NASA M&P UPDATE (NMPU)

October 1998 **NASA M&P Update Newsletter** **Vol. 2, No. 1**

http://eis.jpl.nasa.gov/ndeaa/nasa-mp/mp-hp.htm or Webhub http://ndeaa.jpl.nasa.gov

FROM THE EDITOR

We are pleased to publish the second issue of the NASA Materials & Processes Update (NMPU). This Newsletter is a communication forum of the NASA M&P Working Group (NMPWG) and efforts will be made to publish it quarterly from this issue. The goal of the NMPU is to serve as a communication platform for technical information interchange among the space M&P scientist and engineers. We are seeking to cover M&P space related activity and technical news from the various NASA Centers, the aerospace industry, academia, standardization technical societies and other non-NASA organizations (NGS). Efforts are made to report information in a format of short paragraphs with a point of contact for inquiries of further details.

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NASA TECHNICAL STANDARDS

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THE CHANGING CLIMATE FOR STANDARDS IN NASA

The goal of the NASA has a Technical Standards Program is to support the needs of Enterprises and their programs for Technical Standards. This program is part of the "Provide Aerospace Products and Capabilities" Cross-Cutting Process in the NASA Strategic Plan. The program is sponsored by the NASA Chief Engineer's Office and establishes preferred technical standards for use on NASA programs. The program establishes the process for the coordination and development of engineering standards products through a Lead Center at the Marshall Space Flight Center. It provides an integrated administrative system for the issuance of all NASA technical standards, including those developed and approved under the functional authority of other Headquarters' offices.

OMB Circular A-119, "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities," directs all Federal Agencies to "use Voluntary Consensus Standards in lieu of Government-unique standards except where inconsistent with law or otherwise impractical." It also states that Federal Agencies should "give preference to performance standards when such standards may reasonably be used in lieu of

prescriptive (Voluntary Consensus or Government-unique) standards."

Objectives of the Program as reflected in NASA Program Directive 8070.6A "Technical Standards" include: (1) the development and maintenance of an integrated system of NASA Preferred Technical Standards for use in enterprise programs; (2) improve the availability of technical standards products for the design, development, and operation of NASA programs; (3) reduce duplication of efforts and improve interoperability; and (4) promote the increased use and development of national and international Voluntary Consensus Standards in NASA Programs.

GOALS: The goal of the NASA Technical Standards Program is, therefore, to assist NASA to become more productive in Agency-sponsored programs and projects through the use of effective technical standards products. Another goal is to help the Agency improve contractual agreements with its suppliers through greater recognition of standard commercial practices. An additional goal is to assist NASA engineers and program and project managers in selecting appropriate technical standards for their programs and use in evaluating proposals. Performance standards and specifications are an excellent way to achieve these goals. However, if a sound business or technical justification can be made for mandating a Government-unique (NASA or otherwise) or Voluntary Consensus prescriptive standard or specification in a procurement action, then that is the direction which NASA should pursue.

CURRENT STATUS: The NASA Technical Standards Program activities over the past couple years have moved forward rather rapidly. A major asset of the program is the NASA Engineering Standards Steering Council consisting of a senior staff member from each Center and JPL. The Council plays a key role in the identification and recommendations to the NASA Chief Engineer regarding the selection of standards products for inclusion in the NASA Preferred Technical Standards listing, which is available through the Technical Standards Program HomePage: http://standards.nasa.gov. Currently the listing consists of 9 NASA-unique engineering standards plus 8 in development; 414 VCS standards adopted by NASA, plus 450 candidates for adoption. It also contains an important and growing list of 13 NASA safety and mission assurance standards plus 7 in draft form; 17 information technology standards; proposals for adoption of 21 data communications standards from ISO/CCSDS actions; and a link to over 4000 standards concerning facility construction via SPECS-INTACT system. It should be noted that about 70 percent of the standards products currently included in the NASA Preferred Technical Standards listing are in the materials and processes area. The NASA Materials and Processes Working Group has played a key role in the identification and support of the adoption of these standards.

POTENTIAL AREAS FOR PARTICIPATION: What are some potential areas for continued Materials and Processing Working Group members' participation and assistance to the NASA Technical Standards Program? Some actions needed include the continuing need to recommend Voluntary Consensus developed products for adoption; identification of constantly used Government-unique products, including Center peculiar, that can be replaced by Voluntary Consensus Standards; and actively participating in the standards developing efforts of Voluntary consensus Standards bodies. Where Voluntary Consensus developed standards do not exist, the Working Group members can be most valuable in taking the initiative to develop NASA-unique standards products, not only for use in NASA activities, but also to capture "lessons learned". Where potential application extends beyond NASA, those NASA-unique standards may also be the starting point for future VCS projects.

FUTURE DIRECTION: The NASA Technical Standards Program's future thrusts include to increase NASA use of Voluntary Consensus Standards, conduct selective development of NASA-unique standards products where necessary,

better harmonize with national and international standards organizations, and fully exploit the use of Web based capabilities to promote access to NASA Preferred Technical Standards products. In this regard, I encourage you to check the Programs HomePage frequently should be consulted for additional details and timely information on the Program activities and products. The website is: http://standards.nasa.gov and inquiries or comments on how we can improve the Program may be addressed to (256) 544-2488 or e-mail: nasa.standards@msfc.nasa.

Figure 1: Some of the participants of the 6th NASA M&P Meeting at LeRC, held in May 1998. From left to right: Don Louis (JPL), Harry Johnson (WSTF), Gail Horiachi (JSC), Dennis, Griffin (MSFC), John Reagan (LeRC), Paul Gill (MSFC), Scott Murray (KSC), Joe Jones (LeRC), Mike Yentzen (SSC).

NMPWG

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NMPWG BACKGROUND

The NASA M&P Working Group (NMPWG) was formed in 1992 and it consists of a coordinator and an alternate member from each of the NASA Centers. Initially, NMPWG concentrated on the formation of standardized specifications using mature documents from individual NASA Centers. Now, the NMPWG efforts are directed to addressing general M&P issues that are related to space technology. The standardization part of the NMPWG efforts has shifted to adoption of Non-Government Organizations (NGS) standards as well as the transfer of NASA's mature standards to become VCS documents.

The first NASA-wide meeting of NMPWG was held in March 1993 at the Jet Propulsion Laboratory (JPL), Pasadena, CA. The most recent NMPWG meeting was the 6th one and it was held in May this year at LeRC, Cleveland, OH. Up until 1995, the effort was managed by Richard Weinstein, NASA HQ, and Chaired by Tim O'Donnell with the assistance of Yoseph Bar-Cohen, JPL. The effort has chaired by Frank key, MSFC, and Co-Chaired by Dennis Griffin, MSFC. The Standardization efforts are now under the responsibility of Gabriel Wallace, MSFC, and Paul Gill, his deputy. To support the NMPWG activity, JPL created in 1994 a homepage and its URL address is:
http://nasa-mp.jpl.nasa.gov/jpl-mp/homepage.htm.

6th NASA M&P INTERCENTER COMMITTEE MEETING HELD IN MAY AT LeRC

The meeting at LeRC covered the concerns and progress of the various NASA Centers in the various areas related to materials and processes. The issues of ISO, NASA standards and the adaptation of non-NASA standards were discussed. Further, it was agreed that there is a need to expand the collaboration with the space industry through the continuation of the NMPU Newsletter and to take an initiative to form annual conference on the topic of Space M&P which can be done under the auspices of a related technical society such as ASTM, SAE or SAMPE.

NASA CENTERS ACTIVITY

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DEGRADATION OF HUBBLE SPACE TELESCOPE TEFLON® FEP

During the Hubble Space Telescope (HST) Second Servicing Mission (SM2), 6.8 years after

deployment, astronauts noticed severe cracking in the unsupported outer layer of the multi layer insulation (MLI) blankets (aluminized Teflon® FEP). The cracking was found in hundreds of locations on both solar- and anti-solar-facing surfaces of the telescope. The most dramatic crack, more than one meter long, occurred on the solar-facing side of the telescope's light shield. The astronauts patched the worst of the damage and retrieved a sample of the degraded outer layer for ground testing. A failure review board was established to, among other tasks, determine the cause of the damage and select a replacement material.

The first phase in determining the damage mechanism was to characterize the damage. The mechanical, chemical, molecular structure, and thermo-optical properties of specimens retrieved during servicing missions were characterized using over one hundred analyses performed by materials experts from NASA (GSFC, LeRC), private industry, and academia. This investigation determined that the defects were a form of slow crack growth requiring a low load and the presence of a damaging environmental factor. The specimens exhibited surface hardening and bulk embrittlement due to chain scission. Exposure to high temperature extremes (+200 °C) increased the crystallinity of the material. The solar absorptance increased significantly due to cracking and delamination of the metallization, changes in the bulk FEP, and UV darkening of adhesives, in bonded areas

The second phase involved simulated orbital environmental exposures to determine what damage could be caused by trapped electrons and protons, vacuum ultraviolet (VUV) and soft x-ray radiation, and thermal cycling. Pristine Teflon® FEP specimens were exposed to individual components of the orbital environment using facilities at NASA (GSFC, LeRC) and Brookhaven National Laboratories National Synchrotron Light Source. These experiments revealed that while these environmental factors could cause changes in the bulk FEP similar to what was observed on HST, the damage at HST-comparable doses was not nearly as severe as HST experienced. The most damaging combination was electron and proton exposure followed by thermal cycling.

To select a replacement material and prove its durability, ten candidate materials were exposed to roughly ten year doses of thermal cycling, atomic oxygen, and charged particle, UV, VUV and x-ray radiation using facilities at NASA (GSFC, LeRC, MSFC) and at Boeing Defense and Space Group. Based on the results of mechanical and optical testing, the board selected 5 mil Teflon® FEP bonded to a Nomex® scrim to replace the damaged MLI.

> Based on this testing, the board concluded the following: *The observations of HST MLI and ground testing of pristine samples indicate that thermal cycling with deep-layer damage from electron and proton radiation are necessary to cause the observed Teflon® FEP embrittlement and the propagation of cracks along stress concentrations. Ground testing and analysis of retrieved MLI indicate that damage increases with the combined total dose of electrons, protons, UV and x-rays along with thermal cycling*.

The results of this study have been documented in more than twenty-eight publications. A general overview of the major areas of the investigation can be found in the references below.

1. P.A. Hansen, J.A. Townsend, Y. Yoshikawa, J.D. Castro, J.J. Triolo, W.C. Peters; "*Degradation of Hubble Space Telescope Metallized Teflon FEP Thermal Control Materials,*" Science of Advanced Materials and Process Engineering Series, 43, 570 (1998)
2. J.A. Townsend, P.A. Hansen, J.A. Dever, J.J. Triolo; "*Analysis of Retrieved Hubble Space Telescope Thermal Control Materials,*" Science of Advanced Materials and Process Engineering Series, 43, 582 (1998)
3. L. Wang, J.A. Townsend, M. Viens; "*Fractography of MLI Teflon FEP from the HST Second Servicing Mission,*" Science of Advanced Materials and Process Engineering Series, 43, 594 (1998)

4. C. He, J.A. Townsend, "*Solar Absorptance of the Teflon FEP Samples Returned from the HST Servicing Missions*," Science of Advanced Materials and Process Engineering Series, 43, 607 (1998)
5. J.A. Dever, J.A. Townsend, J.R. Gaier, A.I. Jalics, "Synchrotron VUV and Soft X-ray Radiation Effects on Aluminized Teflon FEP," Science of Advanced Materials and Process Engineering Series, 43, 616 (1998)
6. J.A. Townsend, P.A. Hansen, M.W. McClendon, J.A. Dever, J.J. Triolo; "*Evaluation and Selection of Replacement Thermal Control Materials for the Hubble Space Telescope*," Science of Advanced Materials and Process Engineering Series, 43, 968 (1998)

JPL

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MLS PRIMARY REFLECTOR

The Primary Reflector for the Microwave Limb Sounder Mission has been delivered by Composite Optics, Inc. under contract to JPL (see team members in Figure 2). The MLS Instrument is a passive radiometer that senses atmospheric thermal emissions in the submillimeter wavelength bands. This instrument will contribute to the understanding of ozone depletion, climate forces, volcanic effects and tropospheric mixing. This instrument is a successor to the highly successful Upper Atmosphere Research Satellite (UARS). The Primary reflector is an ellipse of 1.6 meters by 0.8 meters and of all composite construction (Figure 3). The front surface is roughened to provide diffuse reflectance of sunlight, and then overcoated with vapor deposited aluminum (VDA) and silicon monoxide to control the thermal balance. The entire reflector weighs only ten kilograms and has a measured surface accuracy of 4.8 microns root-mean-squared. With respect to areal density and overall aperture, this reflector is thought to be the most accurate ever made.

Figure 2: Eldon Kasl (Left) of Composite Optics and Paul Willis of JPL next to the MLS Primary Reflector.

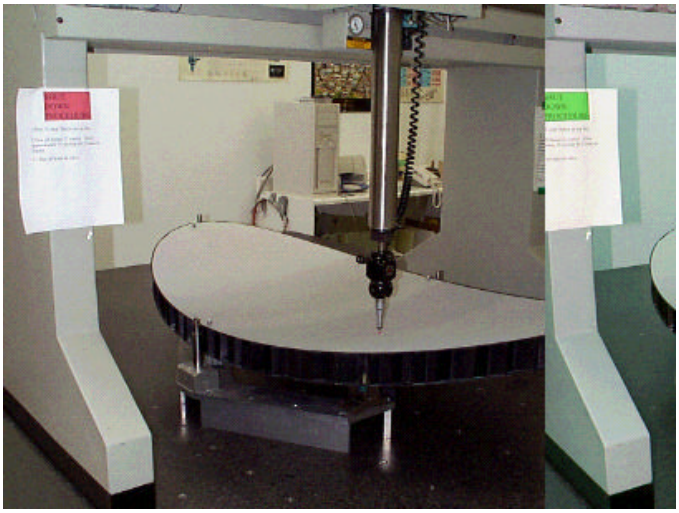

Figure 3: Coordinate Measuring Machine (CMM) checking the surface of the reflector.

ALTERNATIVES TO OZONE DEPLETING SUBSTANCES FOR CLEANING JPL PROPULSION SYSTEM HARDWARE

David Soules has completed an evaluation of three cleaning solutions that are potential replacements for Freon in cleaning propulsion system hardware. The cleaning solutions that were investigated include: Brulin 815GD, Navy Oxygen Cleaner, and Safety Wash AC. Each of these aqueous candidate solutions satisfied the criteria for replacement solutions. Criteria include environmental protection standards, Ozone Depleting Potential (ODP)

requirements, Global Warming Potential (GWP) requirements, and they are not considered Volatile Organic Compounds (VOC). Other requirements included the solutions be non-flammable, non-toxic, and cost effective. Each cleaner was evaluated using several types of metallic samples (7075 Aluminum, 304 Stainless Steel, Ti-6Al-4V, and Invar 36) contaminated with various machining oils. After cleaning each test specimen was subjected to a visual, ultraviolet light, and water break evaluation. The cleaning solutions were also tested to determine if they promoted stress corrosion cracking of Ti-6Al-4V. A final evaluation involved testing the ability to clean extreme hydrocarbon and silicon-based vacuum compatible lubricants on aluminum coupons. After a precision cleaning, the coupons were examined for any residue using Non-Volatile Residue (NVR) analysis. After reviewing the test data, all three cleaners were judged to be acceptable replacements for Freon when cleaning JPL propulsion system hardware.

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SRTM TO MAP THE EARTH'S LAND SURFACE TOPOGRAPHY

SRTM is an upcoming NASA mission that will use a modified version of the Spaceborn Imaging Radar (SIR-C) to map the earth surface topography. SIR-C, which has flown twice already in the Space Shuttle, will be modified to operate as a fixed-baseline interferometer with the goal of producing a digital topographic map of 80% of the Earth's land surface. In order to create a fixed baseline interferometer, a second outboard antenna has been fabricated that will be deployed 60m from the shuttle bay using a deployable composite mast fabricated by AEC-Able. Figure 4 and 5 show the 8m composite outboard antenna attached to the can, which houses the deployable mast. The outboard antenna structure was fabricated by Composite Optics, San Diego, using high modulus graphite fibers in a polycyanate ester resin system. The outboard antenna structure weighs 230 pounds and supports an additional 620 lbs. of hardware. The structure is being prepared for modal testing prior to shipment to Kennedy Space Center.

Figure 4: Outboard Support Structure (OSS) for the SRTM project, which consists of a graphite/epoxy structure.

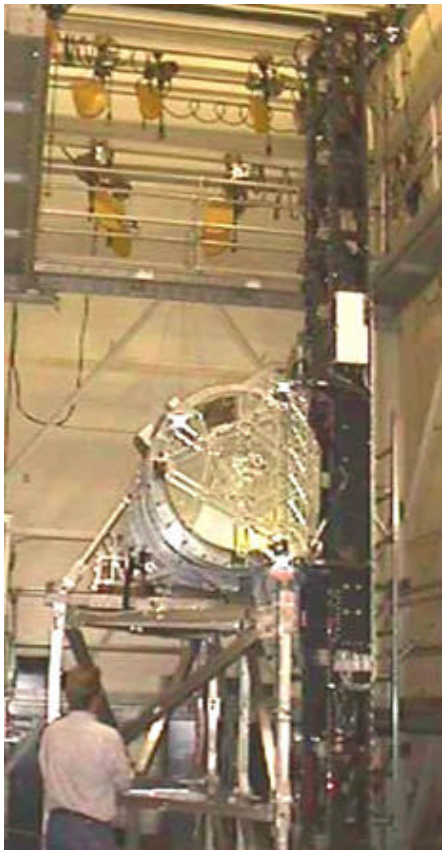

Figure 5: The OSS integrated on the can, which houses the deployment mast.

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NATIBO WORKSHOP HELD AT JPL -- COVERING CORROSION DETECTION TECHNOLOGY INSERTION

The NATIBO team from the USA and Canadian Departments of Defense held its 2nd workshop on Corrosion Management at JPL, Pasadena, CA, on July 8 and 9, 1998 (Figure 6 shows some of the attendees next to the Mars Pathfinder Model). The objective of this series of workshops is to establish a corrosion management program that would generate high payoff. Three technologies were ranked to have a high interest: robotics, data fusion, and sensors. A project strawman outline was established consisting of multiple sensors mounted on a robot programmed to crawl on an aircraft/helicopter. The sensors data output would then be fused to increase the accuracy and the Probability of Detection. Leading NDE experts estimate the sensor-fusion package to be the least mature technology and to post great challenges. Three sensor technologies were selected for inclusion: Edge of Light (see page 11), ultrasonics and eddy current. The JPL's MACS crawler (see Figure 7) was identified as a potential platform for low cost open-architecture robotic baseline. MACS is a small, highly dexterous crawler with payload to weight ratio of about 10:1, designed to perform complex scanning tasks. It suction cups for controlled attachment and it was designed to inspection large structures particularly in field and depot conditions.

In an effort to develop efficient, low cost system with adaptable functionality, MACS was designed as a generic mobile robot. Its platform can carry PC-type boards to serve as a "walking motherboard". MACS is applicable to many areas, including aircraft testing or maintenance, ships paint removal and painting and high-rise windows cleaning. The potential formation of large pool of users and developers would lead to rapidly improving, affordable and tailorable system with a success similar to the personal computers. The crawler performance can be remotely and centrally thru such tools as the internet using password. To employ as much as possible low-cost, off-the-shelf hardware, the crawler platform should be constructed with a standard bus structure, including ISA, PCI or PCMCIA interfaces. To define the crawler functionality, plug-and-ply boards will be needed. Currently, NDE hardware manufacturers have to develop a complete instrument each time a new product is introduced. It is envisioned that concentration on the development of components with focused NDE functionality (e.g., ultrasonics) will have great payoff. It would lead to substantial lower cost of future instruments and to a faster transition of NDE technology to commercial use.

Figure 7: Some of the attendees of NATIBO workshop that was held at JPL July 8-9, 1998. From Left to right: David Hsu, Vinod Agarwala, Mike Slack, Jerszy Komorowski, Yoseph Bar-Cohen, Brian Lepin, Nancy Hoesly, and Thomas Condon.

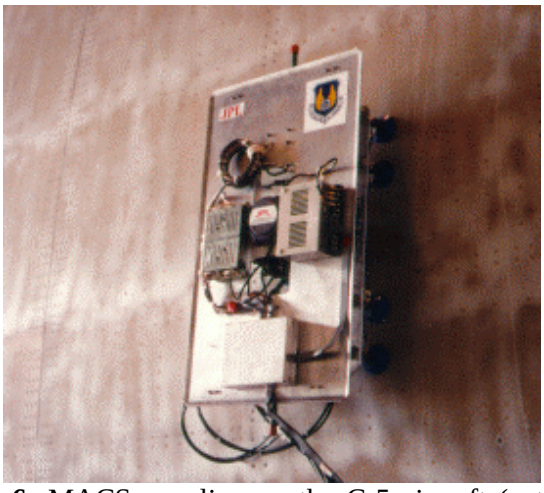

Figure 6: MACS crawling on the C-5 aircraft (patent pending).

ELECTROACTIVE POLYMER (EAP) MUSCLE ACTUATORS *(Webhub: http://ndeaa.jpl.nasa.gov/)*

Electroactive polymer actuators that behave similarly to biological muscles are being developed for space applications. This Telerobotic task is sponsored by NASA Code S and is conducted jointly with LaRC, the University of New Mexico and Virginia Tech. Two families of materials were developed: (a) Bending actuators - made of perfluorinated ion-exchange membrane platinum composites, and (b) Longitudinal actuators - electrostatically activated polymers. These EAP materials have enabled new technologies and applications, including surface wiper for dust removal from solar cells and optical windows, as well as a miniature manipulator arm (Figure 8). The August issue the Discover Magazine covered this activity under the title Breakthrough Technologies. This effort is changing the paradigm about robots where complex mechanisms are replaced by simple actuators made of electroactive polymers.

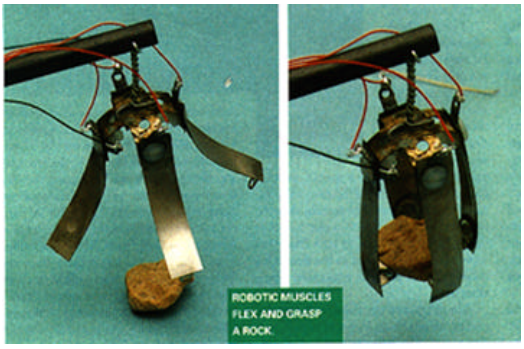

Figure 8: A gripper with electroactive polymer fingers for a miniature, light robotic arm.

JSC

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CARBON NANOTUBE PRODUCTION AND APPLICATIONS

The discovery of the Buckyball in the mid-1980's by a group including Nobel Prize-winner Richard Smalley at Rice University led to a new class of carbon-based materials including fullerenes and nanotubes. Single-walled carbon nanotubes (SWNT) are believed to have extraordinary mechanical, electrical, and thermal properties. Structurally, these SWNTs are like a graphitic sheet folded into a cylinder and capped at the ends. Single wall nanotubes are about 100 times stronger than steel, at a sixth the weight. The technology is being developed towards making high strength lightweight composite materials.

JSC is currently producing single wall carbon nanotubes using the double laser ablation process pioneered at Rice University, and performing diagnostic studies of the nanotube production process for better understanding of nanotube formation. This includes emission spectral studies as a continuation of past diagnostic work and more recent work with laser induced fluorescence (LIF). JSC is also using chemical methods to purify raw nanotube material produced from the laser process so that the material can be used for applications studies. Development of nanotube composites is in the preliminary stages and investigations are ongoing. We will continue to expand current applications studies of carbon nanotubes for NASA goals. These applications will include polymer and metal matrix composites, power storage, hydrogen storage, and rapid prototyping. Some of these applications will be researched in conjunction with industry partners. As appropriate these applications will be investigated at JSC and Rice in collaboration.

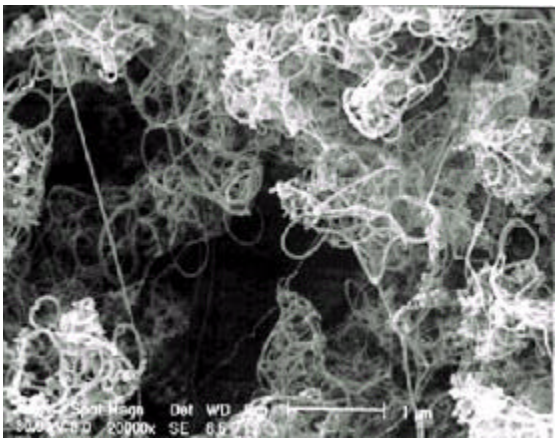

Figure 9: Bundles of carbon nanotubes, produced at JSC, as they appear before purification.

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DEVELOPING A WELDING PROCEDURE FOR JOINING MONEL 400 TO 316L STAINLESS STEEL

An orbital weld procedure to join Monel 400 to 316L stainless tubes, utilizing an Inconel 600 insert, was established and successfully tested at

JSC. The dissimilar weldment is a Space Station requirement for the Umbilical Interface Assembly; the welded tube carries high pressure oxygen gas during service. It was found that the initial Monel 400 /Inconel 600/Stainless Steel 316L qualification welds had inadequate weld mixing and very high carbon levels along the Monel 400 / weldment interface, producing brittle fracture during tensile tests. The carbon-related contributions to the brittle weldments included the carbon levels of the Monel 400 material (worsened since it was manufactured from turned and gun-drilled plate stock) and the as-machined condition of the Inconel 600 inserts. In addition, the initial weld geometry resulted in a heat distribution that further aggravated the condition. A specialized pickling operation from the International Nickel Corporation was used on both the Inconel 600 inserts and the Monel 400 tubes to reduce embedded tooling carbides. This process will be incorporated into the JSC passivation specification and will be available through the JSC/Manufacturing, Materials and Process Technology home page, http://www.jsc.nasa.gov/ea/em/homepage.html. Modifications to the welding procedure and techniques resulted in a weld geometry that minimized Monel 400 dilution into the weld zone and reduced the carbide growth in the Monel 400 heat affected zone. After several stepwise modifications, successful weld qualification samples passed the mechanical and metallurgical test requirements, and the manufacture of the Umbilical Interface Assembly was completed on schedule.

KSC

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ASTM LOX/GOX TEST PROCEDURE

The ASTM LOX/GOX Mechanical Impact test procedure (ASTM G 86) was passed at the Cocoa Beach ASTM meeting, Sept 23 -24. This document will be proposed for acceptance by the ISO TC 20 as "a recognized aerospace standard." This will save at least 3 years of effort. ASTM E 595 is also being proposed as "a recognized aerospace standard." ISO 14952-surface cleanliness of fluid systems has been circulated through TC20/SC14 Working Group 3 for what we hope is the final ballot before being recognized as a Draft International Standard (DIS). Three new draft documents on testing for compatibility with hypergol fluids are in tech writing. They will be proposed as extensions to ISO 14624 at the October meeting in Noordwijk, the Netherlands, to ISO TC20/SC14 Working Group 1.

LeRC

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ISO AT NASA LEWIS RESEARCH CENTER

Lewis Research Center has continued to streamline their Materials and Processes procedures in the wake of the coming ISO 9000 certification. There are 1-10 internal processes in review that will assure Materials and Processes conformance to the overall Business Management System. We have begun transitioning a significant amount of our inhouse design and fabrication to a prime contract know as MRDOC. The RFP was issued in early September.

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HIGH HEAT FLUX RIGS FOR TESTING THERMAL BARRIER COATINGS

Thermal barrier coating (TBC) advancements have been measured largely by coating performance in cyclic furnaces and burner rigs with verification by engine testing and field experience. These laboratory tests have been remarkably good predictors of coating performance in engines. However, certain future coating applications may involve longer hold times at high temperatures, higher gradients and/or thicker coatings in, for example, combustors. Thus, there may be new effects operating in those conditions which are not captured in furnace or conventional burner rig tests. Thus, we at NASA-LeRC have been looking into a variety of high heat flux test approaches for testing TBC-coated as well as non-TBC-coated test specimens or sub-components. These tests include moderately high power CO2 lasers, an arc lamp, and high-pressure burner rigs.

MSFC

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MSFC HAS A NEW DIRECTOR

Arthur G. Stephenson, who was formerly with Oceaneering, Houston, Texas, as well as TRW, has been recently appointed by Dan Goldin to serve as the new NASA's MSFC new Director. Carolyn Griner will remain the Deputy Director.

FRANK KEY ASSIGNED TO THE MSFC SCIENCES & ENGINEERING DIRECTOR OFFICE

Frank Key left the M&P Laboratory of MSFC, where he served as the Deputy Director. His new assignment is as an Assistant to the MSFC Science and Engineering Director, Bill Taylor. The announcement is at http://www.msfc.nasa.gov:80/msfccwa/key/carlofrank.html.

STRESS CORROSION STANDARD

A year ago, MSFC recommended proposing a new stress corrosion standard project to ISO and the NMPWG approved. Later, the full ISO SC14 subcommittee approved the new work item at the May 1998 meeting in Beijing. At that time, MSFC delivered its first draft of the document. In June of this year, ECSS published their own two standards on stress corrosion - one on materials selection, the other on determining susceptibility. It remains to be seen if ECSS will propose using the fully approved ECSS documents in the ISO standard. There is an agreement (the Vienna Agreement) between ISO and CEN, the European Regional Organization, to coordinate work programs in order to avoid duplication and conflict. Under this agreement, recommended documents could go straight into the system as Draft International Standard (DIS's) if approved by the ISO working Group. DIS's are considered to be mature documents for which processing is focused on formal national votes and "RIDS" rather than open technical discussion.

THE CRITICAL NEED FOR US TO BE INVOLVED IN ISO

MSFC and KSC have been actively participating in the development of ISO standards for the Space Systems/Design Development and Operations Committees (TC20/SC14/WG1 and WG3). These efforts include primarily M&P related aerospace standards for flammability, toxic offgassing, aerospace fluids, contamination control, oxygen compatibility, hypergol compatibility, and testing to determine the susceptibility of metals to stress corrosion cracking, etc. Dick Weinstein, NASA HQ, is seeking strategies for future potential M&P related ISO and Voluntary Consensus Standards (VCS) standards projects. European interest in this area has intensified through activities of the ECSS (European Cooperation for Space Standards, the pan-European consortium), in which ESTEC is taking the lead. Because of European Union (EU) legal requirements, "National" positions of the 15 European countries are now being replaced by "unified" European Positions, which all EU members are committed to support - in effect, block voting. In this situation, it is extremely important to have strong technical representation to actively contribute to determining the work program. At the upcoming ISO meeting in October, at ESTEC the Europeans are expected to present a proposal for a set of new extensions to current M&P projects for which ISO or ECSS could take the lead. We recognized that there were other useful tests from 8060.1 that have not been included in ISO projects to date, but had originally projected to complete the 4 current sections (flammability, electrical wire flammability, promoted combustion, toxic offgassing) and address others as follow-on proposals. One new proposal from KSC is a hypergol compatibility test described elsewhere in this newsletter).

It is essential that we have US involvement in this process. Increasingly, we will find that international standards cannot be ignored and other countries are fully prepared to use them as competitive tools. They will be baselined both in cooperative programs and in commercial dealings. It's also important to remember that the objective of standards is to establish common technical guidance on a broad international basis so we don't have to repeat it on an individual basis for every new project. It costs to participate but it pays benefits in avoiding conflict and duplication if done correctly. Although the ISO activity supports the Public Law and the OMB Circular A-119

directive to be involved with non-Government standards, the most important reason for participating is that it's the only way to get proven US standards accepted internationally. If we do not take the lead, or participate vigorously (even by mail), then others will determine International standards and we might not always like the answer. In the past, we've frequently said "This is my project" so we'll do things my way." but I believe those days are numbered. Re-inventing the "standards" every time we have a new program is wasteful. There's good logic for international standards and they will be used. For the reasons stated above, what need is some longer term strategic planning about what we want to see in the ISO program. To see more information about the activity of ECSS you can check their website: http://www.estec.esa.nl/ecss/

ISO STANDARD FOR HYPERGOL COMPATIBILITY

KSC has proposed an ISO standard for hypergol compatibility and received a relatively little endorsement due to the assessment of low level of relevance to NASA. This issue needs to be addressed because it is going to be presented at the upcoming ISO meeting in October. A draft of the NASA M&P Design Guide HYPERS_ISO_14624-5 was sent NASA wide for review in May and received specific comments from KSC and general comments from JSC. Efforts are made to release this document in FY99.

OTHER GOVERNMENT AGENCIES

AIR FORCE

Daniel A Cleyrat, ML Space Materials Office 937-656-6482 cleyrada@ml.wpafb.af.mil

AIR FORCE SPACE RELATED ACTIVITY

A major coming event for the materials community is the Joint Service-NASA sponsored National Space and Missile Materials Symposium, which will be held on 19-22 October 98 at the US Air Force Academy. More information can be found at the following Website: http://www.afrl.af.mil/space/spaceinvitpp/index.htm. This symposium is a forum for government, industry, and academia to obtain information and interact on the latest developments in materials and processes for space and missiles. It should provide managers and planners a global perspective for planning and deciding on strategic and investment planning. At the same time, the symposium should provide for the exchange of technical information and interaction by project engineers and scientists. The symposium will also be ideal for users of materials and advanced technologies who have the desire to impact the future direction of science and technology in the field.

The sessions will be focused on the technical challenges facing the Nation's coming generation of space and missile systems in materials and processes. What are the materials and processes show stoppers to advancing the current state of the art? What technical issues are limiting the application of materials to systems? What are the key materials within each application that will provide a high payoff? What opportunities exist for "joint programming" or "joint partnerships" to overcome these challenges?

The objective is to hit the hot topic areas within each session subject since it will not be possible to allocate time to every material activity. The sessions will review current and planned work in each topic area. The goal is to provide a better understanding of DOD and NASA activities in materials and processes, including current and planned work, capabilities and expertise

INTERNATIONAL

CANADA - National Research Council

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EDGE OF LIGHT - GROUND-BREAKING NDT TECHNOLOGY LAUNCHED BY CANADA'S NRC

A groundbreaking approach to non-destructive testing (NDT) has proven its effectiveness in principle, and is now ready for further development and proof testing. The Edge of Light™ enhanced

optical technique was developed at the Institute for Aerospace Research, National Research Council Canada. The Edge of Light (EOL) scanner is unique in its ability to convert changes in surface slope into light intensity variation in an image. The technique is relatively quick, with scanning speeds in the order of 2 to 20 linear cm/sec and line widths of 10 cm or more. EOL inspection results are easily interpreted, as they closely resemble the actual subject. The technology is proven in principle, in detecting corrosion in surfaces and joints, and in inspecting gas turbine components, such as turbine disks. For many applications, EOL performs better than inspections using liquid penetrant, magnetic particle, ultrasonic inspections, or optical microscopy. Development work is under way to incorporate EOL with eddy current inspection in a single device, as the technologies are complementary in many ways.

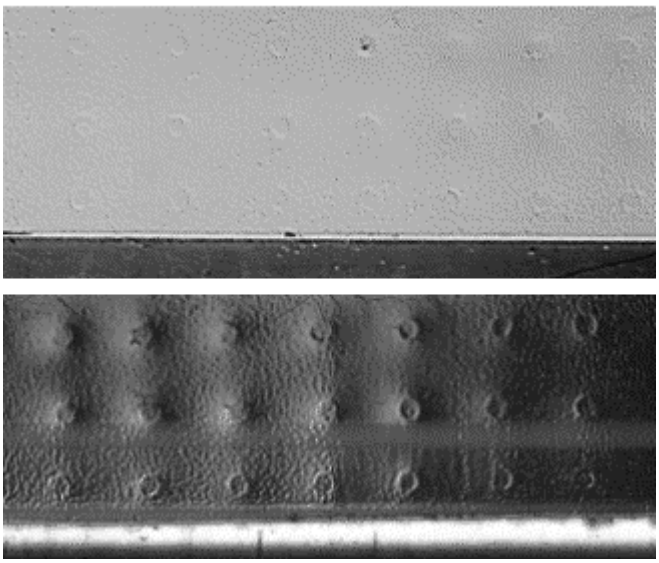

Figure 10: ***Top*** - Lap splice joint from a Boeing 727, as seen by the unaided eye. ***Bottom*** - EOL image of the same lap splice joint clearly showing corrosion pillowing.

UPCOMING EVENT

19-22 Oct 1998	Joint Service-NASA sponsored National Space and Missile Materials Symposium, *Daniel A Cleyrat, 937-255-9081* cleyrada@ml.wpafb.af.mil
1-5 March 1999	SPIE joint Smart Materials and Structures andNDE, Newport Beach, CA., Pat Wight patw@spie.org
22-25 March 1999	ASNT Spring Conference, Nashville, TN, *Lesley J. Hoheisel* lhoheisel@asnt.org
24-27 May, 1999	SAMPE, Long Beach, CA, *Leslie Cohen*, lescohen@aol.com

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