NASA NDE WORKING GROUP NEWSLETTER

April 1994 Quarterly Newsletter Vol.. 2, NO. 2

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NASA HQ CODE Q ASSOCIATE ADMINISTRATOR MESSAGE,

Frederick D. Gregory

It is my pleasure to have Ibis opportunity to address the members of the NASA NDE working Group. As reflected in this Working Group Newsletter, you can be proud of your accomplishments in the year since your organizational meeting at JSC in April 1993. Your willingness to expend considerable time and effort to review Agency NDE needs, to review and evaluate current and new programs, and to aggressively establish a new partnership both with Headquarters and with other centers serves as a role model for the Agency.

It is important as you develop new programs that you continue to emphasize the need for having a measurable payoff to NASA, and a specified customer for the expected new or improved methods under development. Wherever possible co-funding should be obtained so that we can leverage the limited code Q funds that are available for NDE RTOP efforts. These efforts should solve specific problems and contribute to the Agency goals of doing business more effectively, more quickly, and more efficiently than in the past. We need to emphasize the transition of technology from the laboratory to the operational environment. Broad center participation in programs should be encouraged and consensus review and prioritization of programs provided. The Working Group provides an excellent forum for accomplishing this.

1 commend you for your efforts this past year, in making tough decisions and working together to establish new directions for the NDE community necessary for NASA in this era of rapid change. Current development of a rapid optical scanner for orbiter window inspection, the development of an improved Optical] y St imulated 1 lectron 11 mission (0S1 E) probe system for determining bondline cont aminat ion on SRM and RSRM components, and the development of N])11 techniques needed for the certification of silicon nitride ball bearings for the SSME Advanced Turbopump attest to the excellent progress you have made in a short time. My congratulations to all of you for your effective participation in the NASA N])11 Working Group.

Joseph Siedlecki, the new NDE Manager at NASA HQ, Code Q W

NASA HQ Code QW MESSAGE, J. Siedlecki, 202-.358-020.5

The 1<'1'01" review process for the 1'01"94-1 is following the original plan with only minor changes in the due dates for various stages of the process. The centers have given their written packages to 1 leadquarters Code QW in March, followed by the scheduled video teleconferences in late March and early April. The 1 Divisions arc in the process of' prioritizing the efforts, with the "70-30'"" drill being conducted this week. Division RTOP recommendations will subsequently be made and forwarded to the AA by the end of April. In May the interim POP results will be forwarded to the Centers . There is a reclama period for the centers to interact with Headquarters on the POP results. Final decisions on the programs to be funded in the POP call are expected by the week of May 18 to 22.

This is an appropriate time to reflect as a Working Group on improvements that should be considered for the 1<'1'01" process for the next 1'01' Call. You have made an excellent start in this process which will serve as the basis for the future. All members of the Working Group have contributed significantly to this effort, and the Code Q standing, committee has benefitted from these inputs in prioritizing the I<'J'()])s. There are a number of steps that can be taken to improve the process, but it is important to reflect on the progress that was made in this coordinated undertaking.

Some of the areas that 1 would like to scc addressed include]ifc-cycle planning, with decision points throughout the development cycle; clearly identified customers for each program; realistic cost estimates over the life-cycle of the program, estimates which arc linked to milestones in program progress; indicat ion of potential funding support from other sources, regardless of source and including furnished work years as appropriate where the contribut ion is in people rather than explicit funding); and some attempt to limit the total number of 1<'1'01's submitted to a realistic number given the funding constrains of the total NDE program area.

The emphasis is on a thorough life-cycle planning and concomitant costing. This includes costing out of follow-cm efforts for successful RTOP programs to bridge the gap between the original RTOP funding and the transition of support to the "customer" program/project office.

] would encourage the Working Group to start ibis dialogue immediately and 1 solicit your comments.

A BOUT OUR NEW NDE MANA GER, HQ, CODE QW (lb. T. Lynch, Vitro Corp., 202-646-6372)
1 ffective in late January 1994, Joseph Siedlecki was appointed as the new Headquarters Program Manager for N])];, Metrology and Calibration. 1 Ie is located in the new Engineering and Quality Management l)ivision/Code QW, and can be reached by phone at 202-358-0205, and 1 AX 202-358-2776. Joe comes to the Headquarters position from the Reston office where he most recently served as Technical Assistant to the Deputy Manager for 1 ngineering of the Systems 1 ngineering and integration Office. 1 lis major responsibilities in this position involved product review and acceptance, technical quality assessment, management planning as well as identification and resolution of key engineering issues involving the Space station Program. Prior to that he was Acting Chief of the Systems Management Branch and Chief of the on-orbit" integration section.

Before joining NASA Joe enjoyed a imp, and fruitful Civil Service career with tbc Department of Defense in the Department of the Navy, starting as a Project Director for Advanced Acoustic Systems. He served for 13 years as the Manager of the Metrology and Calibration Program of the Naval Material Command.

Joe is a graduate of Case Institute of Technology with a BSI iii. He is married and lives with his wife in Potomac, Maryland. He is the father of three daughters and has five grandchildren. 1 lis favorite leisure activities 'arc golf and bowling,.

Marie Prebilsky, JSC, the new NNWG Chairperson

NNWG HIGHLIGHTS *(R. Neuschaefer, 20S-544-7.382 and M. Prebilsky, 71.3-483-71.34)*
This will be our final Newsletter input as Chairperson and Vice-(:llairl>crso]l since tbc first year of the NNWG is nearing completion. in accordance with our charter, Ms. Prebilsky will become tbc Chairperson and 1)r. Yoseph Bar-Cohen bas been elected Vice-(lllair~lcrsoll. Congratulation Yoseph.

There have been many accomplishments during this past year and wc will attempt to summarize. The formation of tbc NN WG was initiated by Mr. Robert Burdine during his term at NASA Headquarters, Code QR, with the assistance of 1)r. Ted Lynch of Vitro. A charter was developed and is being processed within NASA Headquarters. 1 lector Delgado, KSC, chaired the code Q Standing Committee,

which developed a prioritized list of candidate RTOPs for FY95 funding consideration. Dr. Yoseph Bar-Cohen has been Editor and Publisher of the Newsletter and assisted Mr. Delgado with data management of the RTOP '1'01' submission. Richard Russell, KSC, led completion of the Standard Operating Procedures. John Larson, KSC, is completing work on the Directory.

The NNWG contributed to the review of two specifications developed by JPL for the NDE of composites, One of the principal functions of the NNWG will be to lead to the development of NASA-wide NDE specifications and standards. The NNWG agreed to accept the Agency responsibility for review of NDE specifications following a recommendation by the NASA M&P Standards Committee. An NNWG policy for participation of contractors in the group's activities was developed. The NNWG agreed to accept the Strategic Thrust portion of the S&MA Strategic Plan as written by NASA Headquarters.

We have had the good fortune to interface with three enthusiastic and supportive Headquarters interfaces during this past year - Robert Burdine, Norman Schulze and Joseph Siedlecki. This association has been extremely beneficial in the initial development of the NNWG and during the FY95 RTOP preparation and evaluation.

The Working Group will be in very able hands with Ms. Prebilsky as the Chairperson and Dr. Bar-Cohen as the Vice-Chairperson. They have demonstrated great talent and enthusiastic support for this team and I know that great strides will be made during this coming year.

CURRENT EVENTS AND ACTION ITEMS

- Recently, it was announced that Dr. Joe Heyman has left the NDE activity since he has changed a position at LaRC. NNWG would like to thank Dr. Heyman for his great contributions to the NASA NDE Community both technically and politically. We are wishing him success in his new career.

- The 2nd NASA M&P Standards Meeting was held at JSC from April 5 to 6, 1994. The meeting was organized by Tim O'Donnell and Dr. Yoseph Bar-Cohen from JPL and Dr. Lubert Leger from JSC. The meeting was attended by representative from all NASA centers and representatives of DOD, Technical Societies and industry. Several centers specifications were identified for conversion to NASA wide documents and it was decided to work toward the transfer of the documents to technical societies responsibility. Mr. Richard Weinstein from Code QW is the HQ manager for this program.

- The NNWG Code QW Standing Committee received in January thirty one RTOP inputs for FY95 after establishing the review criteria. These criteria, which are based on NASA goals, consist of 30% for project support, 35% for benefit to NASA, 25% risk assessment and 10% for technology transfer. In March two LaRC RTOP '1'01' items were also reviewed making the total to 33 RTOP's, The following table lists the 33 RTOP's by priority as decided by the Code QW committee.

FY95 RTOP PRIORITY LIST VOTED BY THE CODE Q STANDING COMMITTEE

Priority	Center	Name	Title
1	MSFC	S. Russell, et al	Thermographic Methods of Evaluating Fiber Reinforced & Structures
2	JPL	Y. Bar-Cohen	Nondestructive Determination of Composites Stiffness Constants
3.	LaRC	W. Winfree	Improved Interpretation of Anomalous Ultrasonic Signals

4	KSC	I). Collins & I 1. Delgado	Valve 1 Iealth Monitoring and Control
5	JPL	Y. Bar-Cohen	Development of NASA NDE Policy Documents, Standards and Guidelines
6	KSC	1). Collins & II. Delgado	Production Model Orbiter Window Defect Analyzer
7	KSC	D. Collins & 11. Delgado	Wind Tunnel Window Inspector
8	KSC	I). Collins & 11. Delgado	Snake ultrasonic Leak I Detector
9	LeRC	G. Baaklini	NDE of Space Station Freedom Fastmast Fiberglass Flex Battens
Io	LeRC	I). Roth	Development & Tccl]. Transfer of Ultrasonic I Iomogeneity Characterizer
11	LeRC	(i. Baaklini	Engineering Tomography Standards for 1 Lifting of Composite Components
1?	LeRC	A. Vary	Radioactive Gas Penetrant NDE for Advanced Materials
13	JPL	N. Marzwell& Y. Bar-Cohen	Remote Real-Time 1 Iealth Monitoring of Space Assets
14	KSC	D. Collins & 11. Delgado	Por [able 112 Camera Development
15	KSC	I 1. Delgado	Bolt Joint NDE
16	LaRC	E. Madaras	Subelement ?.: Imaging Elastic Properties
17	LaRC	E. Madaras	Subelement 3; Using Potable Reverse Geometry X-Ray
18	JPL	1'. Shakottai	Thin Film Array Acoustic Emission Sensor
19	ARC	J. Segreto, et al	Reliable Assessment of NDE Sizing Techniques in Support
20	KSC	D. Collins & 11. Delgado	Surface Defect 1 Evaluation in Difficult Access 1 Locations
21	KSC	J. Larson	Radiograph Digitization, Enhancement, Archive Transfer System
??	KSC	D. Collins & II. Delgado	Corrosion and Damage Scanner for SRB Hardware
23	KSC	D. Collins & I I. Delgado	optical Alignment Tool for Shuttle operation
24	GSFC	E. J Chern	An Advanced Ultrasonic C-Scan for Multiple Medium
25	KSC	D. Collins & I I. Delgado	Dynatube Defects Analyze
26	KSC	D. Collins & 11. Delgado	Trace Gas Detection Instrumentation Using Mid-IR Lasers
27	KSC	I). Collins & 11. Delgado	RCC Mass 1 Loss and Subsurface Flaw Detection
28	KSC	D. Collins & Il. Delgado	Upgrade to the 1 External Tank Alignment and Centering System
?9	GSFC	E. J. Chern	A unified NDE Imaging Workstation
3[)	KSC	D. Collins & I 1. Delgado	Automated Weld Inspector
31	KSC	D. Collins & I 1. Delgado	Mobile Sensor Platform
32	KSC	D. Collins & 11. Delgado	Performance Reliability Analysis
33	KSC	I). Collins & 11, Delgado	OMS 1'01) Alignment System

- ***NASA NDE DIRECTORY (J. Larson, 407-867-.?42.?)*** - '1 The 1 Directory data, submit ted by each of the field centers, has been placed in a uniform format and returned to the respective centers for red-line corrections or updates. Revised inputs are due to KSC by 4-28-94. Final typing, and reproduction of the 1 Directory is expected to be completed by 5-13-94. Six bard copies of the 1 Directory will be mailed to each field center and the 1 Directory content will be available in a MS Word for Windows file.

- ***NASA-WIDE NDE SPECIFICA TIONS (Dr. Y. Bar-Cohen , 818-354-2610)*** - Materials Evaluation has published in its February 1994 issue a compiled list of all the NDE specifications and standards.

NASA CENTERS NEWS AND ANNOUNCEMEN TS

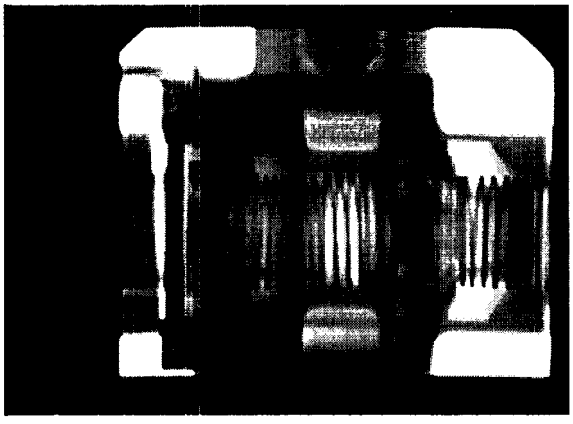
JPL (Dr. Y. Bar-Cohen, 818-3.54-2610)

JINA TECHNICAL SEMINARS - The JPL/Indust ry/Academia (JINA) Seminar series continued and three technical seminars were made at the JPL's Space Materials Science and Engineering Section. This Seminar Series is sponsored by the JPL Techno logy Affiliates Program and is open to MP&NDE individual from the industry and academia to serve as a forum of communication for technology transfer. In January W. Schober, J]'].., reviewed the " Technology Ut ilization Program at JPL .", In 1 ebruary Dr. S. Song, Rohr, reviewed "Intelligent Processing of Composite

Materials in the Aerospace Industry" and in March Dr. A. C. Metaxas, Cambridge, UK, covered "1 'lectroheating - An 1 'merging Technology".

NASA M&P STANDARDS MEETING - The 2nd Annual Meeting was held at JSC from April 5 to 6, 1994 and was attended by representatives from all NASA centers, DoD, major technical societies and industry. J]'], organized this meeting with the help of JSC and the sponsorship of 1 IQ, Code QW.

NASA-WI])] 'NDE NETWORK - J]'], started adapting the electronic network, increasingly known as the "Information Highway", as a form of communication among the NASA NDE and M&P communities. A listing of all the individuals that are currently on the network was formed and will be updated once the NASA NDE Directory is complete. As more individuals obtaining, access to the electronic network it will become the main avenue of communication among the members of the NDE community. For more information please send an E-mail to my address *yosi@jpl.nasa.gov*.



An X-ray Image stored on a JSC computer that was retrieved by JPL using the electronic network

JSC

JSC SR&QA PERSONNEL RECEIVING NEUTRON RADIOGRAPHY TRAINING (M . A. Prebilsky, 713-483-7134) - JSC SR&QA personnel recently received advanced Neutron Radiography training at Aerotest Operations in San Ramon, CA. This training was in preparation for the ASNT National Level III examination for Neutron Radiography (NJ<']"). The training included hands-on experience operating the 250 KWatt Radiography and Research Reactor. At the same time, another SR&QA Technician became a certified Level II Neutron Radiography 1 'ilm Interpreter.

JSC personnel routinely examine Neutron Radiographs and X-Radiographs for acceptance of all pyrotechnic devices used in the Orbiters. 1 'ach individual device is radiographed before being accept ed for u sc. in support of the Pyrotechnic Group, two devices of flight hardware which had been fired during normal usc were examined by our personnel at Aerotest to determine configurate ion changes and, in one instance, the cause of a failure.

ON RAMP TO THE INFORMATION SUPER HIGHWAY - JSC has initiated a mechanism for the exchange of information related to Orbiter NDE and orbiter Corrosion. An anonymous FTP server has been activated within the engineering directorate which is accessible to 1 NTERNET users around the world. The server may be accessed using any workstation operating system

(Unix, X, Apple, IBM) by connecting to SAMNET.JSC.NASA.GOV (139,169.122,100). The effort started in order to promote the exchange of information among members of the Orbiter Corrosion Control Review Board. Currently, two separate directories are maintained for corrosion and N])]{, The server was particularly useful during a recent component failure in an orbiter thruster. Photographs and X-rays (SCC Figure on this page) were place on the server the same (lay the problem surfaced. Several research institutions and equipment manufacturers were invited to download the data and discuss ideas for N])E. With 24 hours individuals across the country were aware of the NDE issue and uploaded back to the server sketches and photos of potential solutions. 'l'he next phase of the effort is to transfer this information to the JSC MOSAIC server to improve user accessibility. If you 'vc never heard of MOSAIC or anonymous 171'1', you 're not alone. Most NASA site are only now gaining access to the INTERNET. For more information contact your local system manager or contact Charles Salkowski@ '71 3-483-3500 (*salkowsk@samnet.jsc.nasa.gov*)

1 :VALUATION OF SPECIAL NDE HARDWARE - Representatives from JSC's NDE Laboratory will be in 1 ngland during the month of May to evaluate manufacturers for Special N])T capability. NDT for any critical NASA flight hardware which involves the detection of very small flaws must be evaluated by the appropriate fracture control authority. JSC is responsible for certifying critical NJ)T for Orbiter, Level II Payloads, and Space Station. 1 valuat ions have also been performed in 1 rance and Germany (C. Salkowski).

LIBRARY OF FLAW SAM]'] ES - JSC is maintaining a large library of flaw specimens which are available to any NASA center or NASA contractor for evaluation of standard NDT capability (C. Salkowski).

KSC (J. Larson 407-867-342.3)
KSC PROVIDING TECHNICAL SUPPORT TO THREE OTHER CENTERS - The KSC NDE laboratory provided technical support to LaRC, JSC and MSFC. KSC used the its Computed Tomography (CT) to produce images of tires slices in support of an LaRC studies of tread wear. For WSTF/JSC, the CT technique was used to measure the thickness of fiberglass test coupons of the astronaut suit 1 IUT (hard Upper Torso). Further, the microfocus radiography was used to scan crystal growth experiments for MS] C. Sharing technical capabilities and expertise on a non-interference basis can be beneficial mutually to all NASA centers.

LaRC (Dr. 1%. 1. Madaras, 804-864-4670)
OPTICAL FIBER FTIR REMOTE DETECTION OF Al UMINUM HYDROXIDE - Optical Fiber 1 ourier Transform Infrared Evanescent Wave Spectroscopy has been used to remotely detect solid aluminum hydroxide $Al(OH)_3$ are found between 3400 cm^{-1} and 3600 cm^{-1} which is in agreement with reference data. The absorption features of liquid water and aluminum hydroxide have been found to overlap. As the liquid water evaporates, the aluminum hydroxide spectral features become more strongly absorbing, and consequently more easily identifiable. Although water in the $Al(OH)_3$ masks some of the peaks in some applications identifying the presence of water would be valuable, as in the lap joints which are protected by sealant. Qualitative detection of aluminum hydroxide using optical fiber 1 TIR evanescent wave spectroscopy is an important step in the development of a technique for the remote detection of aluminum. The results of these experiments were presented at the North American Conference (m Smart Structures and Materials in 1 eb. 1994 (R. S. Rogowski and J. S. Namkung (W&M)).

'1'111 ERMAL NDE SYSTEM BEING DEVELOPED FOR ROBINS AIR FORCE BASE - LaRC and Robins Al 'B are cooperating on the development of a technique for the inspection of boron/epox y repair patches used on military aircraft. 1 aRC is adapting their thermal bond inspection system to this problem. The thermal bond inspection system was developed under the ag ing aircraft program. Robins Al 'B has acquired the components of a thermal imaging, system and shipped them to LaRC. The components will be assembled and upgraded with LaRC developed analysis software for the inspection f these patches and then returned to Robins AFB (Dr. E. 1. Madaras and K. E. Cramer).

LeRC (A. Vary, 216-433-6019 or Dr. G. Baaklini, 216-4.3.? 6016)

POD STUDIES CONDUCTED USING NEW THERMOGRAPHIC SYSTEM - The installation of a state-of-the-art thermographic imaging system has recently been completed. Currently probability of detection (POD) studies for polymer-lnatrix, metal-matrix and ceramic-matrix composites is being conducted. These POD studies will be used to define baseline capability of thermography of various defect types in materials that are being developed for the Enabling l'repulsion Materials (EPM) and 111'1'1 EMP programs.

COLLABORATIVE EFFORTS ON NDE O1' 111 EAT EXCHANGERS - A collaborative effort with Babcock & Wilcox for NDE of ceramic composite heat exchangers was initiated. An advanced heat exchanger is a critical component of a waste heat recovery system in the exhaust path of an industrial furnace that produces highly corrosive gases. This environment dictates the need for high temperature corrosive-resistant ceramic composite materials. Thus far, radiographic studies revealed cracking and fiber architecture anomalies. This interactive N])11 work is regarded as essential shortening the design cycle for these exchangers.

'1'1 ECI 1 N()] OGY TRANSFER '1'0 SONIX CORPORATION - Sonix Corporation is studying an 1 eRC-developed ultrasonic. post-scan interactive data display system (PSIDD). PSIDD reveals microstructural anomalies when ultrasonic C-Scan findings depicts "good" results. Additionally, 1 eRC is IIcta-testing new Sonix user-intcrfidce softwarc. These interactions arc advancing ultrasonic characterization of composite materials.

MSFC (Dr. S. Russell, 20.5-544-4416)

S111 EAROGRAPHY AN]) ULTRASONIC 'J'] EST OF COMPOSITE N[)S11 CONE - A nosecone test panel made of graphite/epoxy inner skin with an epoxy-microballoon foam core was examined using shearography and Ultrasonic C-scan. The ultrasonic inspection revealed three linear indications running from the top to the bottom of the panel. '1'0 introduce stresses convection heating was used and shearographic images were taken from both sides of the structure. The indications could be detected by access from one or two-sides of the nose cone. Further, defects were detected irrespective of their location through the thickness. Currently, examinations are made to determine the structure of linear indications that were detected in an earlier test.

SSC, Dr. W. St. Cyr, 601-688-11.34

PATENT FOR IMPROVING GAMMA RADIOGRAPHIC TESTS - The NDT Lab at NASA's John C. Stennis Center, operated by Sverdrup Technology, Inc. has developed and patented a collimator for usc with a 200 curie cobalt 60 gamma ray source. The collimator, in conjunction with specially developed screens, significantly reduces the exposure time and exclusion zone

when radiographing thick wall pressure vessels. Patent coverage is currently in the process of being extended to Canada and Europe.

COMING EVENTS

21st Annual Review of Progress in Quantitative DE, Organized by Iowa State University, to be held at Snowmass Village, CO, July 31 to August 5, 19994.

ASNT 1994 Fall Conference, Atlanta, GA, Sept. 19 to 23, 1994.

2nd NASA NDE Working Group Workshop - Tentative date October 1994.

3rd NASA M&P Engineering Meeting - Marshal Spat.clF'ligllt Center, AL, March 1995.

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