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News Briefs

General Developments

Inquiries about News Briefs, where no contact person is identified, should be referred to the Managing Editor, Journal of Research, National Institute of Standards and Technology, Building 820, Room 126, Gaithersburg, MD 20899-0001; telephone: 301/975-3572.

NATIONAL STANDARDS STRATEGY FOCUS OF SEPTEMBER SUMMIT

In conjunction with the U.S. celebration of World Standards Day on Sept. 23, 1998, NIST and the American National Standards Institute (ANSI) will co-host a summit, "Toward a National Standards Strategy to Meet Global Needs," at the Ronald Reagan International Trade Center in Washington, DC.

The summit will launch a concerted effort to create a more effective national standards strategy that will meet the needs of both the private sector and government. Discussions will cover issues surrounding the development, support and use of national and international standards that significantly affect U.S. manufacturers and exporters. Three scheduled roundtables at the summit will address:

- identifying U.S. needs for domestic, regional and international standardization;
- ensuring that standards reflect the state of technology and that global standards contain U.S. contributions; and
- funding the standards development and dissemination process.

All interested parties, including representatives from standards developing organizations, industry, government, consumers, and other stakeholders, are invited to attend and participate. Cost is $185.

For registration information, contact Lori Phillips, B116 Administration Building, NIST, Gaithersburg, MD 20899-0001 (301) 975-3881, lori.phillips@nist.gov or check out http://www.nist.gov/public_affairs/confpage/ on the World Wide Web. For technical information, contact Krista Leuteritz, Room, 282 Building 820, NIST, Gaithersburg, MD 20899-0001, (301) 975-5104, krista.leuteritz@nist.gov.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov

MICROCALORIMETER FOCUSES ON GENE SEQUENCING

In 1996, NIST scientists developed a revolutionary new x-ray microcalorimeter for precise materials analysis in the semiconductor industry. The advanced-design spectrometer fit easily onto a commercially available scanning electron microscope and achieved x-ray resolution at least 10 times better than many conventional products. Two years later, the researchers are applying the same cryogenic microcalorimeter technology to the problem of measuring large molecular masses. The goal: speeding up human gene sequencing.

The NIST team plans to use the microcalorimeter as the detector on a high-resolution mass spectrometer. In a mass spectrometer, biological molecules like DNA are ionized, accelerated by an applied voltage and separated by mass through a large magnetic field. The new application of NIST's x-ray calorimeter should allow much more efficient detection of these molecules than current devices, resulting in faster and more precise gene mass determination. Since DNA is composed of a chain of specific nitrogen base pairs (cytosine paired with guanine and adenine with thymine) and the mass of these base pairs is known, determining the mass of individual pieces of a DNA sample is one method for gene sequencing.

At present, mass spectrometry techniques can only determine the mass of DNA segments with up to 100 base pairs. "We would like to get to 1000 base pairs," says a NIST scientist. If this is attainable, it could greatly speed up gene sequencing.

For technical information, contact Gene Hilton at MC 814.03, NIST, Boulder, CO 80303-3328, (303) 497-5679, ghilton@boulder.nist.gov.

Media Contact: Fred McGehan (Boulder) (303) 497-3246; mcgehan@boulder.nist.gov

D-DOT SENSOR CALIBRATIONS DELIVER FOR AIRCRAFT INDUSTRY

In order for avionics manufacturers to test their aircraft electronics for susceptibility to outside interference from electromagnetic fields—such as those generated by powerful radars or broadcast transmitters—NIST provides calibrations of the sensors used to measure EMFs. NASA conducts these electromagnetic interference and compatibility (known as EMI/EMC) tests by flying the aircraft close to a high-powered electromagnetic radiator and measuring the resulting EMF inside and outside the craft.

D-Dot sensors (one of the types used in EMI/EMC tests) provide an output voltage proportional to the time derivative of the impinging electric field. These broadband sensors are teardrop-shaped metal objects about 15 cm long, mounted point down over a metal plate using a cylindrical plastic collar. They also may be useful for other forms of EMI/EMC testing. NIST effectively calibrated the D-Dot sensors by mounting them on a metal ground plane near an inverted-cone radiator and inside transverse electromagnetic cells (both are methods of generating known EMFs).

The tests and results are described in Time-Domain Calibrations of D-Dot Sensors (NIST Technical Note 1392), available from Robert Johnk, MC 813.07, NIST, Boulder, CO 80303-3328, (303) 497-3737, johnk@boulder.nist.gov.

Media Contact: Collier Smith (Boulder) (303) 497-3198; smithcn@boulder.nist.gov

INTERNATIONAL TEAM STUDIES HYDRAZINE SPECTRUM

NIST scientists, working with scientists from the Brazilian State University of Campinas, have discovered more than 144 new laser lines in the far infrared (known as FIR) spectrum of hydrazine. The newly defined lines are located in a part of the spectrum where very few lines for laser magnetic resonance (LMR)—an extremely sensitive spectroscopic technique for studying the absorption and emission of electromagnetic radiation in atoms and molecules in a magnetic field were known previously. The new lines should improve the use of LMR for studying molecules in the upper atmosphere and outer space. Understanding the behavior of such molecules is important for studying and assessing the Earth's climate and energy budget.

The 144 new hydrazine lines are particularly noteworthy because only six lines had been known in the LMR range between 50 μm and 200 μm wavelength prior to the NIST research. In addition to the sub-200 μm lines, the research team has discovered and measured the frequency and strength of hundreds of other FIR lines in hydrazine, methanol and difluoromethane during the past few years.

For technical information, contact Kenneth Evenson, MC 847.00, NIST, Boulder, CO 80303-3328, (303) 497-5129, evenson@boulder.nist.gov.

Media Contact: Collier Smith (Boulder) (303) 497-3198; smithcn@boulder.nist.gov

NIST SEEKS PARTNERS FOR CONCRETE IMPROVEMENT PROGRAM

Concrete has been used as a building material for over 2000 years but today's mixture bears no resemblance to its ancestors. Modern concrete represents a sophisticated technology developed through years of research and testing. Since the early 1980s, NIST has continuously sought to improve the predictability and performance of concrete, and then develop the tools needed by the construction industry to make use of these advances.

As part of this continuing improvement effort, NIST recently established the Partnership for High-Performance Concrete Technology (PHPCT). The partnership's purpose is to bring together private firms, government agencies and academia to address critical high-performance concrete issues such as processing, performance prediction, characterization of HPC and its constituents, structural performance, in fires, overall structural performance and economics (including life-cycle costing models).

The PHPCT complements the Strategic Development Council of the American Concrete Institute, another recently established mechanism for fostering partnerships to improve HPC technology. NIST is a member of the SDC.

Organizations interested in joining the PHPCT should contact Geoffrey Frohnsdorff, B368 Building Research Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6706, geoffrey.frohnsdorff@nist.gov.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov

INTERNATIONAL AGREEMENT TO IMPROVE CRYSTAL STRUCTURE DATABASE

A new agreement between NIST and two German science organizations, Fachinformationszentrum Karlsruhe, or FIZ, and the Max-Planck Gesellschaft, or MPG, will ensure the long-term viability and widespread dissemination of NIST's Inorganic Crystal Structure Database.

Chemists and materials scientists have long used the database and its collection of more than 40 000 inorganic compounds to support research advances. Because of new developments in computer-aided design of inorganic materials, as well as the advent of combinatorial methods being applied to these materials, scientists now need a more robust database.

The new agreement between NIST, FIZ, and MPG will focus on two areas: evaluation of current and new structural data, and PC- and Web-based data products that take advantage of recent improvements in information technology. Scientists have begun work outlined in the agreement and expect to release data products in 2000.

The work is being done through a partnership of the NIST Center for Neutron Research and the NIST Standard Reference Data Program and builds on NIST's expertise in diffraction data and crystallographic analysis. FIZ and MPG have supported the Inorganic Crystal Structure Database since 1989 and remain dedicated to its excellence.

For more information on the NIST Standard Reference Data Program, visit http://www.nist.gov/srd/ on the World Wide Web, send e-mail to srdata@nist.gov or phone (301) 975-2208.

Media Contact: Linda Joy (301) 975-4403; linda.joy @nist.gov.

PARTNERS TEAM UP TO "BEAT THE HEAT" IN BUILDINGS

Understanding how energy from a fire moves from the flames to solid surfaces is a critical step toward minimizing or even preventing fire damage in buildings. To gain this knowledge, a cooperative research and development agreement recently was forged between NIST and a private company.

The 3-year-long collaboration will utilize the expertise of both partners—the company's in industrial fire research experimentation and radiation modeling, and NIST's in computer modeling of fire properties—to provide the first examination of fire growth and heat release rates in large-scale industrial settings such as warehouses and factories. The CRADA's eventual goal is to develop a database of experimental data on the role of radiation heat transfer in large-scale fires and mathematical models that can predict these effects.

For more information on the NIST/FMRC CRADA, contact Howard Baum, A345 Polymer Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6668, howard.baum@nist.gov.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov

EMBRITTLEMENT MEASUREMENTS MAY HELP KEEP REACTORS RUNNING

Researchers at NIST have demonstrated the feasibility of using physical-property measurements to evaluate embrittlement resulting from copper precipitation in steel. This is the same type of embrittlement that occurs in reactor pressure vessels exposed to irradiation.

NIST was asked by the Nuclear Regulatory Commission to study ways of sensing microstructural changes, which embrittle RPV steels. The NRC feels that a reliable assessment method is critical because many American power reactors are approaching their design life; measurements and standards may permit the industry to extend these reactor life spans.

The researchers found that nonlinear ultrasonic and micromagnetic measurements provided the most promising approaches for sensing changes. They identified descriminants that uniquely characterize precipitation hardening and dislocation mobility in steel that simulated the microstructural features associated with radiation embrittlement. They also confirmed that the critical measurements could be made on full-scale sections (200 mm thick) of a reactor pressure vessel.

The research team is attempting to confirm the initial results on another surrogate material and on irradiated samples of an RPV steel. They then will develop the measurement standards needed by the NRC to implement the technology in the nuclear power industry.

Media Contact: Fred McGehan (Boulder) (303) 497-3246; mcgehan@boulder.nist.gov

STANDARD INTERFACE PROPOSED FOR INSPECTION PROBES

Inspection systems, the next generation. What sounds like a Star Trek knock-off for the manufacturing minded is actually an ongoing collaboration aimed at developing inspection technologies that are 10 to 20 times faster than currently available. In the project's most recent installment, the partners have proposed a standard for integrating inspection probes with machine controllers.

"Our goal," explains a NIST engineer "is to provide sufficient technical guidance so that independently

developed probe and controller products will be compatible right out of the package." With the proposed Sensor Interface Module, or SIM, users of coordinate measuring machines could integrate new inspection probes without customized engineering efforts. "This should lead to better inspection capabilities, possibly at lower cost," the NIST engineer says. "Probe vendors could see their latest technology in use on shop floors in much less time."

The proposed SIM describes a hardware card that plugs into the Industry Standard Architecture computer bus. It supplies an interface between sensors and control systems for either inspection equipment or machine tools. NIST and nine other organizations are participating in the Next Generation Inspection System project—now in its second phase—organized by the National Center for Manufacturing Sciences. With input from other partners, the proposed specification was written by representatives from NIST, and four private companies.

The SIM now is being evaluated on a coordinate measuring machine at NIST and by two makers of controllers. Before submitting the specification for adoption as a formal standard, the partners are gathering additional industry input.

The NGIS SIM Specification can be viewed at the NGIS Application Programming Interfaces World Wide Web home page at http://isd.cme.nist.gov/info/ngisAPI. For additional information, contact William Rippey, B124 Metrology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-3417, william.rippey@nist.gov.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov.

COMPANY BRINGS FIRE SYSTEMS INTO BACNET CONSORTIUM

The BACnet Interoperability Testing Consortium, a government/industry collaboration working on "smart" buildings where control systems from different manufacturers communicate, work together and are controlled from a central location, has welcomed to the group for the first time a private company that provides fire systems.

The consortium, organized by NIST and now including 21 industry partners, seeks advancement and acceptance of the BACnet (acronym for *B*uilding *A*utomation and *C*ontrol *N*etworks) open data communications standard among manufacturers of building control systems, such as those for fire detection, security, and energy management. The standard was developed by NIST in collaboration with industry partners and under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE adopted BACnet as a new industry standard in 1995. BACnet has been adopted as a pre-standard in the European community and proposed as a world standard. Thousands of BACnet systems, in upwards of 14 countries, already have been installed.

One of NIST's roles in the consortium is testing prototype products on the path to market for their ability to work with the BACnet protocol. Among the products most recently tested at NIST was a new self-contained panel—called the BACpac Portal—specifically designed by the company to provide point-to-point BACnet connectivity for its fire alarm systems.

For more information on BACnet and the interoperability consortium, contact Steven Bushby, B114 Building Research Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-5873, steven.bushby@nist.gov.

Media Contact: Michael E.Newman (301) 975-3025; michael.newman@nist.gov.

NIST, PARTNERS ON AN INTELLIGENCE (IN MANUFACTURING) MISSION

NIST will coordinate U.S. participation in a new international research effort approved by the Intelligent Manufacturing Systems Program. Called MISSION, the IMS project aims to develop and test "modeling and simulation environments for design, planning, and operation of globally distributed enterprises."

Partners from the United States, Japan, the European Union, and Australia will build the software equivalent of a docking station, a generic modeling platform with interfaces that link and integrate data and user-selected simulation tools, such as those for evaluating production scenarios. The platform will support simulations over a range of vantage points, from individual factories to entire supply chains.

A kick-off meeting is planned for July 7-11, 1998, in Berlin, Germany. Technical activities will begin soon afterward. A NIST scientist is serving as the U.S. regional coordinator for MISSION. The group has established a simulation technology testbed to support two NIST-led research efforts on computer-aided manufacturing engineering.

U.S. companies interested in participating in MISSION should contact NIST. Once the project gets under way, opportunities to join will be limited.

The IMS Program was initiated by Japan to foster international cooperation on manufacturing research and development. Fourteen projects are currently under way, involving five nations and the European Union.

For information on the MISSION project, contact NIST's Swee Leong at (301) 975-5426, leong@nist.gov. The terms of reference for participating in IMS projects are available at the IMS site on the World Wide Web at http://www.ims.org/.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov.

CENTERS PROVIDE EDUCATIONAL VACCINES FOR "MILLENNIUM BUG"

NIST's Manufacturing Extension Partnership (MEP) and its nationwide network of centers are stepping up efforts to help smaller manufacturers avoid being bitten by the "millennium bug." The bug, also known as the Year 2000 date problem, refers to a flaw in the way dates traditionally have been entered into computer systems. Many computers that use two digits to keep track of the date will, on Jan. 1, 2000, recognize the double zero not as 2000, but as 1900. Since computers use dates to make calculations, this glitch could cause them to shut down or generate erroneous information.

MEP centers will be conducting seminars and workshops to raise smaller manufacturers' awareness and understanding of the problem and helping client manufacturers assess their systems and resolve Year 2000 problems. A private company, a leading authority on information technology issues, has reported that as of 1997, 88 % of all smaller companies had not yet started Year 2000 remediation projects.

Year 2000 overview information and a self-assessment questionnaire are available on the MEP World Wide Web site at http://www.mep.nist.gov.

Media Contact: Jan Kosko (301) 975-2767; janice.kosko@nist.gov.

TOOLKIT STREAMLINES TESTING OF CORBA SOFTWARE

Software developers can try out a testing tool designed by NIST to speed evaluations of how well programs work together in distributed manufacturing systems based on CORBA—the Common Object Request Broker Architecture advanced by an 800-member consortium.

The new Manufacturer's CORBA Interface Testing Toolkit (MCITT), was developed initially to test components of a modular software framework that will enable integrated control of semiconductor manufacturing systems. It is now a stand-alone tool that can further other CORBA-based approaches to distributed manufacturing. Issued by the Massachusetts-based Object Management Group, CORBA is a publicly available specification for software integration. Its object-oriented approach to distributed computing systems promotes reuse of computer code and interoperability among software products.

With MCITT, a developer can evaluate the behavior of software components in a more controlled environment, without presuming correct operation of all the other components of the distributed manufacturing system, explains a NIST computer scientist. MCITT creates emulated test servers that substitute for the real thing. The user defines a scenario of operations and interactions—such as between scheduling and ordering—and MCITT automatically attends to supporting programming jobs, such as memory management or generating "boilerplate" code.

A "pre-beta" release of MCITT can be downloaded over the Internet at ftp://ftp.cme.nist.gov/ pub/mcitt/.

For more information, contact David Flater, (301) 975-3350, david.flater@nist.gov. A MCITT overview can be found on the World Wide Web at http://www.mel.nist.gov/msidstaff/flater/mcitt.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov.

NEW SPECS RELEASED TO ENHANCE ONLINE LEARNING

To facilitate exchange of educational materials over electronic networks, a Private company announced recently the release of technical specifications for its Instructional Management Systems project. The IMS was developed in collaboration with NIST and dozens of information technology firms, universities, content providers and other organizations. The company also made freely available an example implementation of an instructional management system that illustrates many of the specifications.

The availability of standard, public specifications will promote development of open, interoperable, distributed learning systems and the reuse of instructional materials. Making educational materials available in the public domain is an important step in promoting the commerce of digital objects and related searches over the Internet.

NIST assisted the project by specifying metadata ("data about data" that describes how, when and by whom a particular set of data was collected, and how the data are formatted) and services for metadata, security, and role-based access control, and in developing and testing selected prototype services. NIST researchers also are helping the IMS project to develop a conformance testing and certification program for IMS specifications as well as an accreditation program for testing laboratories.

Should the IMS project opt to use an accreditation program, NIST will help establish it where the IMS specification warrants a formal test and certification system. Conformance testing and certification are recognized as necessary prerequisites to achieving interoperability.

More information on the IMS project is available on the World Wide Web at http://www.imsproject.org.

Media Contact: Anne Enright Shepherd (301) 975-4858; anne.shepherd@nist.gov.

ULTRASOUND METHOD DIAGNOSES STRESS BEFORE BRIDGES CRACK

NIST scientists are using ultrasound to measure the change in stresses on pin and hanger assemblies found on bridges. Their goal is to develop a method for assessing the status of these connections.

In a typical situation, a pin and hanger connection is used to suspend an inner span from an outer support span; it also accommodates thermal expansion. But because the connection is located at the expansion joint, road deicing salts may wash down through the joint and cause corrosion at the pins. If the corrosion is sufficient to lock up the pins, it can cause additional forces on the connection, leading to fatigue cracking and eventual failure.

NIST is experimenting with an ultrasound technique, which has the potential to determine connection stress prior to development of fatigue cracks. To evaluate its method, NIST designed and constructed a pin and hanger simulation facility at its Boulder, CO, laboratories. Strain gauges were mounted on the hangers, and the strains were measured as load was applied. At the same time, ultrasonic measurements were made at the gauge locations. Strains were predicted from the ultrasonic data and compared with values measured by the strain gauges. "Overall good agreement was obtained between ultrasonic and strain gauge results," the scientists report.

For technical paper no. 13-98, which describes the work, contact Sarabeth Harris, MS104, NIST, Boulder, CO 80303-3328, (303) 497-3237, sarabeth@boulder.nist.gov.

Media Contact: Fred McGehan (Boulder) (303) 497-3246; mcgehan@boulder.nist.gov.

BUILDERS NOW HAVE BEES TO BUZZ ABOUT

Environmentally sensitive and cash-conscious BEES are ready to help designers and architects plan better buildings. BEES, an acronym for "Building for Environmental and Economic Sustainability," is a software package developed by NIST to identify building products that improve environmental performance with little or no increase in cost. The first version, BEES 1.0, is now available.

BEES 1.0 is based on consensus standards and designed to be practical, flexible, consistent, and transparent. The Windows™-based decision support software includes actual environmental and economic performance data for 24 building products. BEES was developed with support from the U.S. Environmental Protection Agency's Environmentally Preferable Purchasing program. The EPP encourages Federal agencies to reduce the environmental burdens associated with products and services that they buy, including building products. Refinement and expansion of the software will be done over the next 3 years under sponsorship of NIST and the EPA EPP program.

BEES runs on a Windows 95 TM personal computer with a 486 or higher microprocessor, 32 megabytes or more of RAM, at least 10 MB of available disk space and a 3.5-inch floppy diskette drive.

For technical information, contact Barbara C. Lippiatt, B226 Building Research Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6133, e-mail: blippiatt@nist.gov. A fact sheet on BEES 1.0 can be found at http://www.bfrl.nist.gov/oae/bees.html. To purchase BEES 1.0 for $49.99, contact the U.S. Green Building Council, Suite 1001, 90 New Montgomery St., San Francisco, CA 94105, (415) 543-3001, fax: (415) 957-5890, e-mail: info@usgbc.org, or order directly from the Council's World Wide Web site at http://www.usgbc.org.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov.

NEW NIST CALIBRATION SERVICES USERS GUIDE AVAILABLE

As any manufacturer knows, accurate measurements are essential to producing a high-quality product. In order to help U.S. industry produce the best goods in the world, NIST provides a host of calibration services to assure that manufacturers have access to many of the best measurements in the world. NIST researchers perform a wide variety of calibrations ranging from dimensional measurements to time and frequency measurements. A newly updated Calibration Services Users Guide describes all NIST calibration services with additional information on policies and ordering procedures.

This revised NIST Special Publication 250 reflects significant changes since the last edition. The guide provides a detailed description of each measurement service and identifies a large number of NIST technical experts who can be contacted for information on

Services or measurement problems. A separate fee schedule, SP 250 Appendix, is available also.

To request a copy of the new Calibration Services Users Guide and fee schedule, phone (301) 975-2002, fax a request to (301) 869-3548 or send e-mail to calibrations@nist.gov. The guide also will be available soon on the World Wide Web at http://ts.nist.gov/calibrations.

Media Contact: Linda Joy (301) 975-4403; linda.joy@nist.gov.

GET UP TO SPEED ON INTEGRATION OF MANUFACTURING APPLICATIONS

Providing managers, engineers, systems integrators, software developers, and researchers with a coherent, up-to-date perspective on current and emerging approaches to integrating manufacturing software applications is the aim of a set of "tutorials" that NIST will offer on Sept. 9-10, 1998, at its Gaithersburg, MD site.

Featuring case studies and technology demonstrations, the two-day program, "Information Technology for Manufacturing & Engineering: Integration Tutorials," will cover such topics as distributed design, integration frameworks, virtual prototyping, manufacturing simulation, information modeling, product data exchange, and collaboration technology. In the opening session, a senior staff technical specialist from a major automanufacturer, will describe his company's growing emphasis on information technology and its expectations for suppliers. A special session will survey emerging information technologies, such as intelligent agents. Another will describe relevant research opportunities available through the National Science Foundation, NASA, the Defense Advanced Research Projects Agency, and NIST.

The tutorials are organized by NIST. The 5-year-old program coordinates NIST's manufacturing-related participation in the Federal Government's computing, information, and communications initiatives. Carried out with industry partners, NIST projects develop prototype information-exchange and interface standards that enable integration of manufacturing software applications and interoperability within and across enterprises.

For information on the technical content of the tutorials, contact James Fowler, (301) 975-3180, james.fowler@nist.gov or Howard Moncarz, (301) 975-5070, howard.moncarz@nist.gov. Registration information is available from Lori Phillips, (301) 975-4513, lori.phillips@nist.gov.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov

PROCEEDINGS OF WELDING CONFERENCE NOW AVAILABLE

NIST long has been involved in promoting the use of computer technology in welding. In 1986, the agency and a partner, the American Welding Institute, co-sponsored the first U.S. workshop on the computerization of welding data. Over the years, the workshop has expanded so most aspects of welding technology are now covered.

In July 1997, the seventh conference was held in San Francisco. It was sponsored by NIST, AWI and the American Welding Society. Proceedings of that meeting are now available. Topics covered include overviews, case studies, controls and controllers, modeling, process automation, resistance welding, sensing and weld plan simulation.

To order Seventh International Conference on Computer Technology in Welding (NIST Special Publication 923), contact the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 98-126964; the cost is $21.50.

Media Contact: Fred McGehan (Boulder) (303) 497-3246; mcgehan@boulder.nist.gov.

FQA FINAL RULE PUBLISHED; IMPLEMENTATION DATE EXTENDED

The amended final rule for the Fastener Quality Act of 1990—the national program to protect public health and safety by ensuring that certain nuts, bolts and other fasteners used in critical situations (such as attaching aircraft engines to fuselages) conform to specifications—has been published by NIST (see the Federal Register, April 14, 1998). In addition, the act's implementation date is being extended 60 days until July 26, 1998. The final rule:

- defines the procedures by which fastener manufacturers can use Quality Assurance Systems/Statistical Process Control—an in-process quality inspection of fasteners—after May 14, 1998, as evaluation by an accredited testing facility;
- allows manufacturers to test fastener lots for FQA compliance starting May 14, 1998, in order for them to replace their non-FQA-compliant inventory with compliant stock;
- continues the policy of allowing manufacturers to sell as non-FQA-compliant, any fasteners in inventory (all fasteners produced after July 26, 1998, must be tested by an accredited laboratory or produced by an approved QAS/SPC manufacturing facility); and

- permits manufacturers who operate QAS/SPC fastener production lines that have not been completely certified by July 26, 1998, to list their operation as provisionally certified, as long as specific conditions are met; the official certification must be completed by May 25, 1999.

For more information on the FQA, contact Subhas G. Malghan, (301) 975-5120, malghan@nist.gov; or Jogindar S. Dhillon, (301) 975-5521, dhillon@nist.gov; fax for both: (301) 975-2183. Additional information is available on the FQA page of NIST's World Wide Web site at http://www.nist.gov/fqa/.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov.

NIST, CAM-I CHART PROGRAM OF "LEVERAGED" RESEARCH

NIST and the Consortium for Advanced Manufacturing-International, a Texas-based research organization with more than 40 company members, have targeted six projects for closer collaboration. A particular focus of these "leveraged" research programs will be technologies and standards supporting scalable flexible manufacturing (SFM)—the ability to rapidly configure production and support operations to accommodate any manufacturing volume or to respond to any market opportunity.

CAM-I recently launched a major SFM initiative, while NIST has stepped up efforts aimed at enabling greater interoperability among equipment, systems, databases, and other elements of modern manufacturing operations. At both CAM-I and NIST, efforts address the needs of individual companies and the challenges involved in organizing and coordinating multicompany enterprises.

At a recent review attended by 35 representatives of the consortium, five NIST projects were identified as complementary to the goals of CAM-I's SFM initiative. These projects include work to develop prototype standards for open architecture machine tool controllers and an ongoing collaboration that is creating an integrated toolkit of software applications to support factory-layout decisions and other manufacturing engineering functions.

CAM-I also singled out NIST efforts to create a common language for describing manufacturing processes as likely to benefit several of its research programs. In addition, NIST has agreed to participate in a CAM-I project to develop standards intended to improve the capabilities of dimensional measurement systems and to increase the reliability of inspection.

For more information, contact Mark Luce, NIST Office of Manufacturing Programs, (301) 975-2159, mark.luce@nist.gov or Bailey Squier, CAM-I, (817) 860-1654, bsquier@cam-i.org.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov.

SATELLITE SIGNALS IMPROVE CLOCK SYNCHRONIZATION 100-FOLD

Those who need to synchronize widely separated clock systems to better than a billionth of a second have only a few methods available, but a technique being developed at NIST offers a new level of precision.

Tests between clocks separated by up to 2000 km have shown that they can be synchronized with an error as small as the clocks' own timekeeping errors—in the case of the best clocks, as low as 50 ps to 80 ps over the course of a day. Such precision is needed by scientists in radio astronomy, deep-space tracking and guidance of spacecraft, and international coordination of timekeeping systems.

The new method uses signals from Global Positioning System satellites in a manner borrowed from the geodetic community (which is devoted to precise distance measurements on Earth). Instead of being based on the time code transmitted by the satellites, the technique uses the carrier frequency by which the code is sent. The carrier frequency is about 1000 times higher than that of the time code, and thus can be resolved up to 1000 times better in theory. So far, in practice, results are about 100 times better than using the time code and seem to be limited by the accuracy of the clocks being compared.

Copies of two papers (nos. 10-98A and 10-98B) describing the work may be requested from Sarabeth Harris, MC 104, NIST, Boulder, CO 80303-3328, (303) 497-3237, sarabeth@ boulder.nist.gov.

Media Contact: Collier Smith (Boulder) (303) 497-3198; smithcn@boulder.nist.gov.

THE NEW SRM CATALOGS ARE IN!

Manufacturers and analytical laboratories in nearly every industrial sector rely on NIST Standard Reference Materials as specialized measurement tools. So, for many in U.S. industry, the issuance of an updated NIST SRM Catalog is a significant event that parallels the eagerly awaited arrival of a department store catalog by a home shopper. After all, both are trusted sources for the items that keep things running smoothly.

The newest edition of the NIST SRM Catalog includes recently developed materials—such as those

signed to validate analytical measurement results needed to ensure compliance with nutrition labeling laws—as well as long-relied-upon standards—such as NIST's Cast Iron SRM, which has changed little since the agency's predecessor, the National Bureau of Standards, adopted it from the American Foundrymen's Association in 1906.

Each SRM includes a physical sample that has been well characterized and analyzed by NIST scientists and a certificate that gives analytical values, handling instructions and other details about the SRM. One example of an ever popular SRM is Lipids in Frozen Human Serum (SRM 1951a), which helps medical laboratories report accurate values for cholesterol tests.

To request a copy of the new 180-page NIST Standard Reference Materials Catalog and price list, phone (301) 975-6776, fax a request to (301) 948-3730 or send e-mail to srminfo@nist.gov. Information about NIST SRMs also is available on the World Wide Web at http://ts.nist.gov/srm.

Media Contact: Linda Joy (301) 975-4403; linda.joy@nist.gov.

DOCUMENT RECYCLES MULTIMODE OPTICAL FIBERS EXPERTISE

Single-mode optical fibers have been preferred by the optical communications industry for some time because their wider bandwidth can transmit information faster. Multimode optical fibers, however, are staging a comeback, particularly in local area networks where their limited length-bandwidth product is not necessarily a drawback. Many younger optical fiber engineers have spent most of their careers dealing with single-mode fibers and are not as familiar with multimode fibers.

To help remedy this situation, NIST has published a Bibliography of NIST Publications on Multimode Optical Fibers. It is hoped that the publication will familiarize today's engineers with earlier NIST work on the metrology of multimode fibers and related components—much of which was carried out in collaboration with the Electronic Industries Association and its offshoot, the Telecommunications Industry Association.

What readers of the new bibliography will find is that many of the measurement problems facing today's users of multimode fibers are identical to those encountered 20 years ago.

For a copy of the bibliography, contact Sara Metz, MC 815, NIST, Boulder, CO 80303-3328, (303) 497-5187, smetz@boulder.nist.gov.

Media Contact: Fred McGehan (Boulder) (303) 497-3246; mcgehan@boulder.nist.gov.

AIRCRAFT MANUFACTURER IMPLEMENTS NEW DATA EXCHANGE STANDARD

As part of its ongoing effort to foster product affordability, a major aircraft manufacturer, recently implemented an international data exchange standard known as the Standard for the Exchange of Product Model Data, or STEP, on its F-16, F-22, Joint Strike Fighter, F-2 and KTX-2 programs.

The manufacturer is unique in implementing STEP on such a wide range of programs. While others in the industry have done controlled pilots within their respective companies, or between two companies, at the aircraft manufacturer the standard is being used for all programs within the plant. Moreover, the manufacturer is pioneering the STEP standard with smaller businesses that are its supply base, whereas most users of STEP are, at this point, larger companies with large systems that move data around in bulk. The standard provides a universal format to share product data between companies, their suppliers, and customers, which leads to cost savings through direct use of the engineering digital data model.

At the aircraft manufacturer, STEP has realized significant savings and process improvements. For example, within engineering design, pilot programs have shown a 10 % improvement in reliability of data exchange, a 10 % process savings for noncomposite parts, and a 50 % process savings for composites. For manufacturing, the projected savings for tool design on CAD/CAM systems is 27 % and 38 % for NC CAM systems due to elimination of data re-entry.

Prior to implementing STEP, the process for exchanging data between companies and vendors was considerably slower and more expensive. Custom software for data exchange had to be developed and data re-entry added to the overall expense of building fighter aircraft. STEP, on the other hand, captures the complexities of fighter aircraft design, manufacture, and support in a digital format that is customized for the fighter aircraft industry.

To achieve this capability, the manufacturer banded together in August of 1988 with other industrial companies and formed PDES, Inc. The aircraft manufacturer was a founding member of this consortium that continues today with 24 industry and government members who represent more than $600 billion in annual revenue and sales. PDES, Inc., is a global leader in accelerating the development and deployment of the STEP standard for digital product data.

"The principal driver behind standardizations like STEP is the increasing emphasis on affordability by the customer, which in turn is driven by reduced defense budgets in the United States and abroad. Therefore, the

entire industry has to strive to become a leaner manufacturer," said the engineering chief of CAD/CAM Systems at the aircraft manufacturer.

The STEP standard also is playing an important role in advancing the manufacturer's Virtual Product Development Initiative, or VPDI, which will be critical to managing life-cycle costs of future weapons systems like the Joint Strike Fighter. To supplement the consortiums efforts, the manufacturer has developed strategic partnerships with several companies, which have been instrumental in implementing the STEP standard within VPDI.

NIST is a government member of the PDES, Inc., Board and led the developmental efforts of ISO 10303 (STEP) since the concept inception in the early 1980s. Today, NIST actively works in the area of product data standardization, and leads the standardization effort by carrying out responsibilities as the Secretariat of ISO TC 184/SC4, under which ISO 10303 is developed.

Contact: Lisa Phillips, (301) 975-5020; lisa.phillips @nist.gov.

NIST ADVANCES DEVELOPMENT AND COMMERCIALIZATION OF IPsec TECHNOLOGY FOR NEXT GENERATION INTERNET (NGI)

NIST researchers contributed to the design and development of IPsec protocols that have demonstrably expedited the standardization, improved the technical quality, and fostered the commercial availability of this critical technology. IPsec protocols are designed to provide authentication, integrity, and confidentiality services that are critical requirements for the development of the NGI and the use of Internet technology to support mission-critical applications such as electronic commerce.

At the request of the Internet Engineering Task Force (IETF), NIST staff collaborated with select key industry partners to co-author key protocol specifications and resolve technical impasses that threatened the progress of the IPsec design and standardization process.

In addition to providing leadership in IETF standards development, NIST staff designed and developed Cerberus, a leading-edge research prototype and reference implementation of the latest IPsec specifications. Since its release in December 1997, more than 80 organizations, from all segments of the Internet industry (major computer/router/switch manufacturers, operating system vendors, Internet service providers, and research organizations), have acquired the NIST-developed Cerberus for use as a reference implementation and a platform for ongoing research on advanced issues in IPsec technology. At the recent, industry-sponsored Automotive Network eXchange (ANX) IP Security Interoperability Workshop, Cerberus served as a focal point for testing by more than 40 vendors with IPsec products under development.

To answer an industry call for more frequent and accessible interoperability testing for emerging commercial implementations of IPsec technology, NIST developed the IPsec WWW-based Interoperability Tester (IPsec-WIT). IPsec-WIT is built around the Cerberus prototype and ubiquitous WWW technology and allows implementors to remotely execute series of interoperability tests against the Cerberus reference implementation. IPsec-WIT also serves as an experiment in test system architectures and technologies. The novel use of WWW technology allows IPsec-WIT to provide interoperability testing services anytime and anywhere, without requiring any distribution of test system software or relocation of the systems being tested.

The standardization and commercialization of basic IPsec technology has become a success story within the Internet industry, so NIST researchers are shifting focus to other open issues in IPsec research and supporting technologies such as key management systems. A NIST scientist leads current efforts to add research prototypes of Internet Key Exchange protocols to the Cerberus reference implementation and IPsec-WIT test system.

Contact: Robert Glenn, (301) 975-3667; robert. glenn@nist.gov or Sheila Frankel, (301)T975-3297; sheila.frankel@nist.gov.

NIST LEADERSHIP RESULTS IN SUCCESSFUL DEMONSTRATION OF "PLUG AND PLAY" PRINCIPLE FOR PRINTED-WIRING BOARD MANUFACTURE

NIST has successfully demonstrated the plug-and-play principle as applied to the manufacture of printed-wiring boards. With product life cycles lasting only weeks and production runs changing with every shift, board manufacturers cannot afford down time resulting from data incompatibilities among software applications and equipment formats. This is the issue being addressed by the Plug and Play Factory project of the National Electronics Manufacturing Initiative (NEMI), which is driving the development of the standards needed by the electronics industry for interoperability of hardware and software components. The

project, which was conceived and initiated under a Factory Information Systems (FIS) committee co-chaired by a NIST scientist, held its first demonstration at the National Electronics Packaging CONference (NEPCON) in March 1998—just a few months after its inception.

The project team demonstrated for NEPCON attendees the ability to link together equipment in Georgia, New York, and Pennsylvania with distributed software applications over the Internet, via a common software framework developed at Sandia National Laboratories. The team plans to validate and benchmark a variety of framework approaches and recommend methodologies for adoption by NEMIs membership. The team also is developing process specific machine communication interface standards for surface mount technology equipment using the Semiconductor Equipment and Materials International Generic Equipment Model specification. The resulting standards for passing information between machines and host controllers will enable a reduction in the cost of Factory Information Systems implementations for both manufacturers and suppliers. Both manufacturers and suppliers will be able to leverage volume cost advantages resulting from this standardization effort. In addition to reducing the cost of developing equipment control software, establishing communications standards for equipment is expected to enable the development of low-cost third party FIS solutions and to allow manufacturers freedom in mixing products from different suppliers.

Contact: James A. St. Pierre, (301) 975-4124; james.st.pierre@nist.gov.

NIST ASSISTS U.S. COMPANY THROUGH CALIBRATION OF DMMS

NIST scientists have carried out a series of Special Tests for a private company to investigate tto help the company obtain accreditation to the National Measurement Accreditation System (NAMAS) in the United Kingdom.

The tests involved a commercially available, precision (limited range, high-accuracy) digital multimeter (DMM) used to calibrate multifunction calibrators, which in turn are used to calibrate DMMs of lower accuracy. Before NIST involvement, the private company was tracing its measurements for five electrical quantities (ac and dc voltage and current and dc resistance) through the calibration of three precision DMMs, which then were ultimately traceable to the National Physical Laboratory in the United Kingdom, via the DMM manufacturer. This traceability path was expensive and took as long as three months, and there were problems in dealing with both U.S. and United Kingdom Customs for transatlantic shipments. As a result of this situation, the private company requested that NIST provide the company with calibration service for the particular make and model of DMM they were using.

NIST now has tested and calibrated three of the company's precision DMMs. Under computer control provided by NIST, modifications have been made to the instruments firmware correction tables to bring the readings of each instrument as close to nominal values as possible. Over 200 tests were performed at ac and dc voltage and current and dc resistance points for each instrument. NIST has supplied the company with both the initial data and the final data (the residual correction after making firmware adjustments in the DMMs). These instruments now have been used by the company for internal calibration testing, and the supporting NIST Report of Special Test(s) has been used by the private company to meet the NAMAS requirements.

Contact: Barry A. Bell, (301) 975 2419; barry.bell@nist.gov.

NEW PROCESS LOWERS THE TEMPERATURE FOR TITANIUM THIN FILM DEPOSITION

Researchers from NIST recently developed a new low-temperature chemical vapor deposition (CVD) process for the thin film deposition of titanium metal. The new process requires a CVD substrate temperature of only 610 °C, well below the current industrial temperature of 900 °C to 1200 °C. Lowering the substrate temperature is important because many potential substrate materials undergo a phase transition at temperatures less than the current 900 °C requirement, thus rendering them unsuitable for use. An example is mild steel (phase transition at 723 °C) on which titanium films are often deposited for enhancement of surface hardness and corrosion resistance.

The new technique involves the reaction of an alkali metal (sodium) with a metal halide (titanium tetra chloride) in a low pressure co-flow diffusion reactor which was developed at NIST. Thermodynamics simulations are being used to determine the reaction parameters (substrate temperature, reactant concentration, and reactor pressure) used to grow titanium and titanium nitride thin films. A series of experiments have shown that these simulations successfully predict reactor conditions where salt deposition (a reaction byproduct) becomes a potential contamination problem.

An important aspect of this work is that the reaction chemistry demonstrated to be effective for the CVD of titanium is completely generic for production of a wide range of ceramic and metallic thin films. This new process has now been used to produce titanium and titanium nitride deposited on copper, as well as titanium dioxide and titanium silicides deposited on silicon. Future work will investigate deposition of industrially important films such as silicon carbide and titanium carbide. Since the worldwide market for CVD equipment and services (primarily for microelectronics and surface coating applications) is expected to grow from $3.5 billion in 1995 to $5.4 billion in 2000, new processes such as this one can have a significant economic impact. U.S. and PCT patent applications have been filed.

Contact: Jay H. Hendricks, (301) 975-4371; Jay.hendricks@nist.gov.

METHOD DEMONSTRATED FOR NEARLY INSTANTANEOUS MEASUREMENT OF PRESSURE AND TEMPERATURE

A method for the simultaneous measurement of pressure and temperature of a gas mixture using a single-shot, laser-based technique has been demonstrated by researchers at NIST. Pressure and temperature are extracted from the Raman spectra that are captured in a single-laser shot of 20 ns duration, making the measurements nearly instantaneous. The nonlinear optical technique of broadband coherent anti-Stokes Raman spectroscopy (CARS) was used to generate the entire spectrum at once. NIST researchers employed a Fabry-Perot inter ferometer to spatially modulate the CARS signal beam before entering a spectrometer equipped with a two-dimensional array detector. Compared to the conventional CARS methods that employ a spectrometer alone, the technique enhances the spectral information for the determination of line shift, line width, and spectral shape all recovered from a single shot measurement. Measurements were made with gas mixtures of deuterium in either argon or nitrogen to benefit from the good sensitivity afforded by the large pressure shift of deuterium that was determined in earlier research. Single-shot pressure measurements to within ± 2 MPa up to 10 MPa in gases at ambient temperatures were demonstrated, with agreement of temperature to within 3 %. Adoption of the technique in combustion studies of flamestructure and in measurement of low-level shocks could resolve pressure and temperature in formation at levels needed for the understanding of these complexsystems.

Contact: Wilbur S. Hurst, (301) 975-4814; wilbur.hurst@nist.gov.

NIST RESEARCHER'S EYEBALL-LIKE LENS SYSTEM DRAMATICALLY IMPROVES CONTRAST RATIO MEASUREMENTS FOR DISPLAYS

To provide the electronics industry with improved contrast ratio measurement capability for displays, a NIST scientist has developed a prototype lens system that is capable of dramatically improved measurements. Contrast ratio is one of the most commonly used metrics for characterizing electronic displays and is one of the key parameters considered by manufacturers and users when making purchasing decisions. It relates the ratio of white luminance (colloquially known as brightness) to black luminance. The human eye is capable of discerning contrast ratios that can be well beyond those that currently available instruments can measure (with a single image); this is due in part to the effects of glare on the lens systems of light measurement devices.

The NIST scientist reasoned that since the human eye works so well, contrast ratio measurements could be improved by copying the construction of the eye in eliminating all air-solid interfaces along the optical path by filling the optical path with a liquid. Accordingly, he constructed and tested a prototype in which a target was imaged by a charge-coupled device (CCD) sensor using a simple lens with and without liquid between the protective glass plate covering the CCD and the lens. The liquid used was mineral oil, chosen to have an index of refraction close to the index of refraction of the lens and cover, i.e., the transparent solids in the light path. He varied the distance between the target and the lens to keep the size of the image relative to the CCD the same for both configurations. The improvement in contrast with the liquid system was extraordinary. The contrast measured without the liquid was 3:1 whereas with the liquid it was over 200:1. This new development is expected to improve greatly the ability of U.S. manufacturers to differentiate the capabilities of candidate display systems.

Another potential application for the lens system is photography. Conventional digital cameras, which typically use CCD sensors, are limited in the contrast they can record. Digital cameras are becoming more plentiful not only for home use but also for scientific measurements. In the past, since there were few methods to exploit contrasts over 150:1, contrast ratios were not considered to be a problem. However, since electronic displays are being manufactured that can reproduce contrast ratios higher than 400:1, it becomes useful to have a recording system capable of rendering an image of an object with better contrast fidelity. In light of the many diverse potential applications for this lens system, NIST has applied for a provisional patent.

Contact: James A. St. Pierre, (301) 975-4124; james.st.pierre@nist.gov.

NIST ASSISTS DoE IN DEVELOPING ELECTRIC MOTOR TEST PROCEDURES

NIST researchers have provided significant technical guidance to the U.S. Department of Energy (DoE) in developing test procedures to support the proposed rule for efficiency testing of electric motors. The Energy Policy and Conservation Act, as amended, establishes energy efficiency and en ergy consumption standards for certain consumer, commercial, and industrial products. DoE recently proposed a rule applying to electric motors [10CFR Part 431, Energy Conservation Program for Certain Commercial and Industrial Equipment: Test Procedures, Labeling, and Certification Requirements of Electric Motors]. In the rulemaking process, DoE has relied on NIST in connection with the development of testing procedures and methods for evaluating test data.

Of particular interest to DoE has been a recent statistical analysis performed at NIST. The issue addressed through this analysis is the sampling protocol to be applied to the verification and enforcement of the rule for each manufacturers motors. NIST's analysis provides DoE the technical basis for selecting sampling procedures that implement the intent of the rule and at the same time do not burden unduly the manufacturers of motors. Details of the analysis method and results are presented in two recent NIST publications, NIST Technical Note 1422, Electric Motor Efficiency Testing under the New Part 431 of Chapter II of Title 10, Code of Federal Regulations: Enforcement Testing, and NISTIR 6092, Analysis of Proposals for Compliance and Enforcement Testing Under the New Part 431; Title 10, Code of Federal Regulations. These reports discuss current industry practice the nature of the burden imposed on industry by the proposed rule, and the degree to which efficiency standards would be met by testing under the various proposed testing procedures. The NIST statistical methodology also is applicable to the analysis of sampling plans for the testing of other types of devices. NIST now is investigating how to apply this methodology to tests of distribution transformers, under consideration by DoE for rulemaking.

Contact: James K. Olthoff, (301) 975-2431; james.olthoff@nist.gov.

NAMT PROGRAM EXPANDS WITH SEVEN NEW TECHNICAL PROJECTS

The National Advanced Manufacturing Testbed (NAMT) program, initiated in 1996, is a research program led by NIST. It is designed to help U.S. industry speed the transition to 21st century manufacturing capabilities. The NAMT is a distributed testbed built on a state-of-the-art, high-speed computing and communications infrastructure that has been developed to support collaborative research between NIST, industry, academia, and other government agencies. The collaborative testbed is bringing together NIST scientists and engineers, industry experts, academic scholars, and scientists from other government agencies to solve measurement and standards issues that impede companies and industries from making the most of their information technology.

On April 1, 1998, the NAMT program was expanded to include seven new technical projects. They are: Tele-Calibration of Gas Flow Meters; Verification of Information Technology Solutions for Size Manufacturing Enterprises; Remote Calibration and Verification of Electrical Standards; Internet-Based Calibrations Services for the Radiation Processing Industry; Interface Standards and Internet Technologies for Robotic Arc Welding; Virtual Cybernetic Building Testbed; and Use of Next Generation Internet and Intelligent Collaboration and Visualization Technologies to Build NAMT Collaboratories.

With the addition of these new projects, the NAMT program now includes 16 technical projects with participation from NIST Laboratories at both Gaithersburg and Boulder. Information on the NAMT program and the technical projects is available on the NAMT web page (http://www.mel. nist.gov/namt/).

Contact: Mark Luce, (301) 975-2159; mark.luce @nist.gov or Dave Stieren, (301) 975-6100; dave.stieren @nist.gov.

NIST-INDUSTRY ROUND ROBIN ADDS CONFIDENCE TO SILICON WAFER MEASUREMENTS

A NIST-coordinated round robin among industrial firms to compare results fromdifferent types of instruments for measuring the surface roughness of siliconwafers has increased the confidence in the measurements by the different techniques. The roughness of silicon wafers is an important functional specification in the semiconductor industry. Silicon wafers, similar to those used in the semiconductor industry as the substrates for the fabrication of integrated-circuit chips, were prepared withdifferent finishes by a major wafer manufacturer. Scientists at NIST and scientists and engineers from at least six differentcompanies (instrument producers or users) participated in the round robin.

Five different types of surface dimensional measuring instruments were used: scanned probe microscopy,

optical profiler, capacitance-gage profiler, optical scattering instrument, and stylus profiler. Instruments such as these are used to determine the root-mean square (rms) roughness of silicon wafers in production. Apower spectral density (PSD) computed from the measured data provided a more detailed description of the surface properties in the different frequency ranges covered by the instruments. Comparison between the PSDs showed a high degree of an interaction agreement among instruments. Initial results of the ongoing comparison were reported in January 1998 at the SPIE Photonics West meeting in San Jose, CA, with final results being prepared for publication in the Journal of Vacuum Science and Technology.

Contact: Egon Marx, (301)T975-3498; egon.marx @nist.gov.

NEW EMG RESULTS REPORTED AT ASME GEAR METROLOGY MEETING

At the March 1998 meeting of the American Society of Mechanical Engineers Committee on Gear Metrology, a NIST scientist reported on a new method to be used at NIST to measure a key gear quality parameter—the spacing or angles between gear teeth. The redundant measurement technique involves the use of NIST's high-accuracy coordinate measuring machine and a newly procured rotary table. The new method adapts the metrology principle of "closure" to measurement on a coordinate measuring machine. The closure principle is based on the fact that when measuring angles over a full circle of 360°, angular errors of a measuring system must sum to zero. Using this principle, the errors of the measuring machine then can be separated from the errors (deviations from nominal) in the artifact standards.

Contact: Howard Harary, (301) 975-3485; howard. harary@nist.gov.

NEXT GENERATION INTERNET (NGI) "NETAMORPHOSIS" DEMONSTRATION

N I S T scientists demonstrated the NGI initiative at the March 11-13, 1998, "Netamorphosis" event hosted by the White House Office of Science and Technology and the National Economic Council. NIST joined other participating government agencies (DARPA, NASA, NIH, and NOAA) in demonstrating advanced applications and new networking technology being developed through the NGI program.

The NIST demonstrations focused on advanced telepresence and telerobotic applications being developed through the National Advanced Manufacturing Testbed (NAMT) and National Construction Automation Testbed (NCAT). By interconnecting the NAMT and associated laboratories with the DARPA Advanced Technology Demonstration Network (ATDNet), NIST scientists were able to allow Netamorphosis visitors to remotely collaborate with NIST researchers and remotely control the operation of testbed equipment physically remote, i.e., at NIST.

NIST staff demonstrated the use of Internet security technology to create a secure virtual private network, over the commercial Internet, for the manufacturing data being transmitted between the demonstration site and the NIST site. NIST developed prototype routers that employed encryption and digital signature techniques were used to protect the critical telerobotic control data associated with the NAMT demonstrations. In addition, NIST staff used NIST-developed network emulation tools to demonstrate the advanced network performance requirements of the NAMT applications and the need for research on Internet quality of service issues.

Contact: Doug Montgomery, (301) 975-3630; doug. montgomery@nist.gov; David Stieren, (301) 975-6100; dave.stieren@nist.gov; Bill Stone, (301) 975-6075; bill. stone@nist.gov.

NIST ADDS NEW CRYPTOGRAPHIC MODULE TO THE FEDERAL INFORMATION PROCESSING STANDARD (FIPS) 140-1 VALIDATED PRODUCTS LIST

In April 1998, NIST validated a new single-chip cryptographic module by Transcrypt International for use by Federal agencies. The SC20-DES v1.0 module was validated as conforming to FIPS 140-1, Security Requirements for Cryptographic Modules. FIPS 140-1 specifies four separate levels of security provided by Cryptographic Modules, with each level providing increased security and assurance. This new validation brings the total number of validated products to 16 for the NIST Cryptographic Module Validation (CMV) program.

The new validation impacts Federal agencies by increasing the number of cryptographic products available for use in securing sensitive information. The SC20-DES v1.0 module is validated with an overall level of 1 with the EMI/EMC section rated at level 3. The module provides DES encryption for land mobile radios.

The CMV program is a joint effort between NIST and the Communications Security Establishment (CSE) of the Government of Canada. NISTs security technology group, and the CSE serve as the validation authorities for the program. Currently, there are three National Voluntary Laboratory Accreditation Program accredited laboratories that test cryptographic modules.

In addition to the FIPS 140-1 validation efforts, NIST and CSE sponsored a FIPS 140-1 conference in May 1998. The conference was titled "Assuring Cryptographic Security: Development, Validation and Use of FIPS 140-1 Compliant Products." The goals of the conference included providing users with information on the benefits of implementing validated products; providing vendors with procedures for submitting products to the validation process; making Cryptographic Module Testing laboratory personnel available to answer questions and provide information; and giving vendors of validated products the opportunity to describe and demonstrate their products. The workshop included an overview of Federal government cryptography, a FIPS 140-1 tutorial, guidance on implementing FIPS 140-1, international initiatives, and the future of FIPS 140-1. Panel discussions addressed Federal agency implementations of FIPS 140-1, availability of validated modules, the cryptographic module testing and validation laboratories, and the banking community.

For more information on the conference, FIPS 140-1, validated modules, and the accredited laboratories please see http://csrc.nist.gov/cryptval.

Contact: Ray Snouffer, (301) 975-4436; ray.snouffer@nist.gov or Jim Foti, (301) 975-5237; jim.fati@nist.gov.

X-RAY DIFFRACTION REVEALS UNEXPECTED STRUCTURE IN SEMICONDUCTOR THIN FILMS

NIST scientists have developed x-ray scattering instrumentation and analysis techniques that accurately measure the thickness, density, and structure of thin film stacks. The measurements are particularly useful for characterizing thin films on silicon wafers used in semiconductor device manufacturing. The semiconductor industry is rapidly moving to new thin film materials, such as tantalum nitride and copper, in the quest for smaller device dimensions and higher speeds, but the physical properties of the new films depend strongly on the process conditions under which they are prepared. Now, the NIST measurements are helping researchers understand processing problems with some of the new materials.

SEMATECH (the consortium of U.S. semiconductor manufacturers) recently made a time-critical request to NIST for help in characterizing a family of tantalum nitride films used to block copper diffusion into silicon, an important issue in the manufacture of higher speed copper-based semiconductor devices. The group quickly adapted its x-ray apparatus to accommodate the 200 mm wafers. Measurement and analysis of the initial group of 16 wafers showed large changes in film thickness, den-sity, and structure resulting from relatively minor changes in processing conditions. The entire measurement procedure, aside from the needed instrument modifications, was completed in 10 working days.

Unlike other film-characterization techniques, the x-ray measurements simultaneously determine the thickness, density, and number of layers starting from nominal stack composition. In the measurements for SEMATECH, the technique revealed an unexpected 1 nm thick layer of a different phase beneath the tantalum nitride film, and remarkable changes in the film density resulting from different processing conditions. NIST researchers have begun further analysis of the SEMATECH samples using a modified x-ray powder diffraction technique to probe the microcrystalline structure of the films, hoping to understand the causes of the wide density variations. SEMATECH subsequently has sent additional wafers with various combinations of metallic copper and tantalum layers produced by several techniques, and preliminary analysis reveals further unexpected complexity.

Contact: Richard Deslattes, (301) 975-4841; richard.deslattes@nist.gov or Joseph Pedulla, (301) 975-3740; joseph.pedulla@nist.gov.

ACCURATE, EFFICIENT COMPUTATIONAL MODELS DEVELOPED FOR QUANTUM NANOSTRUCTURES

Researchers at NIST and a guest researcher from Nicholas Copernicus University in Poland have developed an accurate, efficient computational model for the electronic and optical properties of semiconductor quantum nanocrystals. These zero-dimensional

nanostructures are being intensely studied by many researchgroups with the goal of tailoring optical materials for use in lasers, optical limiters, and optical communication devices with greatly enhanced response and efficiency. Such nanostructures are a challenge to model because they are a few nanometers or less in diameter, a size regime where quantum confinement is critical and a bulk theory is no longer possible, but they still contain hundreds to thousands of atoms, so atomistic models cannot be implement efficiently. A model that is both accurate and efficient has been realized by applying extended multiband effective mass theory to study these systems.

This model has been applied to study quantum dot quantum wells (QDQW) and InAs nanocrystals. Typical QDQWs are CdS spherical nanocrystals grown with a fewmonolayers thick internal shell of HgS. This shell acts as an internal quantumwell to tailor electronic energies and enhance optical response by keepingcarriers away from nonradiative traps on the nanocrystal surface. As recently reported in Physical Review B, calculations using this model accurately reproduce observed optical transition energies and oscillator strengths near the band gap. No previous theory of QDQWs could explain this data.

In collaboration with the Naval Research Laboratories and the University of California at Berkeley, the new model was applied to InAs nanocrystal photoluminescence and photoluminescence excitation spectra recently recorded at Berkeley. InAs is a narrow gap semiconductor with strong valence band/conduction coupling. The new model accurately describes the competing effects of large band nonparabolicity, band coupling, and quantum confinement and quantitatively reproduces the optical data. This work is described in a report recently submitted for publication. Work is continuing to extend this model to other systems and test its capabilities as the atomic limit is approached.

Contact: Garnett Bryant, (301) 975-2595; garnett.bryant@nist.gov.

NEW SP 250 DOCUMENTS PUBLISHED FOR RADIATION PROCESSING DOSIMETRY CALIBRATIONS

Two new NIST Special Publications dealing with radiation dosimetry have been published. SP 250-45, Radiation Processing Calibration Services and Measurement Assurance Program, describes the high-dose radiation dosimetry calibration services at NIST and details the methods by which the standard fields for ^{60}Co irradiation facilities were established. SP 250-44, Radiation Processing Calibration Services: Manual of Calibration Procedures, details the procedures and analyses used in providing the calibrations.

hese two reports update the documentation on this important calibration program that provides measurement quality assurance for the many industrial radiation processing applications carried out in the United States. These applications include radiation sterilization of single-use medical disposables (e.g., syringes, surgical gloves, intravenous sets, surgical kits, and trays); radiation processing of blood products; surface curing of coatings, inks, and adhesives; crosslinking of polymers (e.g., rubber in tires, wire and cable insulation, shrink films and tubing); food irradiation (deinfestation of spices, control of pathogens and spoilage in fruit, vegetables, seafood, chicken, and red meat); pollution control (elimination of solvents in manufacturing certain products, stack gas irradiation, treatment of sewage sludge, waste- and ground-water, soil and sediment, and medical waste); and testing radiation hardness of space-based electronics and materials.

Contact: Marc F. Desrosiers, (301) 975-5639; marc.desrosiers@nist.gov.

GPS CARRIER-PHASE TIME TRANSFER

NIST and University of Colorado scientists recently used Global Positioning System (GPS) signals to achieve a resolution of 100 ps averaged over one day for time transfer between Boulder, CO and Washington, DC.

The traditional approach to high-accuracy GPS time transfer involves two observers observing the same code-based timing signal from a satellite that can be viewed simultaneously by both. This approach is limited in resolution to about 2 ns when averaging for one day.

The new method used the phase of the GPS microwave carrier rather than the code for the common-view time transfer. This process requires identifying the same cycle of the carrier (or carrier cycles with constant separation), a difficult problem because the frequency is high, each satellite is in common view for only a short period, and there is no reference available to help identify a particular cycle. This method is similar to one used by geodesists to compare and adjust observations from a large number of sites to identify the appropriate cycle. The NIST-Colorado researchers were able to achieve carrier-phase time transfer for periods lasting many weeks.

This work is critical to comparison of frequency accuracy among the new generation of laser-cooled atomic frequency standards being developed at NIST

and in laboratories around the world. The carrier-phase method should provide an order-of-magnitude improvement in the precision of such frequency comparisons. This first experiment already achieves frequency comparisons at the level of 1 part in 10^{15} over one day.

Contact: Judah Levine, (301) 975-3903; judah.levine@nist.gov.

OPTICAL GAIN WITHOUT POPULATION INVERSION

Researchers at NIST recently observed optical gain without inversion (GWI) in a sample of laser-cooled and trapped atoms. Measurements and analysis by NIST researchers indicate that the GWI results from quantum interference among coherences in the atom established by applied optical fields. Interpretation of previous GWI and lasing without population inversion experiments has been highly controversial. The NIST experiments provide unambiguous interpretation.

In the experiments, ^{87}Rb atoms were laser cooled and trapped in a magneto-optical trap and irradiated with a strong drive laser field at 780 nm. Light at 795 nm was observed to undergo gain of as much as 0.2 % per pass through the trapped atoms. Direct measurements established that there was no population inversion between the relevant excited and ground states. Other measurements were made to rule out any explanation based on direct Raman processes. The results indicate promise for the use of optical coherences in generating shorter wavelength radiation.

Contact: Leo Hollberg, (303) 497-5770; leo.hollberg@nist.gov.

NEUTRAL PRODUCTS OF SILICON ETCHING DETECTED BY NEW METHOD

NIST researchers have developed a new optical method to detect many of the neutral species produced during silicon etching processes.

Etching of silicon wafers is a critical process in semiconductor device fabrication, but many process details remain poorly understood. For example, recent simulations predict large fluxes of neutral silicon atoms during etching, but it has been difficult to measure such fluxes. Measurements are complicated by large obscuring fluxes of ions, by neutral background species with the same mass as silicon, and by larger molecular product species that fragment during normal mass spectrometer ionization.

The new optical method to measure neutral species uses a pulsed vacuum ultraviolet laser source to ionize the neutral species during the etching process. A silicon wafer is dosed with chlorine molecules and simultaneously bombarded with an energy-variable flux of argon ions. A laser pulse sequence first sweeps large fluxes of interfering ionic species away from the wafer. Then the neutral products from the ion bombardment and etching processes are interrogated directly with the laser and a time-of-flight mass spectrometer.

Significant evolution of neutral silicon atoms is observed, resulting from the simultaneous action of the ion beam and the chlorine chemical reactivity. In addition, a significant flux of silicon monochloride and a much weaker flux of silicon dichloride radical species are seen. In these measurements the silicon monochloride species has by far the highest yield under realistic etching conditions, which consist of several hundred eV argon ion bombardment and saturation dosing of chlorine. This work confirms for the first time that chlorine dosing liberates neutral silicon atoms during reactive ion etching. The results demonstrate a new method for laser flux monitoring process control in complex ionic/chemical plasma etching processes.

Contact: Stephen R. Leone, (303) 497-3505; stephen.leone@nist.gov.

NIST AND IMGC COLLABORATE IN PRODUCING A VERY ACCURATE REFERENCE FUNCTION FOR Pt/Pd THERMOCOUPLES

A joint study between NIST and the Istituto di Metrologia “G. Colonnetti” (IMGC) in Torino, Italy, has produced an emf-temperature reference function for platinum versus palladium (Pt/Pd) thermocouples for the temperature range 273 K to 1773 K in air. The reference function is based on the International Temperature Scale of 1990 (ITS-90) and has an expanded uncertainty (coverage factor of $k = 2$) of less than 11 mK for temperatures up to 1300 K and increasing smoothly to approximately 0.3 K at 1773 K. The NIST/IMGC reference function has an uncertainty that is a factor of three to eight smaller than that of previously determined functions for Pt/Pd thermocouples and has a wider temperature range.

The stability and thermoelectric homogeneity of the Pt/Pd thermocouples prepared for this study were approximately a factor of 10 superior to that of platinum-rhodium alloy thermocouples, which are currently the predominant choice in industry for demanding applications such as instrumentation of semiconductor processing equipment or use as secondary reference standards for calibration of other thermocouples. The use of Pt/Pd thermocouples in these applications would result in substantial improvements in the accuracy of the temperature measurements.

All of the thermocouples used in the study were constructed at NIST from 0.5 mm diameter Pt and Pd wires of the highest purity available. After preliminary tests indicated that the thermocouples had exceptional thermoelectric stability and homogeneity, data at various thermometric fixed points of the ITS-90 were obtained at NIST on a set of seven thermocouples. Then, three thermocouples were delivered to IMGC, where additional fixed-point data were obtained and where calibrations of the thermocouples were performed by comparison with a radiation thermometer from 1073 K to 1773 K. At NIST a separate set of four thermocouples also was calibrated by comparison methods, using as reference thermometers a standard platinum resistance thermometer up to 723 K and Au/Pt thermocouples from 692 K to 1273 K. A statistical analysis of all of the data was performed at NIST, and a reference function giving the thermocouple emf as a function of the temperature was derived by doing a least-squares fit to a selected subset of the data. A detailed presentation of the NIST/IMGC measurements and an extended discussion of the reference function and its uncertainty are to be published shortly in an archival journal.

Contact: Dean C. Ripple, (301) 975-4801; dean.ripple@nist.gov.

NIST RESEARCHERS SURVEY TORNADO DAMAGE

In the aftermath of the recent tornadoes in Alabama, Georgia, and Mississippi, NIST researchers visited the Birmingham, AL, area to survey the structural damage. The storm occurred on the night of April 8, and the largest tornado, which was rated an F5 by the National Weather Service (NWS), killed 30 people and left behind an extensive trail of damage. The same weather system also spawned tornadoes in Mississippi and Georgia. All told, 43 people were killed, and approximately 2000 structures were damaged or destroyed.

Since more than 1100 structures either were destroyed or badly damaged in Jefferson County alone, the research team focused its efforts on cataloging the damage to engineered structures. On April 10, they performed an aerial survey of the tornado track; on the following day they visited and inspected the most significant damage sites. The ground survey began near where the tornado first touched down in the town of Oakgrove and followed the track to its end in McDonald Chapel.

The most well-built structure that was damaged badly was the Oakgrove Elementary and High School. This school complex was composed of five buildings with brick-faced, lightly reinforced, concrete block walls. The worst damage occurred to the gymnasium, where the roof cladding was blown off and the external walls blown down, which led to a complete collapse. All roof cladding was lost and all windows were broken in the main building, which also suffered extensive wall and internal damage from the wind and flying debris. A portable classroom was torn loose from its anchorage and apparently tossed against the main building, before being carried away and left in a nearby field. In addition, some auxiliary buildings around the schools football field were demolished completely.

Other significant structures that were destroyed included the Oakgrove Fire Department building, constructed with a light steel frame on a concrete slab, and two brick and masonry churches, both of which were leveled. Another church, constructed of steel framing with prefabricated RC wall panels, was damaged beyond repair; however, the primary structural elements survived to protect the inhabitants.

A complete report on the observed structural damage is currently being compiled by NIST scientists. Post-disaster investigations provide valuable information on the response of structures to extreme loads. Comparisons between damaged structures and those that performed successfully can yield a wealth of useful information. In addition, the investigations provide information related to the wind velocities associated with the damages and indications of whether the conditions were consistent with current codes and standards. They also provide evidence that additional research is needed to improve the current building standards.

The NIST research team was assisted by the Bessemer Civil Air Patrol, the National Oceanic and Atmospheric Administration, NWS, and the Office of the Federal Coordinator for Meteorology.

Contact: Long Phan, (301) 975-6077; long.phan@nist.gov. or Michael A. Riley, (301) 975-6065; michael.riley@nist.gov.

NIST HOLDS WORKSHOP FOR HEART VALVE MANUFACTURERS

Technical issues facing manufacturers of heart valves were identified in a workshop held at NIST in February 1998. The workshop focused on problem areas where NIST may provide assistance, particularly with regard to carbon heart valves. Issues identified for follow-up discussions included carbon reference materials, reliability analysis for the di fferent kinds of carbon materials being used, flaw detection and quality assurance, accelerated test methods for wear, acceler-

ated testing for reliability, and dynamic computational modeling of fluid flow. The workshop involved 21 participants, including representatives from four of the largest U.S. heart valve manufacturers, NIST, The Food and Drug Administration, the National Institutes of Health, and an independent, private-sector, surgeon-expert on cardiovascular technology.

Contact: John A. Tesk, (301) 975-6799; john.tesk @nist.gov.

MEETINGS HELD ON IMPACT TESTING MACHINES

A NIST scientist participated in a European Commission (BCR) meeting on the certification of reference materials for verification of Charpy impact testing machine. NIST is responsible for certifying (using NIST SRMs) Charpy impact testing machines. The meeting was held at the Institute of Reference Materials and Measurements in Geel, Belgium. At this meeting, two master batches of reference materials were recommended for certification. For the first time, one of the NIST test machines was included in the BCR certification process. NIST test results were close to the mean value of the 17 machines in Europe that participated in the testing, and now the NIST machine is recognized as a reference machine for Europe.

A second meeting was held to discuss an inter-national comparison that NIST has organized for reference impact machines and test specimens. The plans call for a horizontal comparison of the machines and specimens used by the European Commission, France, Japan, and NIST. The results will enable the first statistical evaluation of bias and standardduration for this broadly used mechanical property test.

Contact: Tom Siewert, (303) 497-3532; tom.siewert @nist.gov.

NIST'S VIRTUAL FACTORY AIDS UNIVERSITY OF MARYLAND MANUFACTURING RESEARCHERS

The University of Maryland Computer Integrated Manufacturing (CIM) laboratory is working with NIST to set up a factory of simulated machine tools. Under the supervision of NIST scientists, graduate students run the NIST Enhanced Machine Controller (EMC) software in simulation as the basis for their research in flexible manufacturing system (FMS) architectures.

Multiple EMC simulations run on the CIM laboratories workstations, each configured to represent a different machine. The software is identical to that used for real-time control of actual machine tools, with the addition of simulated motors that can be configured for armature resistance, inductance, back EMC constant, inertia, and damping coefficient. The simulation of a machine tool from the factory network interface down to the physical motors means that the universitys FMS research can be applied directly to real machines.

NIST provides help with configuring the system, interfacing the controllers to the FMS network software, and writing graphical animations of the machines. This allows the university to focus as quickly as possible on their FMS research while giving them confidence that the results will have practical applications.

Contact: Fred Proctor, (301) 975-3425; fred.proctor @nist.gov.

NIST/SEMATECH STATISTICIANS DEMONSTRATE INTERNET ENGINEERING STATISTICS HANDBOOK

Statisticians from NIST and the Statistical Methods Group of SEMATECH demonstrated the prototype of the Internet Engineering Statistics Handbook at the Conference on Characterization and Metrology for ULSI Technology at NIST in March 1998. The handbook will be made available to scientific and engineering communities via the World Wide Web in early 1999.

The goal of the handbook is to enable engineers and scientists, particularly those from the semiconductor industry, to incorporate statistical methods into their work efficiently and effectively. The focus is problem oriented with step-by-step procedures and numerous case studies based on data from industrial processes and scientific laboratories. A unique feature of the handbook is its seamless integration with statistical software.

The juxtaposition of software and hypertext links creates a powerful environment for illustrating the application of statistical techniques to engineering and scientific problems.

Conference attendees viewed content, structure, and real-time analysis of engineering data from within the handbook using an HTML browser. They also participated in two usability studies organized by NIST. These studies tested navigational features of the handbook and alternative methods for linking casestudies with software. Special instrumentation interfaced with the handbook pages charted paths and times taken by the participants to accomplish specific tasks. The data should prove key in guiding the developers in making the operation of the handbook transparent to the novice user.

Contact: Carroll Croarkin, (301) 975-2849; carroll-croarkin@nist.gov.

WORKSHOP HOSTED ON INTRAVASCULAR BRACHYTHERAPY STANDARDS

NIST hosted the first CIRMS Workshop on Measurementsand Standards for Intravascular Brachytherapy in April 1998. More than 70 U.S. and European researchers, medical professionals, medical equipment manufacturers, pharmaceutical producers, and regulatory officials participated in the workshop held at NIST-Gaithersburg. CIRMS is the Council on Ionizing Radiation Measurements and Standards, an advisory-group that helps NIST better respond to customer needs for radiation services.

Brachytherapy is the therapeutic irradiation of tissues using radioactive sources directly implanted in, or located adjacent to, the target tissue. Intravascular-brachytherapy is a rapidly developing research procedure to prevent restenosis (reclosing) of blood vessels following angioplasty for removing coronary artery-blockages. More than 600 000 such angioplasties are performed in the United States each year, with up to 50 % of patients undergoing repeat angioplasties due to restenosis. Intravascular brachytherapy uses a catheter containing tiny radioactive sourcesto irradiate the newly opened blood vessel walls (from within the vessels) immediately following angioplasty. The procedure takes only a few minutes and appears to reduce dramatically the incidence of restenosis. Medical researchers estimate that up to 90 % of future angioplasty procedures may include intravascular brachytherapy.

Researchers still are investigating the proper therapeutic doses, and calibration is made difficult by the small size (1 mm or less) and relatively intense radioactivity of the brachytherapy sources. Since the sources typically use short-lived radioisotopes, accurate calibrations must be completed rapidly and the information delivered to the medical professionals. NIST has pioneered techniques to provide the required calibrations for various types of brachytherapy sources, including intravascular sources. A National Advanced Manufacturing Testbed (NAMT) project is attempting to automate the calibration procedure and rapidly report the results to medical practitioners.

The brachytherapy workshop brought together researchers, practitioners, and equipment manufacturers to address the measurement and standards requirements that must be overcome to begin widespread clinical trials of intravascular brachytherapy. The workshop included presentations and discussions on the status of and needs for intravascular brachytherapy; experimental and calculational dosimetry methods for brachytherapy sources, and regulatory aspects of brachytherapy.

Contact: Bert Coursey, (301) 975-5584; bert.coursey@nist.gov.

NRIP SPRING WORKSHOP HELD

Participants in the NIST Radiochemistry Intercomparison Program (NRIP) held the semi-annual Users Workshop at NIST in March 1998 to discuss improving low-level radionuclide measurements. The meeting focused on technical and programmatic issues associated with NRIP and the establishment of a national radiochemistry traceability testing program. In attendance were representatives from the participating laboratories, Environmental Protection Agency, several state monitoring labs, Department of Defense, Nuclear Regulatory Commission, more than a half dozen U.S. Department of Energy national laboratories, ANSI standards-writing committees, the International Atomic Energy Agency (Austria), Ontario Hydro (Canada), and several U.S. commercial suppliers of radioactivity standards.

Metrology discussions focused on analytical techniques for the analysis of Sr-90, U-238, Pu-238, and Am-241 on glass-fiber air filters. The users agreed that this is an invaluable forum for improving radiochemical metrology that will eventually cover five matrices included in the NRIP test-sample distributions (water, glass-fiber air filters, synthetic urine, synthetic fecal material, and natural-matrix soil). A major topic of discussion was the implementation of the American National Standard N42.22-1995 (Traceability of Radioactive Sources to the National Institute of Standards and Technology and Associated Instrument Quality Control) as the acceptance criteria for NIST traceability testing. This standard defines acceptable testing results and the “traceability limit” to which a source manufacturer can claim traceability.

Discussions also were held on the establishment of reference laboratories as defined in the American National Standard N42.23-1996 (Measurement and Associated Instrumentation Quality Assurance for Radioassay Laboratories). This ANSI standard envisions the accreditation of a small group of program-specific reference laboratories that participate directly in a traceability testing program with NIST, including technical document reviews and on-site assessments. These reference laboratories would act as intermediaries, establishing the traceability testing link to the service laboratories through performance testing (PT) programs. One current driving force to establish reference laboratories is the privatization of the EPA Drinking Water Crosscheck Program that will require the NVLAP accreditation of the PT providers for the drinking water laboratories. It is anticipated that traceability testing for reference laboratories will be initiated within the next 12 months.

Contact: Michael Schultz, (301) 975-4336; michael.schultz@nist.gov or Kenneth G. W. Inn, (301) 975-5541; kenneth.inn@nist.gov.

AEROSPACE CASTING TEAM RECEIVES FLC TECH TRANSFER AWARD

A team of scientists from NIST has been recognized by the Federal Laboratories Consortium (FLC) for their success in transferring metalcasting technology to the aerospace industry. The overall goal of the program was to improve the modeling of the casting process to shorten development times and reduce reject rates on the critical cast parts of aircraft engines.

The members of the NIST team provided several contributions to more detailed and accurate modeling, including procedures for predicting the solidification behavior for complex multicomponent alloys having user-specified compositions, a sensor for detecting the advancing solidification front, accurate measurements of alloy thermophysical properties, and definition of the conditions for formation of certain defects. The NIST effort also provided benchmark measurements of extremely low sulfur concentrations in superalloys, requested by the consortium members for the next generation of engine components.

Contact: Robert J. Schaefer, (301) 975-5961; robert.schaefer@nist.gov.

Standard Reference Materials

NEW SRM SUPPORTS WAVELENGTH CALIBRATION FOR WDM OPTICAL FIBER COMMUNICATIONS

NIST scientists have developed a new wavelength reference for optical communications systems that is now available as Standard Reference Material (SRM) 2517. Optical fiber communication systems are becoming more complex as operators try to push even more information down the same fibers. Wavelength references are needed in the 1500 nm region to support current and future wavelength division multiplexed (WDM) optical fiber communication systems. In a WDM system, many wavelength channels are sent down the same fiber, thereby increasing the bandwidth of the system proportionally to the number of channels. If one channel's wavelength were to shift, cross-talk could occur between it and a neighboring channel. Wavelength references can be used to calibrate optical instruments that characterize system components and measure the channels' wavelengths.

Fundamental molecular absorptions provide references that are very stable under changing environmental conditions. SRM 2517 is an optical fiber coupled absorption cell containing acetylene ($^{12}C_2H_2$) gas. A user-supplied light source can be coupled into and out of the unit via optical fiber connectors. The SRM is intended for use in calibrating the wavelength scale of wavelength measuring equipment in the 1510 nm to 1540 nm spectral region. More than 50 accurately measured absorption lines are available for acetylene in this wavelength region. To obtain the certified wavelength values for this SRM, the NIST researchers measured the pressure shift due to the collisions between acetylene molecules at the 27 kPa cell pressure. Literature values for the line centers then were adjusted for this pressure shift. The wavelengths of the acetylene absorption lines are certified with an expanded uncertainty of ± 0.0006 nm (coverage factor $k = 2$). Another SRM with reference lines in the 1530 nm to 1560 nm region is being developed.

Contact: Sarah Gilbert, (303) 497-3120; sarah.gilbert@nist.gov.

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Calendar

July 14–15, 1998
HIGH-DIMENSIONAL EMPIRICAL LINEAR PREDICTION (HELP) WORKSHOP

Location: National Institute of Standards and Technology
Gaithersburg, MD

Sponsor: NIST.
Audience: Test and measurement engineers and calibration lab managers.
Format: Workshop.
Purpose: To introduce a new approach for optimizing the testing of electronic instruments and devices.
Topics: Model building, test point selection, response prediction statistics and quality control, and PC laboratory exercises using HELP toolbox.
Technical Contact: Michael Souders, NIST, Building 220, Room B162, Gaithersburg, MD 20899-0001, phone: 301/975-2406, fax: 301/926-3972, email: t.souders@nist.gov.
Electronic Registration: https://sales.nist.gov/conf/

July 15–17, 1998
ELECTRONIC COMMERCE OF COMPONENT INFORMATION

Location: National Institute of Standards and Technology
Gaithersburg, MD

Sponsors: NIST, IEEE Computer Society (pending), Silicon Integration Initiative (S12).
Audience: Electronic designers manufacturers' tool users, product users, product developers, EDA tool developers and users, government, standards organizations, and consortia.
Format: Lecture, breakout sessions, poster sessions, panel sessions, and group discussions.
Purpose: To identify technologies that can be developed to remove barriers and to create opportunities for businesses and consumers in the electronics industry by accelerating the development of means to access, exchange, and reuse electronic component information.
Topics: End-users scenarios and requirements, standards efforts, interoperability and lessons learned, discussions and forward plan.
Technical Contacts: Curtis Parks, NIST, Building 225, Room A53, Gaithersburg, MD 20899-0001, phone: 301/975-3517, fax: 301/975-3157, email: curtis.parks @nist.gov James St. Pierre, NIST, Building 225, Room A53, Gaithersburg, MD 20899-0001, phone: 301/975-4124, fax: 301/975-3157, email: james.st.pierre @nist.gov.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF72/conf_register.htm.

August 4–6, 1998
1998 FEDERAL TECHNICAL STANDARDS WORKSHOP: STANDARDS MANAGEMENT—A WORLD OF CHANGE AND OPPORTUNITIES

Location: Loews L'Enfant Plaza Hotel
Washington, DC

Sponsors: NIST, Department of Energy (DOE), Environmental Protection Agency (EPA), National Aeronautics and Space Administration Partnership in Reliability, Supportability, and Maintainability Standards (RMS Partnership).
Audience: Primarily federal employees, but others such as state government employees and members of the RMS Partnership will be included.
Format: Workshop with plenaries and breakout sessions.
Purpose: To assist federal agencies in their implementation of the tenets of the National Technology Transfer and Advancement Act and the Revised OMB Circular A119.
Topics: Strategic standardization (private sector initiatives and the influence of strategic standardization approaches on standards management systems),

acquisition reform, privatization/internationalization issues related to standards, global trade and the influence of standards, harmonization/interoperability issues, common standards for Federal agencies, and implementation of the new OMB Circular A-119 by Federal agencies.
Technical Contacts: Rick Serbu, Technical Standards Program Manager, Department of Energy, EH-31, phone: 301/903-2856, email: richard.serbu@eh.doe.gov or Don Williams, ORNL, phone: 423/574-8710, email: dw5@ornl.gov.

August 9–12, 1998
1998 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS RADIO AND WIRELESS CONFERENCE

Location: Sheraton Hotel
Colorado Springs, CO

Sponsors: NIST, Institute of Electrical and Electronics Engineers (IEEE), and Institute for Telecommunication Sciences (ITS).
Audience: Engineers in commercial wireless communication.
Format: Single-track, technical sessions, workshops, panel sessions, and exhibitions.
Purpose: To provide an interactive forum for new results in wireless communications and advance the process of industry standardization.
Topics: Systems, active components, passive components, measurements, antennas, and propagation.
Technical Contact: Michael S. Heutmaker, Lucent Technologies, P.O. Box 900, Room 2-2063, Princeton, NJ 08542-0900, phone: 609/639-3116, fax: 609/639-3197, email: heutmaker@lucent.com.
Conference Homepage: http://rawcon.org/

August 20–22, 1998
FIRST ADVANCED ENCRYPTION STANDARD (AES) CANDIDATE CONFERENCE

Location: DoubleTree Inn
Ventura, CA

Sponsor: NIST.
Audience: International audience consisting of cryptographers and other interested parties who wish to participate in the evaluation and analysis of candidate algorithms for the Advanced Encryption Standard (AES).
Format: Presentations, demonstrations, and discussions.
Purpose: A process to develop a Federal Information Processing Standard (FIPS) for the Advanced Encryption Standard (AES) specifying an Advanced Encryption Algorithm (AEA) has been initiated by NIST. NIST is currently soliciting candidate algorithms for inclusion in the AES. The purpose of this conference is to announce and present the AES candidate algorithms to the public, in order to begin to facilitate the Round 1 Evaluation and Analysis Period.
Topics: FIPS, AES, AES Analysis Packages, and AEA.
Technical Contacts: Miles Smid, Building 820, Room 412, Gaithersburg, MD 20899-0001, phone: 301/975-2938, fax: 301/948-1233, email: miles.smid@nist.gov Jim Foti, NIST, Building 820, Room 417, Gaithersburg, MD 20899-0001, phone: 301/975-5237, fax: 301/948-1233, email: james.foti@nist.gov.
General Information: Ed Roback, NIST, Building 820, Room 426, Gaithersburg, MD 20899-0001, phone: 301/975-3696, fax: 301/948-1233, email: edward.roback@nist.gov.
Conference Homepage: http://csrc.nist.gov/encryption/aes/aes_home.htm.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF9/conf_register.htm

September 9–10, 1998
INFORMATION TECHNOLOGY FOR MANUFACTURING AND ENGINEERING: INTEGRATION TUTORIALS

Location: National Institute of
Standards and Technology
Gaithersburg, MD

Sponsor: NIST Systems Integration for Manufacturing Applications Program (SIMA).
Audience: Managers, engineers, systems integrators, software developers, and researchers.
Format: Tutorials and demonstrations.
Purpose: To provide a coherent, up-to-date perspective on current and emerging approaches to integrating manufacturing software applications.
Topics: Distributed design, integration frameworks, virtual prototyping, manufacturing simulation, information modeling, product data exchange, and collaboration technology.
Technical Contacts: James Fowler, NIST, Building 220, Room A245, Gaithersburg, MD 20899-0001, phone: 301/975-3180, fax: 301/258-9749, email: james.fowler@nist.gov or Howard Moncarz, NIST, Building 220, Room A348, Gaithersburg, MD 20899-0001, phone: 301/975-5070, email: howard.moncarz@nist.gov.

Conference Hompage: http://www.mel.nist.gov/msid/sima/simaconf.html.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF53/conf_register.htm

September 9–11, 1998
1998 INTERNATIONAL SYMPOSIUM ON ADVANCED RADIO TECHNOLOGIES

Location: National Institute of Standards and Technology
Boulder, CO

Sponsors: NIST, IEEE Communications Society, IEEE Antennas and Propagation Society, Institute for Telecommunication Sciences (ITS), Personal Communications Industry Association (PCIA), and Modular Multifunction Information Transfer System Forum (MMITS).
Audience: Technical.
Format: Symposium, ITS and NIST tours.
Purpose: The symposium will focus on state-of-the-art and future trends in software radio and smart antenna technologies and applications. Session presentations by leading experts in software radio and smart-antenna fields from government, industry, and academia will be followed by forward-looking open round table discussions on future directions in technologies and related issues. An interactive dialog with the audience is desired where symposium participants are encouraged to share their ideas and opinions.
Topics: Software radio technologies, software radio applications, smart antenna technologies and smart antenna applications.
General Information: Francesca Repetto, U.S. Department of Commerce, NTIA/ITS.S3, 325 Broadway, Boulder, CO 80303, phone: 303/497-3822, fax: 303/497-3680, email: repetto@its.bldrdoc.gov.
Technical Contacts: Dr. Christopher Holloway, U.S. Department of Commerce NTIA/ITS.S3, 325 Broadway, Boulder, CO 80303, phone: 303/497-6184, fax: 303/497-3680, email: cholloway@its.bldrdoc.gov or Dr. Roger Dalke, U.S. Department of Commerce, NTIA/ITS.S3, 325 Broadway Boulder, CO 80303, phone: 303/497-6184, fax: 303/497-3680, email: rdalke@its.bldrdoc.gov.
Conference Homepage: http://ntia.its.bldrdoc.gov/meetings/art/art98.html.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF62/conf_register.htm

September 14–17, 1998
ISIC/CIRA/ISAS '98 IEEE INTERNATIONAL SYMPOSIUM ON INTELLIGENT CONTROL (ISIC) INTERNATIONAL SYMPOSIUM ON COMPUTATIONAL INTELLIGENCE IN ROBOTICS AND AUTOMATION (CIRA) INTELLIGENT SYSTEMS AND SEMOTICS (ISAS)

Location: National Institute of Standards and Technology
Gaithersburg, MD

Sponsors: NIST, National Science Foundation (NSF), Institute of Electrical and Electronics Engineers (IEEE) Control Systems Society, and U.S. Army Research Office.
Audience: Leading researchers in the area of intelligent systems, including design and application.
Format: The conference will be organized in three parallel tracks including nine workshops and three general discussions. The three days of the meeting will be preceded by a day of relevant tutorials.
Purpose: To focus upon learning processes in intelligent systems, and dedicated applied semiotics and its application in large and complex systems, including intelligent machines.
Topics: Large systems, formal tools of semiotics, brain architectures, decision making, planning and control, learning in the systems and applications.
Technical Contact: Richard Quintero, NIST, Building 220, Room B124, Gaithersburg, MD 20899-0001, phone: 301/975-3445, fax: 301/990-9688, email: richard.quintero@nist.gov.
Conference Homepage: http://isd.cme.nist.gov/proj/is98/

September 15–17, 1998
SYMPOSIUM ON OPTICAL FIBER MEASUREMENTS

Location: National Institute of Standards and Technology
Boulder, CO

Sponsors: NIST, IEEE Lasers and Electro-Optics Society and the Optical Society of America.
Audience: Private companies, government labs, and universities engaged in lightwave communication development.
Format: Contributed and invited papers grouped into sessions.

Purpose: To provide a forum for reporting the results of recent measurement research in the area of lightwave communications, including optical fibers.
Topics: Optical fiber metrology including attenuation, dispersion, geometry, reflectometry, and connectors; integrated optic devices; laser diode sources and detectors; and system measurements.
Technical Contact: Paul Williams, NIST, 325 Broadway, Mailcode 815.02, Boulder, CO 80303, phone: 303/497-3805, fax: 303/497-3387, email: pwilliam@boulder.nist.gov.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF61/conf_register.htm

September 22–24, 1998
FINGERPRINT AND OTHER FORENSIC DATA INTERCHANGE STANDARDS WORKSHOP

Location: National Institute of Standards and Technology
Gaithersburg, MD

Sponsors: NIST Information Technology Laboratory (ITL) and the Federal Bureau of Investigation (FBI).
Audience: Law enforcement agency staff involved with fingerprint processing and other AFIS users, producers, and consultants. In addition, those staff associated with mugshot and palm print processing should find this workshop useful.
Format: Breakout and demonstration sessions.
Purpose: To re-evaluate the concepts and information contained in the ANSI Fingerprint and Mugshot Data Interchange Standards.
Topics: Review of current fingerprint and mugshot standards, palm print data exchange, evolution of the Type-9 record, aspects of data security, and certification authorization.
Technical Contacts: R. Michael McCabe, NIST, Building 225, Room A216, Gaithersburg, MD 20899-0001, phone: 301/975-2932, fax: 301/975-5287 email: mccabe@nist.gov Mike Rubinfeld, NIST, Building 225, Room A216, Gaithersburg, MD 20899-0001, phone: 301/975-3064, fax: (301) 975-5287, email: miker@nist.gov.
Conference Homepage: http://www.itl.nist.gov/div894/894.03/fing/stand2.html.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF47/conf_register.htm.

October 5–9, 1998
21ST NATIONAL INFORMATION SYSTEMS SECURITY CONFERENCE

Location: Hyatt Regency Crystal City
Arlington, VA

Sponsors: NIST and National Computer Security Center of the National Security Agency (NCSC/NSA).
Audience: Government, industry, commercial, and academic communities.
Format: Tracks, tutorials, and panels with a separate vendor exposition.
Purpose: To address today's hottest information systems security issues.
Topics: Information systems security issues.
Technical Contact: Tim Grance, NIST, Building 820, Room 426, Gaithersburg, MD 20899-0001, phone: 301/975-4242, fax: 301/948-0279, email: tim.grance@nist.gov.
Conference Homepage: http://csrc.nist.gov/nissc/welcome.htm

October 19–21, 1998
SEVENTH ANNUAL MEETING OF THE COUNCIL ON IONIZING RADIATION MEASUREMENTS AND STANDARDS

Loaction: National Institute of Standards and Technology
Gaithersburg, MD

Sponsors: NIST and the Council on Ionizing Radiation Measurements and Standards (CIRMS).
Audience: Industry, government, and academia in applied radiation sciences.
Format: Conference, breakout sessions, and poster sessions.
Purpose: To identify national needs for ionizing radiation measurements and standards.
Topics: Measurements and standards, medical applications, occupational radiation protection, environmental and public radiation protection, industrial applications and materials effects.
Technical Contact: Bert Coursey, NIST, Building 245, Room C229, Gaithersburg, MD 20899-0001, phone: 301/975-5584, fax: 301/869-7682, email: bert.coursey@nist.gov.
Conference Homepage: http://www.cirms.org/sum97.html.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF50/conf_register.htm

October 19–23, 1998
PRECISION THERMOMETRY WORKSHOP

Loaction: National Institute of
Standards and Technology
Gaithersburg, MD

Sponsor: NIST.
Audience: These workshops are intended for calibration laboratory personnel and others who wish to undertake precision temperature measurements. Applicants should possess undergraduate training in physics or engineering and should have some laboratory experience in metrology. Participation is limited to 16 people. There is no on-site registration.
Format: Classroom and laboratory instruction.
Purpose: To provide advice and assistance on measurement and calibration problems, tracing to NIST the accuracies of measurement standards needed for research work, factory production, or field evaluation.
Topics: Temperature scales, platinum resistance thermometry, vapor pressure and gas thermometry, low temperature calibrations, thermistor thermometry, liquid-in-glass thermometry, and thermocouple thermometry.
Technical Contact: Andrea Swiger, NIST, Building 221, Room B128, Gaithersburg, MD 20899-0001, phone: 301/975-4800, fax: 301/548-0206, email: andrea.swiger@nist.gov.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF48/conf_register.htm

November 2–4, 1998
IN-SITU BURNING OIL SPILL WORKSHOP

Location: DoubleTree Hotel
New Orleans, LA

Sponsors: NIST and the Minerals Management Service (MMS).
Audience: Local, state and federal agencies, responders, environmentalists, academia, and the user community.
Format: Invited technical paper presentations and panels.
Purpose: To present the current state of knowledge for the in-situ burning of spilled oil.
Topics: Historical perspective of in-situ burning, pre-planning for in-situ burn operations, extending the window of opportunity for burning, fireboom performance testing, training and preparedness, monitoring, smoke plume trajectory modeling, alternative approaches to in-situ burn operations and inland/freshwater burning.
Technical Contact: Nora Jason, NIST, Building 224, Room A252, Gaithersburg, MD 20899-0001, phone: 301/975-6862, email: nora.jason@nist.gov.
Electronic Registration: https://sales.nist.gov/conf/secure/CONF63/conf_register.htm

November 2–6, 1998
1998 ANNUAL CONFERENCE ON FIRE RESEARCH

Location: National Institute of
Standards and Technology
Gaithersburg, MD

Sponsor: NIST Building and Fire Research Laboratory's Fire Science Division.
Audience: Industry, government, and university fire researchers.
Format: Parallel sessions.
Purpose: The Annual Conference on Fire Research has long been the prime forum for the presentation and discussion of the latest advances in the science of fire and the engineering of fire safety.
Topics: Fire suppression, fire detection, fire plumes, flame spread, halons, numeric databases, polymers, pool fires, risk assessment, soot, toxicity, urban fires, and composites.
Technical Contact: Richard Gann, NIST, Building 224, Room B250, Gaithersburg, MD 20899-0001, phone: 301/975-6866, fax: 301/975-4052, email: richard.gann@nist.gov

November 17–19, 1998
ADVANCED TECHNOLOGY PROGRAM FALL NATIONAL MEETING

Location: Atlanta Sheraton Gateway Hotel
Atlanta, GA

Sponsor: NIST Advanced Technology Program.
Audience: ATP companies and public potential bidders.
Format: Multiple, parallel meetings and workshops.
Purpose: To provide forum for conduct of multiple workshops in various topics of importance to the ATP, in order to focus attention on the program and reduce the cost and planning burden for NIST and its staff.
Topics: Bidders conference; best practice workshops; focused program planning and review workshops;

thought leaders workshops for long range planning; state's activities in support of technology; venture capital and alternative financing workshops; small company issues workshops, impact assessment meetings; poster sessions, including perhaps other agencies; cooperative agreement management workshops.

Technical Contact: John Gudas, NIST, Building 101, Room A227, Gaithersburg, MD 20899-0001, phone: 301/975-3214, fax: 301/590-3053, email: john.gudas @nist.gov.

Conference Homepage: http://www.atp.nist.gov/atp/conf.htm.

Electronic Registration: https://sales.nist.gov/conf/secure/CONF71/conf_register.htm

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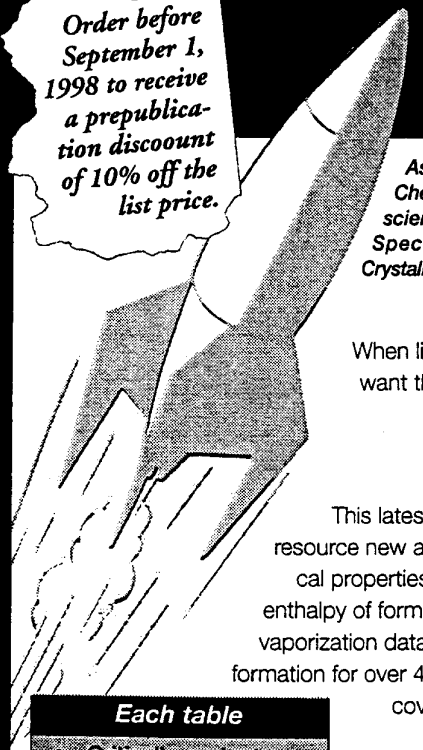

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