Editor: Alan Broadwin
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President's Message ...Mark Schafer

The only constant in this world is change, and the UIA is continuing on its path to the future. In the last issue, we introduced new Mission and Vision statements adopted by the Board of Directors. This month, we unveil the new logo, both here and on the UIA website. The now retired logo served the organization for many years; however, its shortcomings were becoming increasingly apparent. The Board, therefore, commissioned a new one. Our goal is not to bury the past, but to build upon it. The change reflects our commitment to constantly updating, innovating, and moving ahead with our organization.

But these changes must be more than cosmetic. In order to continue our progress, we must build the organization. Our plans--for improved member services, better symposia, better links between suppliers, users and researchers--all require membership growth. This is being addressed in a number of ways including new membership categories to better target and serve members. The next issue of Vibrations will have more details. Until then, every member should ask: How can I help grow the UIA? What do I want the UIA to be and do for me?

...Mark Schafer, President

New UIA Logo

Thank you Ethicon Endo-Surgery!

The UIA extends a special thank you to Ethicon for designing the new UIA logo. In particular, we would like to thank Jeff Vaitekunas for volunterring and driving the development of a new UIA logo and to Jill Vaias for all of her great designs. Thank you, Jeff and Jill. Electronic copies of the new logo can be obtained for your use by Emailing the Headquarters office at uia@ultrasonics.org.

Note Phone Change at Ethicon Endo-Surgery

Please note that Enthicon's Cincinnati office has a phone number change. The exchange will now be 337. The 483 and 786 exchanges will no longer be in effect.

Laser Ultrasonic Tool Images Composite Parts

by Edward H. Phillips

Lockheed Martin Tactical Aircraft Systems (MTAS) is using advanced, laser-based ultrasonics to perform detailed inspection of complex, composite parts such as large fuel tanks and assemblies for the F-22 and Joint Strike Fighter.

Interior sections of an early developmental fuel tank for the X-33 vehicle were imaged recently using a laser ultrasonic technique developed and patented by engineers at LMTAS. The tanks were inspected after having been subjected to more than 70 cycles of cryogenic testing by NASA. The X-33 is an advanced technology demonstrator for the proposed Venture Star RLV. Initial flight tests were scheduled to begin in 2000 but a liquid hydrogen tank failed earlier this month.

The laser system, which uses proprietary ultrasonic technology to rapidly scan composite parts is viewed by LMTAS officials as a key technology discriminator for the Joint Strike Fighter competition between teams led by Lockheed Martin and Boeing. Plans call for LMTAS extensive application of the system during the engineering, manufacturing and development phase of the JSF program, if the Lockheed Martin team wins the contract in 2001.

The LaserUT process facilitates inspections of large parts such as the X-33's 17x10x5-ft. tanks without the use of special tooling or specific data input regarding the shape of the tanks, according to Tommy Drake, technical lead for the LaserUT program. The 10,000-sq. ft. facility became operational earlier this year, and a second unit is scheduled to become available during the first quarter of 2000. He said it will be devoted chiefly to imaging F-22 parts such as the composite inlet duct, longerons and fuel system structural components.

Drake said the machine is capable of inspecting as many composite parts as 20 conventional machines but at 10 times the speed and with improved resolution and fidelity. Although the existing system is limited to scanning 20-40 sq. ft. per hour, improved software and other system modifications will increase scan performance of the second machine to about 64 sq. ft. per hour. Drake noted, however, that by 2008, when the JSF is scheduled to enter production, the machines will be capable of up to 160-200 sq. ft. per hour. He said plans call for expanding not only the range of composite materials that can be scanned, but also variations in ply configurations and thicknesses.

In addition to the X-33 tanks, the LaserUT process already is being used to image the composite inlet duct for the F-22 and recently the system successfully scanned the upper skin of a JSF wing carry-through structure. The F-22 inlet can be scanned in about 2 hours compared with 24 hours for conventional equipment. Drake expects the machines to increase parts throughput significantly and reduce inspection costs by about $300 million over the life of the JSF and F-22 programs.

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The Discovery of Power Ultrasonics

by Dr. Karl Graff

Researchers in power ultrasonics know of the frequent reference to the 1927 Wood and Loomis paper as the seminal publication of a new field of ultrasound (see reference at end of article). The story behind the discovery of "power ultrasonics" is a fascinating chapter of acoustics.

The modern ultrasonics era arose from Professor Langevin's 1917 invention of the quartz sandwich transducer for underwater sound transmission in submarine detection. Intense ultrasound's physical effects had not gone unnoticed in the first decade of modern ultrasonics. Langevin's tests with quartz plate transducers had resulted in killing fish in the beam of sound. Professor Van Dyke had observed in 1924 the searing of skin when a resonant quartz bar was touched, the explosive atomization of water drops from the end of the rod and friction alleviation between a metal surface and the vibrating quartz. Nevertheless, no steps were taken to investigate these early observations more fully.

Among observers of Langevin's work was Professor R. W. Wood, an American physicist from Johns Hopkins University. Already famous for his work in optics and spectroscopy, and for his classic book "Physical Optics," he was also known as a brilliant lecturer and a writer of popular fiction and verse. With U.S. entry into WW I, Professor Wood was commissioned an Army Major and assigned to the Bureau of Inventions in Paris, where he devoted particular attention to the work of Langevin. Wood later noted how the contact with Langevin had made a strong impression:

"It was my good fortune during the war to be associated for a brief time with Prof. Langevin during his remarkable developments. At the arsenal at Toulon I witnessed many of the experiments with the high power generators. One was mounted in a large wooden tank filled with sea water, and when the Poulsen arc was started and the frequency adjusted for resonance the narrow beam of supersonic waves shot across the tank causing the formation of millions of minute air bubbles and killing small fish which occasionally swam into the beam. If the hand was held in the water near the plate an almost insupportable pain was felt, which gave one the impression that the bones were being heated."

Another wartime meeting that proved essential to the invention of power ultrasonics occurred when Professor Wood met Alfred E. Loomis at the Aberdeen Proving Grounds. Loomis, a successful lawyer, was directing Aberdeen research as an Army Major and invented, during this time, the "Loomis chronograph" for measuring the velocities of shells. After the war, Wood pursued other areas of war research and returned to his work in optics and spectroscopy, with his interests in ultrasonics remained dormant for several years. Loomis, following the war, entered investment banking, amassing a personal fortune during the 1920s. However, his interest returned increasingly to scientific research and, in 1924, Loomis renewed the wartime acquaintance with Wood and offered to collaborate and underwrite any joint research ventures. In 1926, Wood told Loomis of Langevin's experiments and suggested the subject offered a wide field for research in physics, chemistry, and biology.

With a high power General Electric vacuum-tube oscillator and a quartz plate transducer immersed in an oil-filled dish, experiments began in Loomis's garage in Tuxedo Park, New York. As research expanded, Loomis purchased a nearby mansion, converting it into his well-known Tuxedo Park Laboratory. The huge vacuum tubes, a large bank of oil condensers and an oversize variable condenser and step-up induction coil made the ultrasonic apparatus an imposing affair. Vibrations of 200-500 kHz were transmitted through the oil bath into glass vessels or rods immersed in the bath, achieving a range of spectacular effects that included:

- radiation pressures of sufficient magnitude to support 150 g and to raise a pronounced mound of oil above the transducer;
- intense searing of the skin by the vibrating glass rod and the burning of wood chips and the etching and drilling of glass pressed against the tips of vibrating glass rods;
- heating of liquids and solids and the formations of emulsions and fogs;
- biological effects including rupturing of red blood cells, killing of cellular organisms, and harmful to lethal effects on fish, frogs, and mice;
- observations of chemical reactions and crystallization and flocculation of particles suspended in a liquid.

These pioneering results could be taken as a present-day litany of ultrasonic achievements. Wood and Loomis also made observations of the modal patterns of rods, tubes, and plates and gave some of the first experimental data on phase velocity in rods and disks. Another first occurred when they made an ultrasonic horn by drawing down a glass tube to a tapered point to concentrate the energy at the point of application. Publication of these results started avenues of work being exploited to the present day.

Professor Wood did not continue work in ultrasonics, but returned to optics and spectroscopy. Aside from a 1939 "supersonics" monograph, in a scientific career spanning a half-century, this was to represent his involvement with ultrasonics. Loomis continued with other collaborators in research on the chemical effects of ultrasound while maintaining his interest in precision time measurement and other scientific areas. Backed by a private fortune, he was a 20th century patron of the sciences. In the years ahead, Loomis played an important role in founding other major laboratories and in stimulating World War II radar research.

See Graff, K. F., "A History of Ultrasonics," Chapter 1 of "Physical Acoustics," Vol. 15, Mason and Thurston, editors, Academic Press, 1981 for an extended account.

In the News...

Morgan Matroc has New Name

In a recent restructuring, Morgan Matroc has changed their name to Morgan Electro Ceramics. This change affects all three divisions: Bedford, OH; Southhampton, England; and Ruabon, Wales. Primarily a piezoelectric manufacturer, they also produce microwave ceramic and ceramic capacitors. Also, new is the website at: http://www.morganelectroceramics.com.

Branson Awarded Three Environmental Quality Awards

Branson was awarded its second consecutive Green Circle Award. The Award recognizes Connecticut companies that make contributions to promote pollution prevention and environmental awareness such as Branson's ongoing volunteer work in the Still River Alliance.

Branson also received the U.S. Environmental Protection Association's Leadership Award for activities in the Climate Wise program, designed to reduce greenhouse gas emissions and energy consumption., and attained ISO 14001 Environmental Management Systems certification, a voluntary standard that provides a framework for integrating environmental considerations into a company's operations, products, and services.

Papadakis Named Life Member of IEEE

Dr. Emmanuel P. Papadakis, President of Quality Systems Concepts, Inc., has been made a Life Member of the Institute of Electrical and Electronics Engineers (IEEE). This honor is for long dedicated service as a member of IEEE. His service has been principally in the ultrasonics group--the Society for Ultrasonics, Ferroelectrics, and Frequency Control (UFFC Society).

He has most recently edited two books for Academic Press on the successful commercialization of instruments and devices arising from research in ultrasonics.