

NASA NDE WORKING GROUP NEWSLETTER

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Quarterly Newsletter

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NASA HQ MESSAGE

N. Schulze 202-358-0537

I am looking forward to the opportunities that we will have together to continue to strengthen all the phases of the NASA NDE Working Group programs. Your commitment to establishing the NASA NDE Working Group as an effective forum for "Agencywide cooperation, to promote technical cooperation, improve customer interfaces and optimize the use of resources" is evident in your activities to date. Much has been accomplished in a short time and much remains to be done.

With the change of Program Manager here, it seems appropriate to consider what I will be looking for in existing programs and in the development of new programs. I stress teamwork, cooperated activities and cooperative efforts as exemplified in your formation of an Agencywide working group. Programs should be practical, applications oriented, with good, clear cut planning and realistic plans. Products of the efforts should be clearly identified. Plans should be rigorously adhered to, with the ability to meet schedules and to cost according to the plan. I cannot emphasize too strongly the need for timely obligation of money and costing to schedule.

Note: Please don't hesitate to call me with any questions that you may have regarding these comments or any other issues which you wish to discuss. I look forward to working with you to advance NDE technology within NASA and to transfer our expertise to industry, both aerospace and non-aerospace.



Dr. T. Lynch, Vitro Corp. 202-646-6372

In answer to the requests for more information about our new Headquarters Program Manager for NDE, I have prepared a short bio-sketch on Norman Schulze. Norm is a graduate of the University of Chicago in Physics with a long and distinguished career with NASA at LaRC, JSC, and since 1975, at Headquarters. He was working on virtually all of NASA's program types: manned and unmanned spacecraft, science, research, aeronautics and aerospace. This includes the Mercury, Gemini, Apollo, and Shuttle programs. He served as a flight test project engineer for launching six vehicles at Wallops, served as Gemini Spacecraft Propulsion System Manager, a Program Manager for Lunar Mission Safety and Rescue Study and worked on the Apollo program through Apollo 12, including safety of propulsion systems after Apollo 204 fire.

At headquarters Norm has worked in Code M as Chief of Safety, Reliability and Quality Assurance, Space Shuttle Program Office, as Manager of Deep Space Programs, and established the initial work on Shuttle bailout testing at LaRC for incorporation into the Orbiter flown after Challenger. Norm has served as Deputy Director, Engineering Division for Code D, and is currently Manager, Advanced Technology Development Programs for Code Q, including fiber optic rotation sensor, EOS laser sensors, enhanced damage resistance optics and the NASA Aerospace Pyrotechnics Systems Program.

Norm conceived and prepared the Shuttle Payload Safety Requirements NHB 1700.7, initiated the NASA Battery Program, organized the NASA Aerospace Pyrotechnics Programs, and the NASA/DoD/DoE Aerospace Pyrotechnics Steering Committee, and the NASA/DoD Aerospace Battery Systems Steering Committee.

Norm was featured in the NASA HQ Bulletin of October 18, 1993, for his work on a laser-initiated pyrotechnic (ordnance) system. Norm and Lee Every, Director of Procurement Policy Division have been successful in just two months in establishing a Government-Industry team for testing the laser ordnance system. Ensign Bickford Inc. developed the system which will be installed on Orbital Sciences Corporation's Pegasus air-launch space booster. A flight test is scheduled in five months for an in-flight demonstration of the laser ignition system.

Norm is married, father of three sons, Erich, Ron and Byron, and resides with his wife in Clifton, VA.

With his broad and in-depth experience at several Centers, with working groups and with several Headquarters Codes, Norm will be an invaluable resource for the NDE Working Group.

NNWG HIGHLIGHTS

R. Neuschaefer, 205-544-7382 or M. Prebilsky, 713-483-7134

The NASA NDE Working Group has continued to progress during this past quarter. The Charter is being reviewed through NASA Headquarters and the Operating Procedure has been published by Richard Russell of KSC. Hector Delgado, KSC, has made significant strides in the Code Q Standing Committee by initiating the development of Guidelines and Criteria for the assessment of candidate RTOPs, and development of recommendations for NASA Headquarters.

The NDE Working Group is grateful for the leadership and advice provided by Robert Burdine during his tenure as our interface with Code QR. His enthusiasm, support, and insight were the initiating spark and catalyst for the Group, and we wish him well in his new assignment at MSFC.

We welcome Mr. Norman Schulze as our new Headquarters interface for NDE. Those of us who have had the pleasure of working with Norm know him to be strong advocate for NDE who has a personal interest in the discipline. His prior experience in the Agency will serve all of us well during our relationship.

CURRENT EVENTS AND ACTION ITEMS

NNWG is preparing a NASA NDE directory that is intended to briefly describe the NASA centers' NDE capabilities, facilities, responsible personnel and contractors. This Directory is being prepared by Mr. John Larson, KSC, who has collected input from most NASA centers. Mr. Larson is compiling the input with a uniform format and he is trying to assure the completeness of the directory. A letter with the desired format and an example will be redistributed by Nov. 1, 1993 to all members of NNWG to clarify any confusion regarding the format. Responses will be due by Nov. 19, 1993.

The NNWG review of JPL's two NDE of composite specifications has been a success story. These two specs which cover the use of ultrasonics and radiography were sent recently to all the members of NNWG for comments. Responses were received from the majority of the centers that are involved with issues related to specifications. The following individuals sent very useful comments and suggestions: Dr. George Baaklini (LeRC), Dr. Jim Chern (GSFC), Gordon P. Conklin (KSC), Kenneth Jernigan (KSC), Robert W. Neuschaefer (MSFC), Stephen C. Robling (KSC), Charles L. Soklowski (JSC), Michael Suits (MSFC) and Kenneth Woodies (MSFC). Most responses were positive regarding the formation of NASA-wide standards and the use of specific specs as a basis for such standards. We recommend using NNWG as a forum for reviewing and recommending NDE specs for multi-center interest.

With the assistance of Dr. Eric Madaras of LaRC, individuals that are members of JANNAF reviewed the JPL Spec. entitled "NDE of Composites using Radiography" and sent very helpful suggestions. The individuals that participated in this review were: Mr. Julian H. Sparrow and Mr. Bernie Strauss from NIST, as well as, Mr. Tom Harkins from the U.S. Army Research Lab/Materials Directorate, Watertown, MA.

The Code Q Standing Committee, chaired by Hector Delgado from KSC, has established Guidelines and Criteria for the assessment of candidate RTOPs for development of recommendations to NASA Headquarters.

NASA CENTERS NEWS AND ANNOUNCEMENTS

ARC

John Segreto, 415-604-4112

USA FIRST-EVER GRAPHITE/EPOXY COMPOSITE WIND TUNNEL COMPRESSOR BLADE HAS BEEN SUCCESSFULLY TESTED NONDESTRUCTIVELY: UT and RT were used to determine the structural integrity of this Ames Research Center developed and built wind tunnel blade.

Squitter thru-transmission C-scan and an advanced X-ray system called Digiray™ (otherwise known as reverse geometry X-ray) were both identified to be very effective methods. These methods were applied under a cooperative NASA/DoD effort with McClellan AFB, Sacramento, CA. Working together in a true spirit of cooperation and enthusiasm, using high levels of experience and sophisticated equipment, a very successful NDI program was accomplished. Precious time and limited financial resources were saved by using advanced technology and equipment that are readily available.

GSFC

Dr. E. J. Chern, 301-286-5836

NASA-HQ VISIT: Mr. Robert Burdine, the former HQ Code QR representative, and Dr. Ted Lynch of Vitro visited the Materials Branch, Office of Flight Assurance, Goddard Space Flight Center on August 26, 1993. They met with Mr. Brian Keegan at the directorate office and then visited the Quality Assurance and Detector Development Laboratory, which is the new location of the Materials Branch. Mr. Burdine and Dr. Lynch met with Mr. Richard Marriott, Head of the Materials Branch and several branch members to discuss the NASA NDE Working Group efforts. Mr. Burdine and Dr. Lynch also toured the branch laboratories after the meeting.

JPL

Dr. Y. Bar-Cohen, 818-354-2610

INDUSTRY/ACADEMIA INTERACTION: JPL continued to hold monthly Technical Seminars that are opened to the industry and academia. This JPL Seminar series was initiated in Feb. 1992 as a forum for collaboration and technical interaction. The August speakers were Dr. N. Shaikh from Analytical Engineering, Milpitas, CA, and Dr. N. Hagood from MIT. Dr. Shaik presentation was entitled "Smart Structural Composites with Piezoelectric Micro-Constituents", whereas Dr. Hagood's presentation was entitled "Solid State Actuators: Materials, Mechanisms and Devices". The September speaker was Dr. A. Biswas from JPL and his presentation was entitled "Materials Process Monitoring Using Raman Scattering and Fluorescence Emission".

A SYSTEM FOR COMPOSITES ELASTIC PROPERTIES MEASUREMENT: Jointly with UCLA, a leaky Lamb wave system was developed for measuring elastic properties of composite materials. The system requires access from only one side of a part and utilizes lamb waves analysis. The software is now operational for unidirectional laminates and efforts are underway to expand the capability to multi-orientation composites. This work is conducted jointly with Prof. Ajit Mal and Dr. Shyh-Shiuh Lih from UCLA's MANE Dept. and potential applications are considered in collaboration with Northrop, Hughes and Rohr.

NASA-WIDE NDE SPECS: Comments from members of NNWG on the two JPL-developed NDE of composite specs are being incorporated into the final documents.

JSC

C. Salkowski, 713-483-3599

JSC IS SUPPORTING THE AIR FORCE REVISION OF MIL-STD-1522: A draft of a related interim policy letter requires rigorous inspections of graphite/epoxy overwrapped pressure vessels at KSC. JSC is collecting data on potential defects, acceptance criteria, and inspection methods, to ensure that implemented tests have value added. Initiating an inspection requirement before all critical defect types

are identified and proven inspection methods are available, may result false rejection of vessels with an associated cost of millions of dollars to NASA.

CCRB IS MAKING PROGRESS IN RESOLVING ALL ACTIVE ORBITER CORROSION ISSUES:

The Orbiter Corrosion Control Review Board (CCRB) is making recommendations for preventive maintenance and inspections. One activity involves a comprehensive review of all structural regions that are not inspected due to limited access or various other reasons. Identified regions will be evaluated for potential corrosion or cracking problems.

SPACE STATION NDE ISSUES ELEVATED TO LEVEL II AUTHORITY: The new space station integration contractor, Boeing Defence and Space Group, has concurred with JSC's plan on the requirements for demonstration of NDE capability concerning fracture critical hardware. This task has been elevated to Level II authority which means that, for demonstration of flaw detectability, all other work packages will have access to JSC flaw specimens and services.

DoD AND FAA TENTATIVELY AGREED TO BACK NASA STANDARD FOR FRACTURE MECHANICS ANALYSIS OF AEROSPACE STRUCTURES: This development will require significant coordination among various government agencies concerning the identification of assumed NDE initial flaw sizes for both newly manufactured hardware and field inspections. Standardization on a single fracture analysis program will allow more direct comparison of Interagency inspection capabilities.

KSC

J. Larson 407-867-3423

EG&G FLORIDA WINS BASE OPERATION: NASA has selected EG&G Florida Inc. for final negotiations for the operations contract at Kennedy Space Center. The KSC NDE laboratory operations are part of that contract. Pending final contract approval, NDE support services and personnel are expected to remain essentially the same as present.

LaRC

M. Namkung, 804-864-4962

DELIVERY OF PROTOTYPE EVALUATION SIMPSON PROBES TO INDUSTRY FOR EVALUATION: A hand-held, self-nulling eddy-current probe developed at LARC (Simpson probe) has been delivered to both Boeing Commercial Airplanes and McDonnell Douglas Aircraft for evaluation. Each probe was accompanied by a set of standard test panels and a manual describing the characteristics. The NDI personnel of each company were briefed on the operational principles, detection capabilities and the projected development of the probe. The company personnel will test the applicability of the probe to the fatigue crack detection in many different areas of aircraft bodies. The objective is to produce feedback information that is essential to the upcoming technology transfer briefing for commercialization of the probe, which is scheduled for Oct. 22, 1993.

P. H. Johnston, 804-864-4966

PORTABLE PC ULTRASONIC INSTRUMENT CONFIGURED FOR DETECTION OF DISBONDS AND CORROSION IN AIRCRAFT STRUCTURES: Commercial ultrasonic pulser/receiver and digitizer were procured and installed in a portable personal computer for a development platform of portable ultrasonic instrumentation for inspection of aging aircraft. The data acquisition software developed by the vendor was modified to include NASA LaRC developed data processing techniques. These techniques include a neural network based algorithm for disbond detection and the spectral analysis scheme for quantitative detection of corrosion. A hand scanner connected to a PC enables rapid manual scanning and imaging of test regions. In its current configuration, the entire instrumentation is packaged in the portable computer, except for the transducer and the hand scanner. As a demonstration of its functionality, the instrument was used to scan a 1.6 mm thick aluminum sample with milled material loss that was previously scanned using a desktop scanner in conjunction with a rack of ultrasonic instruments (see Figure 1). There is excellent agreement between the material losses obtained and the sample documented material losses.

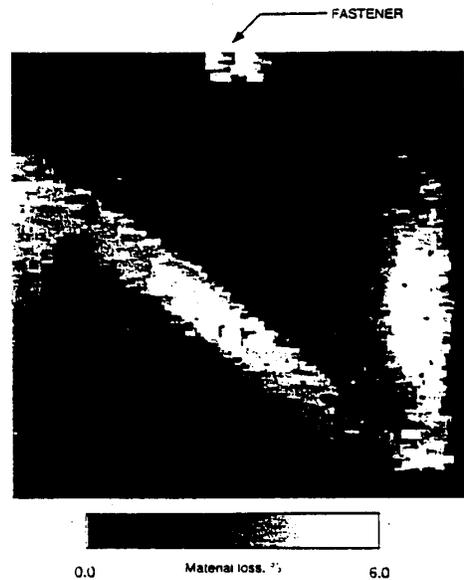


Figure 1: Hand-scanned image of 1.6 mm aluminum sample with milled material loss in the shape of the letter "N". Material loss ranges from 0 to 6%.

LeRC

A. Vary, 216-433-6019 or Dr. G. Baaklini, 216-433-6016

The progress made at the NDE Laboratory during last year includes but is not limited to:

- * Collaboration with engine companies in the Metal Matrix Composite life system Development Program.
- * Organization of an NDE workshop to assess and guide the growth of NDE technology by our industrial and academic partners.
- * Transitioning NDE Modalities developed under the Advanced High Temperature Engine Materials Technology Program (HITEMP) to the Enabling Propulsion Materials Program (EPM).
- * Installation and testing of a thermal wave imaging system for microstructure characterization of HITEMP panels and components.
- * Integration of in-situ NDE and mechanical testing system to monitor failure mechanisms in composites at 1550°C (2800 F).
- * Improvements of ultrasonic imaging systems in interrogating advanced composite plates and rings.
- * Installation and verification of an x-ray microtomography system for composite characterization and analytical modeling.
- * Demonstration of acousto-ultrasonics capabilities in monitoring changes in axial modulus and interfacial shear strength of ceramic and intermetallic matrix composites.

- * Demonstration of neutron diffraction capabilities in measuring residual stress in intermetallic matrix composites.

MSFC

R. Neuschaefer, 205-544-7382 or Dr. S. Russell, 205-544-4416

DEVELOPMENT OF SILICON NITRIDE BALLS NDE PROTOCOL: Progress has been made in this multi-center, multi-Agency and contractor activity to develop an NDE Protocol for the acceptance of silicon nitride balls for the Alternate Turbopump Development (ATD) bearings. The ATD is a planned replacement for the current Space Shuttle Main Engine Turbopump. Mr. Jonathan Salem of the Ceramics Branch of LeRC continued his major contribution by developing reference standards and Dr. George Baaklini of the LeRC NDE Branch continued providing NDE expertise. Dr. Eric Madaras of the LaRC is providing valuable assistance in applying the Scanning Electron Microscope (SEM), Scanning Electron Acoustic Microscope (SEAM), and Laser Ultrasonic Imaging of ball and flat plate LeRC specimens.

EFFECTIVE TESTS OF GRAPHITE/EPOXY BOTTLES: Work funded under the RTOP entitled "Filament Wound Composite Pressure Vessel Damage Tolerance Program" through Dr. Dan Mulville, code QE, is continuing. The NDE characterization using shearography and Video Image Correlation (VIC) by Dr. Sam Russell has proven very valuable in characterizing the Graphite/Epoxy ASTM bottles. NDE tests are also planned for Kevlar/Epoxy bottles .

IMPROVEMENT OF SURFACE CONTAMINATION MEASUREMENTS: Surface contamination measuring capability, using Optically Stimulated Electron Emission (OSEE), has been improved dramatically as a result of the team activity by LaRC, MSFC, Thiokol, and the original equipment manufacturer. LaRC delivered three units to MSFC on October 1, 1993. These units will be evaluated inhouse at MSFC with a goal of transfer and implementation in the RSRM program. According to Dr. Tom Yost, LaRC Lead, these improvements eliminate the repeatability problem of prior models and provide an increase in sensitivity. The only activity remaining to bridge this technology transfer gap will be Code QR support for the team in development of reference standards and a noncontacting proximity control mechanism.

COMING EVENTS (All events are based on Eastern standard time)

1993

Oct. 28 - 1:00 pm*, NDE Working Group, teleconference.

* **Note:** This is one hour earlier than previously planned.

Nov. 1 - A letter from Mr. J. Larson will be sent to solicit a consistent format of the NNWG Directory

Nov. 8 - Fall ASNT Conference in Long Beach, California. ASNT is planing a half day tour of the JPL facility and its NDE lab.

Nov. 19 - The input to the NNWG directory should be sent to Mr. J. Larson before or by this date.

1994

March - The 2nd NASA Materials and Processes Meeting will be held at JSC.

NASA NDE Working Group (NNWG) Newsletter

This NNWG Newsletter is published quarterly by the NNWG and NASA HQ Code QR for the NASA NDE Community.

Editor: Dr. Yoseph Bar-Cohen, JPL

**All communications should be addressed to:
NNWG Newsletter, JPL, M.S. 82-105, 4800 Oak Grove Dr., Pasadena, CA 91109-8099,
Phone: (818)-354-2610 and FAX (818)-393-4057**
