NASA NDE WORKING GROUP NEWSLETTER

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WWW URL address: http://ndeaa.jpl.nasa.gov/

CODE Q NDE PROGRAM MANAGER MESSAGE

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The world has changed dramatically in the past few years. We have moved into an era that is dominated by international economic competitiveness. The dynamic ability of an organization to do more with less will be a critical factor in favorably positioning the U.S. industries for optimum economic competitiveness. The NNWG will need to continually maintain a balanced research and technology portfolio that leverages existing, distributed, in-house capabilities, and by further developing key alliances with our external partners. We have a lot to do to reach our vision. I know we all look forward to a very productive year.

SUMMARY OF THE 3rd CHAIR TENURE

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With the completion of my tenure, I would like to thank all of you and I am pleased to transfer the Chairship to George Baaklini, LeRC. Our working group collaboration, coordination and various forums of communication are helping to assure the most effective use of NASA resources. During my tenure, NNWG made several significant accomplishments as follows: we held two workshops for which we issued Proceedings, issued the 1996 NNWG directory, formed a WWW Homepage, started using "MMATC" format for our telecons, published four more issues of the NNWG Newsletter (reaching the 12th) and issued the NDE Strategic Plan for Code Q. Our challenges are increasing while our resources declining. Together we need to work with Ed Generazio, Code Q NDE Program Manager, towards materializing the vision for the year 2015 and beyond. New technologies are making the NASA goals of low-cost, better and faster easier to accomplish and we need to implement these technologies effectively.

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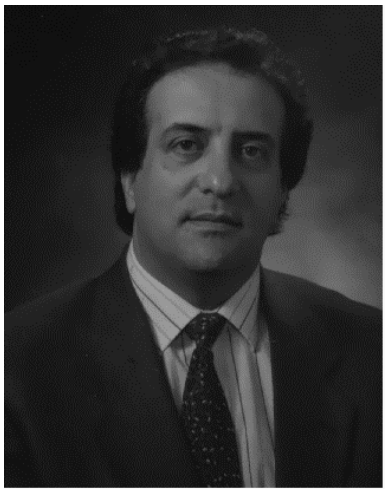
Yoseph Bar-Cohen, NNWG-Chair Emeritus



George Baaklini, new NNWG Chair

NEW NNWG MESSAGE CHAIR

George Y. Baaklini 216-433-6016

I am looking forward to continuing work with all the NNWG colleagues, especially with the newly elected Vice Chair John Larson from KSC and with the Code Q NDE Program Manager Edward Generazio from LaRC. John and I will try to improve the technical integration and the use of resources between centers, and promote cooperative programs with outside organizations and technical societies. NNWG will continue to provide assistance to the Associate Administrator for Safety and Mission Quality in the areas of nondestructive technology development, testing, and inspection according to the NASA NDE Program and Management Plans led by Ed Generazio. Finally, I thank Yoseph Bar-Cohen for his great accomplishments as a Chair of the NNWG and as a Newsletter editor during the 1995-1996 period. These accomplishments make my job much easier during the 1996-1997 period. I hope that I can serve you to the best of my ability and to the highest of your expectations.

NNWG HIGHLIGHTS

John Larson, KSC, Elected New NNWG Vice-Chair - Since the NNWG Chairship is for one year, an election was held for a new Vice-Chair and John Larson, KSC, was elected. On May 1, 1996, Yoseph Bar-Cohen, JPL, the current Chair will transfer the NNWG Chairship to George Baaklini, LeRC.

John Larson, new NNWG Vice-Chair

3rd NNWG Workshop- The NNWG held its 3rd NNWG Workshop at KSC, Florida, from Feb. 21 to 22, 1996, with a tour of the KSC facility on the morning of Feb. 23rd. The theme of this brainstorming meeting was “where we are and where are we going”. During the meeting, current and proposed RTOPs were presented and reviewed. Further, the centers’ on-going NDE activity as well as issues of concerns were presented. One of the new NDE technology that were reported includes a compact KSC leak detector which has impressive performance characteristics. The attendee had the opportunity to view the launch of the Space Shuttle Mission:

STS-75 -TETHERED SATELLITE - 1R & USMP-3.

Some of the participants of the NNWG Workshop on the background of the KSC facility. From left to right: G. Baaklini, LeRC, John Segreto, ARC, Y. Bar-Cohen, JPL, R. Tilley, KSC, S. Russell, MSFC, J. Chern, GSFC, B. Parker, GSFC, J. Siedlecki, NASA HQ, and E. Generazio, LaRC.

Election of New Code Q Standing Committee Chair and Vice-Chair - In May, the Code Q Standing Committee will hold an election of new Chair and Vice-Chair. In June, Bob Neuschaefer, MSFC, the current Chair is ending his tenure. NNWG would like to thank Bob for his excellent job.

ORBITER NDE SUB-COMMITTEE (ONSC)

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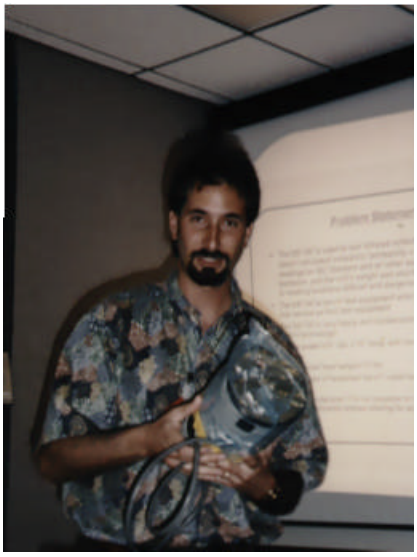
Orbiter NDE Sub-Committee Telecons - The Orbiter NDE Sub-Committee (ONSC) held telecons on February 15 and April 8, 1996.

The results of the inspection of OV-103's Payload Bay Doors (PLBDs) at Palmdale using both shearography and thermography were discussed. Both techniques were successful in finding known defects on test panels and on the PLBDs. Previously unknown defects were also located. These results were corroborated with UT. Suspect defects which could not be confirmed were also identified. Future considerations for using these techniques on the Orbiter and specification development continues.

The team has also discussed the availability of suitable NDE standards. An effort is underway to identify, locate and describe all the standards at the various locations. After this list is compiled and reviewed additional action such as the relocation, manufacturing or procurement of standards will be determined.



Giles, KSC, is presenting a current technology which is a heavy instrumentation and describes the new compact light weight instrumentation that is being development at KSC.

NNWG PERSONNEL NEWS

The following is brief summary about our new NNWG Chair and Vice-Chair.

George Baaklini - George is a research and technology development professional with 14 years experience in directing materials and structures programs and developing modalities for continuous improvement in materials characterization and NDE of inter-metallics, ceramics, and high temperature polymer, metal and ceramic matrix composites. As a NDE team leader at Lewis, George is responsible for the development of

innovative methods for advanced composites combining NDE, experimental mechanics, and life prediction. NDE modalities include x-ray , ultrasonics, thermography, computed tomography, digital radiography, acoustic emission, and laser based ultrasonics. Neural nets are used to integrate these modalities for decision making on lifing and serviceability. George received his BS(1980), MS(1981) and Ph.D. (1991) from Cleveland State University in Applied Mechanics. As a project manager in the Engine Materials Technology Program (HITEMP), George is leading a team to meet long- and near- term subsonic materials and structures requirements in three major disciplines 1) advanced mechanical test methods, 2) high temperature sensors, and 3) NDE, enabling the development of the 21st century civil propulsion systems with greatly increased fuel economy, improved reliability, extended life, and reduced operating costs.

George is an artist at heart. When he is not in his laboratory or on travel, you could find him in any of the many art exhibits or music halls of the greater Cleveland.

John Larson - John Larson, NASA KSC NDE Laboratory Manager, has been with KSC since 1967. Prior to working for NASA, he was a chemist with the Bendix Corporation, first at Kansas City, Mo. and later at KSC. He received his B.S. degree (Chemistry) from Central Missouri State University in 1961. Since he started working in NDE in 1969, he has established contract requirements (ASNT and MIL-STD-410) for certification of personnel, and has initiated development of KSC capabilities in: CC TV, neutron radiography, infrared, computed tomography and microfocus-realtime radiography. His current goals are to develop KSC radiographic digitization capability and electronic transmission of NDE data to customers within KSC and other NASA centers. John currently is a member of: ASNT, the KSC Radiation Protection Committee, the Orbiter NNWG Subcommittee and is the Vice Chair of the NASA NDE Working Group. Automobiles are his hobby; he drives a Miata and is restoring a 1957 Mark VIII Jaguar.

NASA CENTERS NEWS

JPL

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The JPL's Multifunction Automated Crawling System (MACS) Presented to the Air Force NDI Working Group - The crawler that was reported in the previous issue of the NNWG Newsletter was presented on March 4 to the Air Force NDI Working Group. The meeting was held in San Antonio, Texas and the presentation was invited by the meeting organizers. The current model MACS-I has the dimensions of 10x19-in, and weight 10-lb, whereas the new design MACS-II model will have 10x10 in. size and is expected to weigh about 5-lb. MACS was designed and fabricated to carry miniature instrumentation payload to perform a wide variety of tasks while being attached to the surface of the structure of interest. MACS was developed under a contract with the Robotic and Automation Center of Excellence at Kelly Air Force Base. The use of ultrasonic motors, composite materials construction, miniature computer and video imagers enabled the production of a small, light weight crawling system with an effective carrying capability of about 1:10. This carrying capability surpasses any known similar system. The platform of MACS can serve as a shuttle for miniature NDE instruments. One of the potential devices that is highly considered is the Crackfinder that was developed by LaRC and is licensed to Krautkramer Branson. The team that developed MACS consists of P. Backes, Y. Bar-Cohen and B. Joffe with assistance of W. Proniewicz and M. Lih.

Measurement of the Thickness of Thin-Film Electroactive Polymers - The JPL-AA Team jointly with the LaRC's Polymeric Materials Branch and New Mexico University are currently developing electroactive polymers for muscle actuators. These materials have potential applications for a wide variety of space programs including inflatable optics. The thickness of these polymers is in the range of 50 micron and difficulties were

encountered with measuring the thickness when the material is actuated. The cause of the difficulty is associated with the fact that the film vibrates structurally when the thickness changes. Using the commonly used methods such as interferometry and eddy-current cannot provide an accurate measure, since they sense the top surface displacement assuming that the rear surface stays stationary. Potentially, ultrasonic methods offer a capability to distinguish between the thickness change and the top surface displacement. In cooperation with Erdman Instruments (Pasadena, CA), using their instrumentation, it was demonstrated that the use of signals in the 50-MHz range provides the necessary resolution and measurement capability.

JSC

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NDE Procedures are Being Standardized to Conform with ISO - The Quality organization at JSC is rewriting and standardizing all of its NDE Work Instructions. They include instructions for NDE requirements at JSC, certification of personnel, work instructions for each method performed at JSC, and preparation of individual NDE technique sheets (which are written on a specific piece of hardware to be inspected). These instructions will eventually be folded into the ISO 9000 system being developed at JSC. The ISO 9001 Standard is mandated by the JSC Quality Manual as the JSC basic Quality System. The ISO 9000 Compliance Pilot Project at JSC has just issued draft system-level procedures for in-house processes affecting flight hardware and software, to make these processes in compliance with the ISO 9001 standard. Center-wide ISO 9000 implementation is planned for the future, and our NDE processes will be a part of it.

KSC

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NDE Laboratory activity - Using radiography, we continued refining the computed tomography techniques to characterize the Shuttle TPS tile block material densities and supported the analysis of the STS-75 Tether failure. Further, we are currently examining crawler-transporter shoes (closed circuit TV) for cracks. We are in the process of developing a radiographic technique for LOX pump examination, for a possible savings of $16K during procurement. We are also supporting LaRC and MSFC in the post flight evaluations of the STS-75 crystal growth modules, using conventional radiography, microfocus radiography and computed tomography.

LaRC

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Commercialization of the Self-Nulling Probe Technology Proceeding to the Next Phase - Krautkramer Branson is the licensee for the commercialization of the self-nulling probe technology. The firm introduced handheld crackfinders into the market in March 1995 but improvement is needed for a broader commercial application. The LaRC R&D team visited Krautkramer Branson to demonstrate the performance of the two-coil pickup system which is less sensitive to probe wobble. Other potential techniques were also suggested by the LaRC individuals but more R&D work is needed to find the most optimum method to be implemented. As a result, both short and long term collaboration plans for complete removal of the effects of wobble are being established. Also demonstrated was the recent version of the rotating self-nulling probe system specifically designed for the detection of fatigue cracks hidden under rivet heads in lap joints. The firm showed a strong interest in commercializing this system. An individual from Carpenters Technology also joined the meeting to discuss their current status of applying the self-nulling probe to steel billet production processes.

Three journal articles related to LaRC bolt tension monitor technology advancements are published. - The IEEE Transactions on Instrumentation and Measurement has published three journal articles related to LaRC bolt tension monitor technology advancements. The articles, submitted by the NDE Sciences Branch, were published in the February

1996 issue. The manuscripts are "Interrupted Ultrasonic Bolt Load Measurements Using the Pulsed Phase-Locked Loop System" by M. E. Froggatt and S. G. Allison, "Pulsed Phase-Locked Loop Technology Improvements for Greater Accuracy and Expanded Capabilities" by M. E. Froggatt and S. G. Allison and "Pulsed Phase-Locked Loop Calibration Over Frequency" by M. E. Froggatt, S. G. Allison and J. P. Moore. The technology improvements addressed in these articles are being incorporated in the prototype commercial unit currently under development through an MOA with StressTel Corporation in California.

NASA Langley Displays Measurement Techniques in Nonlinear Acoustics for Visitors - Donna C. Hurley from NIST's Materials Reliability Division Laboratories in Boulder, Colorado, and Gary Peterson from Ritec, Inc. in Warwick, Rhode Island, visited our Nonlinear Acoustics Laboratory. Interest in the measurements has stemmed from an invited paper given by John Cantrell and William Yost entitled "Nonlinear Acoustic Assessment of Precipitation-Induced Coherency Strains in Aluminum Alloy 2024" at the Seattle meeting of the 22nd Annual Review of Progress in Quantitative Nondestructive Evaluation. Both parties were seeking information on our measurement techniques in order to establish their procedure to assure that their measurement uncertainties can approach our published results. During the visit, measurements were taken on two samples so that NIST can use our results as preliminary standards for their nonlinearity parameter measurements.

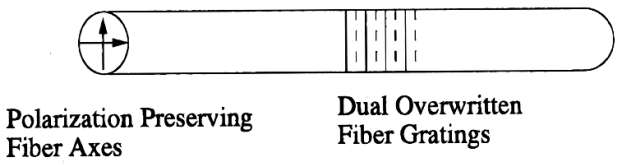
Ultrasonic Technology for Aircraft Inspection Shown at ASNT Conference - The ultrasonic technology developed under the Airframe Structural Integrity Program was displayed by Patrick Johnson at the American Society of Nondestructive Testing Spring Conference in Norfolk, Virginia on March 18-20, 1996, in a tabletop display. A number of potential corporate partners showed interest in the technology. Follow-up discussions of technology transfer and commercialization activities are underway.

Prosser to Receive Publication Award of the Acoustic Emission Working Group and Elected Vice-Chair - William H. Prosser of NESB was notified that he is to receive the Publication Award of the Acoustic Emission Working Group (AEWG) during the recent 39th AEWG meeting in Dana Point, California, March 25-28, 1996. The recognized publication, co-authored by Michael R. Gorman of Digital Wave Corporation, appeared in the Journal of Acoustic Emission and is entitled "AE Source Orientation by Plate Wave Analysis." The award will be formally presented at the 40th AEWG meeting next June at Northwestern University. Also at this meeting, Prosser was elected to the position of Vice-Chair of the Acoustic Emission Working Group. Prosser previously served as Secretary-Treasurer of the AEWG. Prosser also gave an invited lecture at the AEWG Short Course on Acoustic Emission entitled "Modal Analysis of AE in Metals and Composites."

NESB Provides Thermal NDE Support to The General Electric Research and Development Manufacturing Technology Lab - On March 28-29, 1996, Donna Mayton of General Electric Research and Development Manufacturing Technology Lab visited the Nondestructive Evaluation Sciences Branch's Joe Zalameda, Bill Winfree and Elliott Cramer. The purpose of Mayton's visit was to investigate the feasibility of thermal techniques for the rapid inspection of composite turbine blades and corrosion in metal samples. Thermal measurements were performed on the samples and results showing delaminated areas on the composite turbine blades were sent to Mayton.

Thermal Bond Inspection System Exhibited at AeroSense Conference - The NESB-developed Thermal Bond Inspection System was recently exhibited at SPIE's AeroSense Conference in Kissimmee, Florida, April 8-12, 1996. Considerable interest was shown in the application of this technology to inspection problems in the commercial sector. Additionally, a number of companies expressed interest in partnering with NASA to commercialize this technology. On April

11, 1996, as part of the Thermosense XVIII portion of the Conference a paper entitled "Thermal Characterization of Defects in Aircraft Structures Via Spatially Controlled Heat Application" was presented by Elliott Cramer. This paper was well received and appeared to generate additional commercial interest in the thermal technologies developed by NASA.



Fiber-optic strain and temperature sensor

3 Axis Strain and Temperature Point Sensor Based on Fiber Gratings - In many cases it is highly desirable to be able to measure three axes of strain and temperature internal to fiber reinforced composite materials or even certain metals. Conventional electrical strain gauges are difficult to use inside these materials because of their conductive nature, size, susceptibility to electromagnetic interference and temperature limitations.

Blue Road Research (Eric Udd, 503 667-7772, ericudd@aol.com) is investigating the usage of a 3 axis strain and temperature fiber optic sensor based on fiber gratings under a Phase I contract with NASA Langley. The fiber grating sensor consists of two fiber gratings of different wavelengths written onto birefringent polarization preserving fiber. Each grating when written results in two effective fiber gratings along each of the birefringent axes. When two gratings are written onto the fiber four effective fiber gratings result. The result is four equations, in four unknowns that may be used to solve for the three axes of strain and temperature. Since the information is spectrally encoded only a short length of polarization preserving fiber is needed in the vicinity of the three axis fiber grating sensor the rest of the system uses ordinary, low cost single mode fiber.

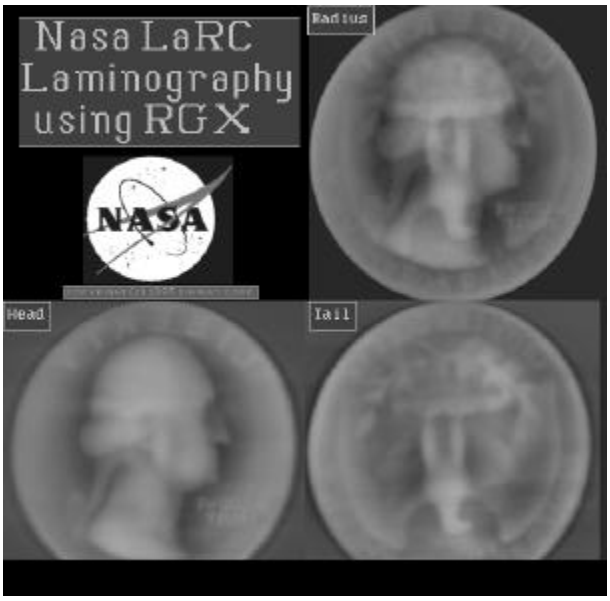
NASA/FAA Co-sponsored MOI SBIR - In September of 1995, NASA Langley and the FAA Technical Center (Christopher Smith) initiated their first jointly funded Small Business Innovative Research (SBIR) task with PRI instrumentation. The objective of this Phase II SBIR was to incorporate concepts from Phase I work into a working commercial instrument for corrosion detection in aircraft skin splices. In particular the new instrument is to have bi-directional sheet excitation, utilization of more efficient waveforms for eddy current excitation, optimized electronics, and new image processing software.

The FAA Technical Center is managing the SBIR and is responsible for facilitating communication between potential end-users and PRI and providing validation services through AANC as necessary. NASA Langley (Min Namkung) is responsible for much of the real-time image processing algorithms now being incorporated in the new system. It is expected that a complete breadboard system will be fully functional by mid-May.

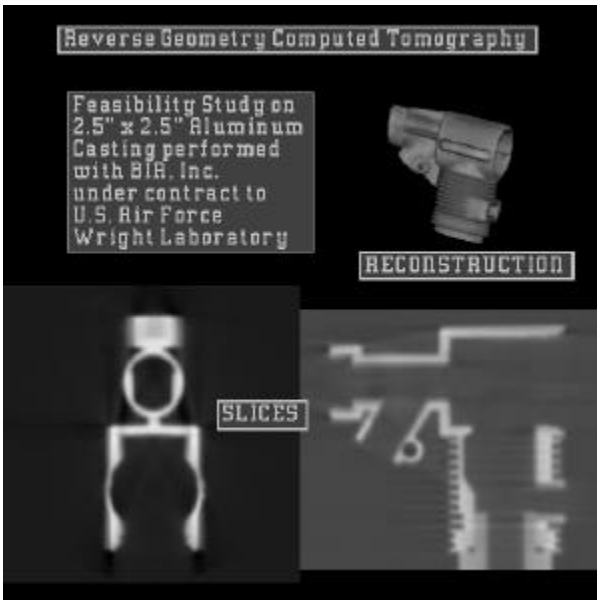
Crack Detection Under Fasteners - The NDE portion of the National Aging Aircraft Research Program (NAARP) states that improvement must be made to existing inspection techniques and devices to increase their reliability and detection capabilities. These NDE needs are derived from concerns about current systems, as exemplified by factors which led to the Aloha Airline accident. This accident was caused by multi-origin fatigue cracks in the fuselage structure. Such cracks are generally short and thus hidden under the flush-head of the fasteners. Hence, there was a need to detect these short cracks before they could grow to unstable size. Under a contract from LaRC (W. Winfree, Technical Monitor), McDonnell Douglas (Donald Hagemaier, 310-593-7304) tackled this goal and sought the detection of 1.25 mm (0.050”) or larger cracks in aluminum fuselage skins with a thickness of 1.6-mm (0.063”) or less. The result show that Nortec 30 EddyScan, the Northrop LFECA, the Hocking Fastscan, and the GK Engineering surface scanning probe with the Elotest B1 mini rotor, can detect fatigue cracks

1.0-mm (0.040”) or larger, under flush-head aluminum rivets, in aluminum skins with a thickness of 1.6-mm (0.063”) or less.

Reverse Geometry X-Ray - The following are photos of X-ray Reverse Geometry images (Richard D. Albert, 510-838-1510 DIGIRAY@delphi.com) that arrived to the Newsletter after the publication of the previous issue. The photos show examples of the capability of this relatively new technology.



Reverse Geometry X-ray ® allows viewing different depth sections. Picture is showing different depths of a quarter coin.



Reverse Geometry Computed tomography test of an aluminum casting showing various slices.

LeRC

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or D. J. Roth, 216-433-6017

Laser System For Remote Sensing of Ultrasonic Plate Wave Velocity in Ceramic Matrix Composites - Harold Kautz successfully employed a 13mJ NdYAG 1064 nm, 4 ns laser pulse to produce ultrasonic plate waves in 20 percent porous SiC/SiC composites (NASA TM#107125). An air coupled 0.5 MHz transducer was used to detect and collect the waveforms which contained first anti-symmetric plate wave pulses. Shear wave velocity was determined and correlated with results from acousto-ultrasonic contact coupling measurements. Similar reproducibility between contact and noncontact measurements was demonstrated. Repeated laser pulsing at the same location did not exhibit permanent damage to the material under characterization. The ultrasonic signal was recovered in the three different architecture of SiC/SiC that were studied. This work points the way to the future role of laser based ultrasonics in remote sensing of material and component degradation assessment.

Single Transducer Ultrasonic Imaging Method For Thickness-Independent Velocity Measurements - Don Roth is in the process of commercializing this method under a cooperative agreement between NASA Lewis Research Center and Sonix, Inc.. The use of this method can result in significant cost savings during material development. Added precision thickness machining is no longer needed to satisfy nondestructive ultrasonic characterization. Images obtained using the thickness-independent methodology were compared with apparent velocity maps and c-scan echo peak amplitude images for monolithic ceramic, metal matrix composite and polymer matrix composite materials having thickness and global microstructural variations. Results showed

that the thickness-independent ultrasonic images reveal and quantify true areas of global microstructural variations like pore and fiber volume fraction due to the elimination of thickness effects.

MSFC

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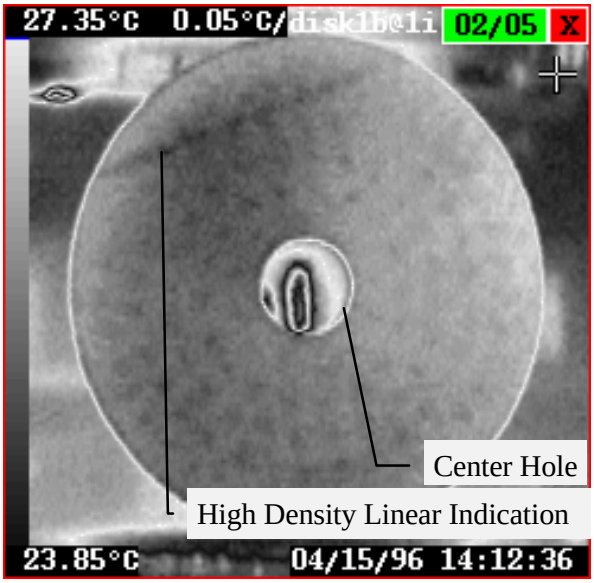
NDE Inspection of Rockwell Composite Intertank Panels (S. Russell, M. Suits) - A full size test panel containing tape inserts as simulated defects was used to develop the NDE procedure for inspecting eight production panels. These panels were fabricated in MSFC Productivity Enhancement Center. The procedure consisted of first screening with thermography to identify any anomalies in the 203 cm by 102 cm Al-honeycomb with Gr/Ep facesheet panels. Then, ultrasonics and X-radiography are used to characterize the anomalies.

Thermography inspection consisted of scanning with two 500 watt heat lamps and observing the transient temperature response on the opposite side with an infrared video camera. Each panel was inspected by heating the back side and observing the front. The panel was then reversed and inspected by heating the front surface and observing the back surface. Only one anomaly in the eight panels was noteworthy, a 23 cm long wrinkle in the lower non-honeycomb region which contact ultrasonics determined contained a disbonded region and some free volume. The tight program schedule prevented the recommended X-radiography on this defect. The panels have been adhesively bonded into a ring. Mechanical and cryogenic testing of the intertank ring and intertank with RI composite fuel tank is scheduled for this summer.

Pulse Thermographic NDE of SiC/SiC Blisks: (Russell) - Pulse heating capability was recently added to the Bales Scientific Inc. (BSI) infrared video camera. The pulse heating system consists of two flash lamps, a high voltage power system, controlling electronics, and an aluminum sheet hood. The BSI camera records infrared images at 50 Hz starting at the initial lamp pulse and recording for up to several hundred frames. Two silicone carbide fiber - silicone carbide matrix blisks, 7.75- inch in diameter and 1- inch thick, were inspected with computed tomography and pulse thermography. Both methods indicated a linear high density region in one of the blisks, see the thermography figure below. These images are the front and back scans 0.04 seconds after the heating pulse. The high density line is visible in the top left quadrant.



SiC/SiC Blisk Thermogram

INTERNET NEWS

AN NDE INTER RELAY CHAT (IRC) CHANNEL WAS RECENTLY FORMED - IRC is the Internet equivalent of the phone. This feature of the Internet is a growing forum of communication. While there are many channels of IRC representing a wide range of topics, NDT is a new topic Channel that was formed recently. Instead of using your phone, you can use your computer's Internet connection to simultaneously converse (via the keyboard) in real time with dozens of people who share your interest. It is effectively a teleconference forum via Internet communicating notes, files, images and voice messages. IRC is much more interactive than newsgroups or e-mail because responses can be seen almost

instantaneously (usually within few seconds) by all the participants.

Here is an example of an IRC conversation between three individuals that took place on the IRC chat channel #ndt within a 1 minute time frame: <DrMarty>: That 5 MHz transducer has too wide of a bandwidth for my application.
<GeorgeF>: Have you ever tried PVDF transducers?
<you>: Ever tried some external filters?
<DrMarty>: The PVDF would not hold up in the environment and we are not allow to use external filters according to the specs.
<you>: So,... what spec is that? That seems very restrictive to me!

Beyond this type of conversation, files can be exchanged via IRC. These files could be pictures of devices or a paper that is about to be submitted for publication. Further, while the file is being transferred the conversation can continue. Also, communication can take place privately with another individual while conversing on the IRC public channel (such as #ndt). Most Internet service providers have software that allows your computer to connect to IRC (for more information you can consult your Internet administrator). Most colleges and universities are providing IRC access for their students. For personal accounts, if you have a PPP/SLIP connection, there is freeware that is available for connection to IRC. In order to talk with a specific person (or group) you must be logged on to the same server's network. There are about dozen IRC networks and the Efnet network has the most servers and channels. Most IRC freeware software are providing a sample list of servers and what network they are on. On a typical evening, there can be over 3000 channels on the Efnet where people discuss almost any imaginable subject. Once you are connected to a Efnet server, a simple command like "/join #ndt" connects you to the NDT channel and you can join the conversation immediately. However, to have a conversation you have to have at least one other person on the channel. The channel is open each week day (barring problems) from 7:30 am to 8:30 am EST and midnight to 1:00 a.m. EST. The channel #NDT is on the Efnet system of servers (using irc.ais.net).

To connect to IRC and the NDT channel, "mIRC" software can be used and it can be free download at http://www.geocities.com/Colosseum/1822/install.html. For more information please contract, Marty Jones, Materials Testing Internet, (412) 793-7385, mpjones@nauticom.net

WWW NDE HOMEPAGES

The following is a list of WWW Homepage addresses with NDE related information.

- ***NNWG homepage***

http://nasa-nde.jpl.nasa.gov/jpl-nde/homepage.htm

- ***LaRC NDE Science Branch***

http://zeta.larc.nasa.gov/docs/nesb.html

- ***JPL's NDE and Advanced Actuators Lab***

http://nasa-nde.jpl.nasa.gov/jpl-nde/nde-aa-l/nde-aa-l.htm

- **Sensors**

http://lenti.med.umn.edu/~mwd/sensors.html

- ***Acoustic Material Property Tables***

http://www.ultrasonic.com/Tables/index.html

- ***Acoustic Properties of Engineering Materials***

http://stud.uni-sb.de/~mala/acoustic.html#acoustic

- ***Damage Identification and Health Monitoring***

http://wxvax7.esa.lanl.gov/damid/damidhome.html

- **ASNT**

http://www.concourse.com/ndt/

- ***List of NDE related internet sites (> 100)***

http://www.dtic.mil/iac/ntiac/ndtlist.html

NON-NASA ORGANIZATIONS

NASA-FAA COORDINATION

The Federal Aviation Administration Technical Center (FAATC), Atlantic City, New Jersey, and the National Aeronautics and Space Agency (NASA) Langley Research Center, Hampton, Virginia, have developed a cooperative research effort aimed at providing technological basis for ensuring the continued safe operation of the US commercial airplane fleet, as set forth under the Aviation Research Act of 1988. The FAA's National Aging Aircraft Research Program (NAARP), a broad-based research and development program, addresses the aging aircraft

structural safety concerns and provides certification authorities, manufacturers and operators with tools and methods to meet those concerns. The NAARP has been formulated to address the concerns in the following areas: Structural Performance, Maintenance, Inspection, and Human Performance. NASA's Airframe Structural Integrity Program (ASIP) is developing fatigue crack growth prediction methodology applicable to determining the residual strength of complex built-up structures and NDE to detect fatigue cracks, corrosion and disbonds in splice joints. Together these programs form the technological basis for a cooperative effort with U.S. industry to address the critical aging aircraft issues.

FAA

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NEWEST ADDITION TO FAA/AANC TEST BED - The FAA's Aging Aircraft Nondestructive Testing Validation Center (AANC) at Sandia National Laboratory, Albuquerque, NM is a facility that was dedicated to serve as a testbed for verification and demonstration of new NDE methods. The facility contains several aircraft and a library of flawed structures and components. Recently, a commuter aircraft was added to the testbed. The aircraft is a Fairchild/Swearingen Metro II, manufactured in 1976, with over 30 thousand airframe hours and almost 50 thousand airframe cycles. At the time of acquisition, the aircraft was believed to be the fleet leader in airframe cycles. The aircraft flew in passenger service until 1990 when it was converted to a freighter.

As part of the purchase agreement, the flight instruments, avionics and other equipment were removed from the aircraft prior to accepting delivery in Albuquerque. Additional parts of the aircraft were exchanged for defective parts that would be useful in the FAA Airworthiness Assurance Program. The initial effort for the aircraft will be a baseline inspection using inspectors from the commuter industry. The data from the inspection will be used in a commuter inspection reliability program.

For additional information contact Mr. William Shurtleff, 505 844 3500, (wwshurt@sandia.gov), the FAA/AANC Manager at Sandia.

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Government-Industry Alliance Led to the Development of Inspection Procedure with Significant Cost Saving - Recently a concern was raised regarding the inspection complexity and length of an McDonnell Douglas wingbox T-cap. Researchers from the FAA Center for Aviation Systems Reliability (CASR) at Northwestern University, testers from the FAA Aging Aircraft Nondestructive Inspection Validation Center (AANC) at Sandia National Laboratories, and Engineers from MDC and SAIC, developed an innovative ultrasonic method for detecting cracks and corrosion. Two ultrasonic transducer-pairs are used at certain shear angles to interrogate the joint from the outside without need to purge the fuel tanks and disassemble the cabin interior to perform a visual inspection. Four signal components are acquired and synthesized to identify flaw signals in the presence of unknown part and sealant thickness.
The new test procedure was granted an FAA approval as an alternate to the visual inspection requirement. The original inspection requirement which took an estimated 800 man-hours to complete can now be accomplished in 48 man-hours and without the need for fuel tank entry. This labor reduction will represents significant savings to the industry - Northwest Airlines alone estimates a savings of at least one million dollars. These achievements were honored with a series of achievement awards to the research team from McDonnell Douglas management.

This program clearly illustrates the mutually beneficial nature of government industry alliances. Without FAA sponsorship, neither the individual airlines nor the manufacturer could justify bearing the entire cost of developing an alternative less expensive inspection. The FAA's participation

allowed the establishment of a more cost-effective inspection, but more importantly it ensured the development of a procedure which enhanced safety by establishing a more comprehensive and less invasive inspection.

COMING EVENTS

- June 23-28, 1996 - 1st US-Japan Conference on Advances in NDE, Oahu, HI, ASNT Headquarters, 614-274-6004.
- July 28 to Aug. 2, 1996 - 23rd Annual Review of Progress in QNDE, Brunswick, Maine, Connie, Nessa, CNDE, 515-294-9749.
- August 18-23, 1996 - 1996 Gordon NDE Conference, Henniker, NH, Chris Fortunko, NIST, 303-497-306+2.
- Oct. 14-18, 1996 - ASNT Fall Conference - Norfolk, VA, ASNT Headquarters, 614-274-6004.
- Dec. 3-5, 1996 - NDE Techniques for Aging Infrastructure & Manufacturing, Scottsdale, AZ. Spie@spie.org, http://www.spie.org/
- Dec. 8-13, 1996 - 14th World Conference on NDT - New Delhi, India, Baldev Raj, 04117-40301.
- Feb., 1997 - 4th NNWG Workshop - JPL, California, George Baaklini, 216-433-6016.
- Feb. 26-28, 1997 - Golden Gate Materials Technology Conference, San Francisco, CA, Jerry Wittneauer 415-424-2243.

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