar, Iowa State University**

*Photos courtesy of Mark Hodnett*