

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 416, Room 119, Gaithersburg, MD 20899-0001; telephone: 301/975-3572.

COMMERCE ADOPTS METRIC TRANSITION ACTION PLAN

The Commerce Department has announced a new action plan that significantly advances the federal government's transition to the metric system and will help U.S. companies become more competitive in the global marketplace. Commerce Secretary Ronald H. Brown said, "Our new plan will serve as a model for all federal agencies striving to make the transition to metric." DoC has two primary metric assignments: to lead and coordinate the metric transition activities of all federal agencies, and to convert programs and functions within the department that relate to trade, industry and commerce to metric use. Metric terms will be used in budgets, procurements, grants and loans, construction and other business-related activities. NIST administers DoC metric transition activities and also leads transition-related activities throughout the federal government. The NIST efforts are led by the chief of the NIST Metric Program, who chairs the federal Metrication Operating Committee. NIST also acts as secretariat to the Interagency Council on Metric Policy, chaired by Commerce Under Secretary for Technology Mary L. Good. Copies of the DoC metric plan are available from the NIST Metric Program, A146 Building 411, NIST, Gaithersburg, MD 20899-0001, (301) 975-3690, fax: (301) 948-1416.

ADVANCED FIRE SAFETY ADVISED FOR HIGH-SPEED TRAINS

NIST fire experts recently recommended that a new generation of test methods and hazard analysis techniques be incorporated into future designs of high-speed passenger trains. These trains are becoming increasingly popular around the world and are being considered for use in the United States. In a recent study, NIST researchers found that U.S. fire safety guidelines for trains have not kept up with advances in fire safety engineering. The current U.S. guidelines are prescriptive, apply to specific materials and do not consider the relationships between materials during a fire. A better understanding of how fires start and spread has led to advances in fire test methods and hazard analysis that can predict actual fire behavior. For example, the NIST-developed Cone Calorimeter can provide data needed to predict the fire hazard of a product, such as a seat cushion, from a small sample of material. Also, advanced computer models, such as NIST's HAZARD I, can predict temperature, smoke and toxic gas concentrations and the likely loss of life and injuries. Fire Safety of Passenger Trains: A Review of Current Approaches and of New Concepts (TN 1406) is available for \$11 pre-paid from the U.S. Government Printing Office, Washington, DC 20402, (202) 783-3238. Order by stock no. 003-003-03246-8.

NEW CHART DETAILS "COLD FACTS" ABOUT SILVER

NIST has developed a new wall chart presenting technical data on the properties of silver at cryogenic (super-cold) temperatures. It is a companion to a previous wall chart on the cryogenic properties of copper. Silver is used extensively in the preparation of high-temperature superconductor wires, tapes, films and other items. Silver not only shields

the superconducting material from the external environment, but also provides flexibility, strain relief and low-resistance electrical contact. As a result, there is a great demand for understanding the low-temperature properties of silver. The wall chart, researched and developed by two NIST scientists, includes 14 charts and three tables on properties such as thermal conductivity, electrical resistivity, magnetoresistance, tensile strength, and tensile strain. Copies of the chart are available free of charge from Fred Fickett at Div. 814.05, NIST, Boulder, CO 80303-3328, (301) 497-3785, e-mail: fickett@bldrdoc.gov (via Internet).

OPEN SYSTEMS PUBLICATION NOW ON CD-ROM

A report addressing agreements on interoperability in open computer systems is now available in electronic format. The latest version of the NIST publication, *Stable Implementation Agreements for Open Systems Interconnection Protocols* (NIST Special Publication 500-214), comes on CD-ROM in formats compatible with most personal computer systems: ASCII, WordPerfect and PostScript. The agreements result from discussions at Open Systems Environment Implementors' Workshops, co-sponsored quarterly by NIST and the IEEE Computer Society to build consensus on issues related to open systems environments. NIST SP 500-214 is available on CD-ROM for \$15. To order, contact the Conference Department, IEEE Computer Society, 1730 Massachusetts Ave., NW, Washington, DC 20036-1992, (202) 371-1013, fax: (202) 728-0884.

ATP FOCUSES ON FIVE TECHNOLOGIES FOR NEW PROGRAMS

The NIST Advanced Technology Program has announced five economically important technologies as the first areas for concentrated research efforts under its new "focused program" strategy. The new ATP programs—all slated for 5 years—include: Tools for DNA Diagnostics to develop compact, low-cost, automated DNA analysis technologies; Information Infrastructure for Healthcare to develop critical information infrastructure technologies to enable enhanced medical information systems; Manufacturing Composite Structures to reduce the high initial costs of using advanced composite materials, enabling their use in large-scale commercial applications such as bridges and auto-

mobiles; Component-Based Software to develop the technologies necessary to enable systematically reusable software components in automated assembly of a broad array of applications; and Computer-Integrated Manufacturing for Electronics to develop a flexible, software-based framework needed to promote greater manufacturability, productivity and product variety in the electronics industry. The new programs are based on ideas from more than 150 "white papers" sent in by the private sector. The programs will be cost shared and carried out by industry. A 5 year government investment is expected to leverage an equal investment by industry. For more information, call 1-800-ATP-FUND (287-3863) or send an e-mail message to atp@micf.nist.gov (via Internet).

QUAKE REPORT: "GOOD NEWS, BAD NEWS" STRUCTURALLY

The strong earthquake that struck the Los Angeles area last Jan. 17 provided the first full-scale test of modern seismic codes and revealed both successes and deficiencies in current construction practices and codes. This is the conclusion of a new report by NIST's Building and Fire Research Laboratory. Among the good news: most structures designed and built after seismic codes (adopted and enforced at the state and local level) were revised in the mid-1970s performed well. Most older bridges retrofitted to meet the revised standards also fared well. On the other hand, significant damage occurred in older structures known to be vulnerable to earthquake shaking, such as unreinforced masonry buildings. The report also states that the Northridge quake demonstrated a serious limitation of modern building codes. Because such codes are intended primarily to prevent structure collapses, non-structural damage to building property or systems (such as lighting, air conditioning and heating) and community lifelines (water, gas, telecommunications and transportation systems) was widespread. The report recommends ways to improve these shortcomings and encourages more education on earthquake-resistant building technologies for designers, constructors and regulators. 1994 Northridge Earthquake—Performance of Structures, Lifelines and Fire Protection Systems (NISTIR 5396) is available for \$27 prepaid from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 94-161114.

1994 BALDRIGE AWARD SOUGHT BY 71 FIRMS

Seventy-one U.S. companies are in the running for a 1994 Malcolm Baldrige National Quality Award. They include 23 in the manufacturing category, 18 in the service category and 30 in the small business category. Last year, 76 companies applied and two won. Firms applying for the 1994 award must provide details on their quality management systems, citing achievements and improvements in seven areas. Applications are evaluated by an independent NIST-appointed board of about 260 quality experts, mostly from the private sector. Announcement of the 1994 winners and a presidential award ceremony will take place this fall. The Baldrige Award program is managed by NIST with the active involvement of the private sector. The award is not given for specific products or services.

U.S. TRADE TO BENEFIT FROM NEW ASSESSMENT SYSTEM

NIST has established the National Voluntary Conformity Assessment System Evaluation Program to improve the acceptance of U.S. products in international markets such as the European Union, based on U.S. approvals. Under NVCASE, the Department of Commerce, acting through NIST, will accept requests to evaluate and recognize competently conducted conformity assessment (product acceptance) activities. NIST evaluations will supplement those of other federal agencies to provide a basis for the federal government to assure foreign entities that qualified U.S. conformity assessment bodies are competent to satisfy foreign regulatory requirements. NVCASE covers organizations engaged in product sample testing, product certification and quality system registration, and will emphasize reliance on their accreditors where applicable. NIST evaluations, based on publicly developed requirements, will be conducted on a fee-for-service basis resulting in a certificate of recognition to organizations that meet the requirements. For information, contact the Standards Code and Information Program, A629 Administration Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-4029, fax: (301) 963-2871.

ULTRASOUND TO EVALUATE "HEALTH" OF AIR BAG INFLATORS

NIST has signed a cooperative research and development agreement with a private company to study the feasibility of using ultrasound to inspect air bag

inflators for weld defects. The company is a leading supplier of air bag inflators to the automotive industry. NIST has a well-established program for using sound waves to non-destructively characterize materials in various manufactured products such as sheet steel and railroad wheels. The private company uses a technique called inertia welding to fuse its inflators. NIST will train the company personnel to examine the welds for flaws—possibly as small as a millimeter in diameter—with a NIST-developed detector called an electromagnetic acoustic transducer, or EMAT. The EMAT will employ an indirect resonance technique to improve the sensitivity of the ultrasound signal. NIST plans to transfer the innovative technology for high-resolution EMAT inspection to the company, and, eventually, the company hopes to use EMATs on the assembly line to provide quality assurance for its products. For more information, contact Van Clark, Div. 853, NIST, Boulder, CO 80303-3328, (303) 497-3159.

SEMINAR ON OMB CIRCULAR A-119

On Feb. 23, the Interagency Committee on Standards Policy (ICSP) hosted a seminar at the Department of Commerce to discuss the significance of the recently revised OMB Circular A-119, "Federal Participation in the Development and Use of Voluntary Standards." The circular establishes policy for executive branch agencies in working with voluntary standards bodies and for adopting and using voluntary standards in procurement or regulatory activities. The purpose of the seminar was to facilitate a dialogue between private and public standards interests to further the circular's objectives. The NIST Office of Standards Services provides the chair and the secretariat for the ICSP.

MUTUAL RECOGNITION OF TYPE EVALUATION BETWEEN THE UNITED STATES AND CANADA

Manufacturers of bench and floor scales, weighing and load-receiving elements up to 500 kg, and electronic indicators can now apply to laboratories either in the United States or in Canada for tests, which, if passed, will result in acceptance for commercial use in both nations. During the past year, National Type Evaluation Program (NTEP) management at NIST; NTEP Participating Laboratory managers from California, Maryland, Ohio, and New York; and engineers at Canada's Type Evaluation Laboratory charted the most efficient test

procedures combining both nations' requirements and developing a single checklist for use whether applying for an NTEP Certificate of Conformance, a Canadian Notice of Approval, or both. A single application form with a guide and checklist of necessary documents and other materials also has been produced. Each nation will continue to issue its own approval.

NTEP is a cooperative partnership with NIST, state governments, the National Conference on Weights and Measures, and commercial measuring device manufacturers. Since 1986 nearly 1400 Certificates of Conformance have been issued for prototype commercial devices and components, including load cells (tested by the NIST force group), turbine and mass flow meters, measurement software, retail motor fuel dispensers, railroad and truck scales, and cash registers, which meet legal metrology standards at federal and state levels. Measurement devices used for commercial exchange of commodities or services by weight or measure may not be offered for sale until national approval is granted that the performance and design of the device meets minimum criteria. For example, meat and poultry plants in the United States purchase commercial scales from a list of potential suppliers whose products have an NTEP certificate.

NIST CRYOELECTRONIC INFRARED DETECTOR SETS RECORDS

Three NIST scientists have invented and implemented a record-setting infrared detector that combines a planar lithographic antenna with a high-temperature super-conducting microbolometer on a silicon chip. The antenna couples far-infrared radiation into a super-conducting strip on a free-standing bridge of yttria-stabilized zirconia created by silicon micromachining. The result is to heat the strip, which is held near its sharp super-conducting transition at 90 K, yielding a voltage proportional to the infrared power. The device has demonstrated record performance for liquid-nitrogen-cooled thermal detectors. Its minimum detectable power (noise-equivalent power = 9×10^{-12} W/Hz^{1/2}) halves the previous record, and it responds 10000 times faster (time constant ≈ 4 μ s). These capabilities open the door to the development of far-infrared imaging arrays based on monolithic integration of these detectors with switching transistors.

NIST THREE-LOOP METHOD ADDRESSES NEED FOR MEASURING ELECTROMAGNETIC RADIATION FROM VDTs

NIST scientists have developed a three-loop method well suited for measuring electromagnetic radiation from desk-top size electronic equipment, specifically including video display terminals (VDTs). Possible adverse health effects arising from VDT use have become a concern; manufacturers already have marketed low-emissions displays, and the Institute of Electrical and Electronics Engineers has formed Standards Committee PAR 1140 to study the measurement of VDT radiation from 9 kHz to 50 MHz. By providing general electromagnetic emissions measurements from low frequencies (kilohertz) to about 100 MHz, the three-loop method responds to the urgent need for readily implemented, cost-effective measurements. Other methods have been developed for the purpose, including an earlier NIST method based on the use of a transverse electromagnetic cell, but these methods require moving either the device under test or the probes used to scan the electric and magnetic fields or the use of a large number of probes.

The three-loop method provides determinations of the emitted electric and magnetic fields quickly, accurately, and with no moving parts. The VDT or other device is placed at the center of the three mutually perpendicular antenna loops, each loop having two diametrically opposed and resistively loaded gaps to measure both the electrical and magnetic components of an electromagnetic wave. Measurements of the voltages generated across the six gaps of the loops provide information from which the dipole patterns and the total power radiated by the device are determined. The loops are 1 m in diameter; signals from the loops are transmitted over analog fiber optic links to the detection and processing electronics. This arrangement confers many benefits: it maintains the phase, amplitude, and frequency information for processing; separates the electric and magnetic components through the use of suitably oriented photodiode pairs. It also contributes to the system's broad bandwidth, provides electrical isolation for the loops, and eliminates coupling between the loops and commonly used electrical lead wires.

DIRECT COMPARISON SYSTEM FOR MICROWAVE POWER PROVIDES BASIS FOR IMPROVED SERVICE TO NIST CUSTOMERS

NIST scientists have developed and put into trial operation a power calibration system that offers NIST clients for microwave power measurements from 50 MHz to 18 GHz significantly reduced turn-around time and the potential for reduced costs without increased uncertainties. Microwave power measurements serve as the basis for characterizing all active microwave devices and as such are key to the design and testing of microwave systems, including those to be used in intelligent highway systems and wireless communications. The new "direct comparison" system is used to measure a parameter known as the effective efficiency of thermistor mounts for customers. Previously, these calibrations were done by means of NIST dual six-port vector network analyzer systems. Responding to a typical customer's request for calibration of a transfer standard required NIST to use two separate six-port analyzers at several frequency bands, a time-consuming process: more than a week was required to perform power calibrations at 120 frequencies, a representative number. These measurements can now be made on the direct comparison system in less than half a day.

The direct comparison system is based on a method that incorporates a measurement of reflection coefficient to correct for any mismatch. This method has been known in principle but has been difficult to implement. With the appropriate hardware and the availability of modern commercial vector network analyzers to make the reflection coefficient measurements, the method has become a viable alternative to the use of six-port analyzers. An additional advantage of the direct comparison system compared to six ports is that it is easier to maintain.

JOSEPHSON-JUNCTION DIGITALLY SYNTHESIZED SOURCES FOR AC METROLOGY UNDER DEVELOPMENT

Three NIST scientists have invented and demonstrated a new type of programmable Josephson-junction array that uses a digital input to select rapidly any one of several thousand quantized output voltages. The new circuit will make possible the digital synthesis of very accurate ac waveforms whose amplitude derives directly from the internationally accepted definition of the volt. The circuit uses a binary sequence of series subarrays of shunted Josephson junctions to make a 14 bit

digital-to-analog converter (one junction in the first subarray, two in the second, four in the fourth ...). Resistive shunts allow each junction to be rapidly switched between its zero and first quantum levels. With 13 bias lines any step number in the range -8192 to $+8192$, corresponding to the voltage range -1.2 V to 1.2 V, can be selected in the few microseconds required to stabilize the bias current. The team also has devised a method for compensating the loading of the circuit resulting from current being drawn at the output, which otherwise would shift the bias points of the junctions. A paper describing this development was scheduled to be published in the June issue of the Institute of Electrical and Electronics Engineers Transactions on Applied Superconductivity.

DRAPER LABORATORY MICROMACHINED SILICON SENSORS EVALUATED IN NIST ANECHOIC CHAMBER

Micromachined silicon sensor microphone systems developed by the Charles Stark Draper Laboratory, Inc., were characterized in the NIST Acoustic Anechoic Chamber. A laboratory measuring microphone system traceable to free-field calibrations by the reciprocity method at NIST was the reference. A computer-controlled multichannel dynamic signal analyzer was programmed to measure either FFT-based narrowband spectra, frequency responses, and coherence functions, or real-time one-third-octave-band spectra and broadband levels. It was used to measure diffraction effects on the sensors, as well as their free-field sensitivity levels at frequencies from about 100 Hz to 40 kHz (exact ranges varied among sensors), linearity, and two-tone intermodulation distortion. To elucidate noise-producing mechanisms, the self-noise output voltage of each sensor was measured at its normal polarizing voltage, and, for two sensor types, with the polarizing voltage turned off. Evaluation by NIST indicates that the sensors are even better than prior sensitivity measurements by Draper (using a relatively limited calibration system) had suggested. The NIST measurements also suggest how to distinguish between a prominent antiresonance in a sensor and effects of diffraction. Draper is developing improved sensors for which evaluation at NIST is planned. Micromachined silicon sensors offer promise of high-quality, rugged, stable, low-cost transducer systems, either individually or in $n \times m$ arrays, for applications where current transducer technologies are either inadequate or prohibitively expensive.

COLLABORATION PRODUCES PROTOTYPE TOOL FOR MONITORING MAP NETWORKS

Factory systems rely heavily on network communications for the exchange of data throughout the factory. Consequently, network problems can result in expensive factory down-time. Frequently, a networking expert must be brought in to diagnose and fix network problems. Reductions in cost and factory down-time can be achieved with tools that allow factory personnel to correct network problems whenever they occur.

NIST and a private company have collaborated to produce a prototype factory network monitoring tool, Intellimon, usable by factory personnel. This prototype can be used to monitor and diagnose problems in a factory network which uses the Manufacturing Automation Protocol (MAP) set of International Organization for Standards Open Systems Interconnection protocols. The tool runs on PC-compatible microcomputers running Interactive Unix equipped with a MAP Network Interface Unit for installation in either a 802.4 Carrierband or 802.4 Broadband network. User interfaces are based on Motif and database interfaces are based on Embedded Structured Query Language. The Intellimon prototype provides a real-time monitoring capability and the ability to capture network data for later retrieval and examination.

PIONEER FUND GRANT FOR ENCRYPTED TIME DATING AWARDED TO NIST

A NIST scientist has been awarded a Department of Commerce Pioneer Fund Grant to develop an encrypted time-stamping method for computer-generated records. This method will permit authentication of dates of records important in patent applications as well as other documents that must remain proprietary. Under this grant, NIST will develop the time-dating and encryption service, which can eventually be provided to both U.S. industry and other government agencies. The process is based on a "hashing" algorithm applied to a computer-generated file with the addition of an encoded NIST time stamp. The enciphered output will be infeasible to duplicate without the original text, which can be produced by the owner in cases of disputes of dating. The method provides an electronic means of validating dates and maintaining confidentiality, with the eventual elimination of notaries and witnesses for records that can be converted to digital format.

SIMPLE OPTICAL TRANSFER CAVITY FOR ABSOLUTE FREQUENCY CALIBRATION

Development of new commercial applications for single-mode lasers in optical communications, high-density data storage, holography, precision machining, and interferometry has spawned a corresponding need for simple and robust methods for absolute frequency standards and calibration. Recently, NIST scientists achieved a relatively inexpensive scheme for frequency calibration of a wide range of laser light sources. The concept is based on both thermal and piezoelectric stabilization of an open transfer cavity, which is locked onto the output of a polarization stabilized HeNe laser. "Fast" acoustic fluctuations of the transfer cavity are corrected with piezoelectric control, while long-term drift is compensated by thermal "stretching" of the cavity length. Due to the better than 1 part in 10^8 long-term absolute stability of this cavity, precise frequency measurements with a tunable laser light source are achieved by interpolating between the stable cavity transmission fringes. Experimentally, frequency drifts of <1 MHz/h are routinely obtained with respect to molecular transitions, with a week-to-week frequency reproducibility of better than 5 MHz. This method provides a much simpler alternative to thermally and acoustically isolated cavities and, therefore, will have more routine application under less ideal, commercial environments.

POLYMER-SUPPORTED CATALYSTS FOR SYNTHESIS OF CYCLOPOLYMERIZABLE MONOMERS

A patent application has been filed for a method that simplifies the preparation of a new class of polymer resins for dental restoratives. Prior work at NIST showed that the polymerization shrinkage of dental resins, which leads to inferior properties, can be reduced substantially by the use of monomers capable of efficient cyclopolymerization. The monomers may be synthesized from inexpensive starting materials by an amine-catalyzed reaction between acrylates and paraformaldehyde. These monomers have elicited interest from the dental industry, but their preparation involves several steps that add to their cost. Further studies showed that the reaction could be simplified by attaching the amine catalyst to a porous polymer support. Advantages of this approach include ease of product isolation (simple filtration rather than extraction or chromatography), a solvent-free

LEARNING THE SHAPE OF THINGS UNSTICKY

A NIST scientist and researchers from a private company recently have completed surface structure studies of a new, ultra non-stick coating that have helped the company better understand how the coating's structure relates to its non-stick properties. The patented coating potentially could be applied to many different types of surfaces so that dirt, food, paints, or other normally sticky materials—even permanent markers—will wipe off easily. Compared with currently available non-stick coatings, the new material is clearer, more durable, more easily applied, and has immediate uses in cookware, however, because current formulations cannot tolerate high heat. Working through a cooperative research and development agreement, the research group used polarized, "soft" x-ray radiation to study the surface structure of the coating made with different processing parameters. The experiments helped reveal that the coating's performance depends on the way a thin layer of fluorocarbon molecules arrange themselves on the surface. The non-stick properties of the coating are optimized when the polymer chains are not completely aligned across the surface. Incomplete alignment occurs with greater chemical crosslinking between the chains and better non-stick properties. A full description of the structure studies appears in the March 3 issue of *Nature*.

NIST FIRE MODELS UTILIZED TO DEMONSTRATE CODE EQUIVALENCY

In a 3 year trial, NIST's predictive fire models FPEtool, HAZARD I, and CFAST have been utilized successfully by a major Swiss company for the evaluation of fire safety designs of unique facilities which could not be evaluated by the traditional building code. The consulting and engineering firm was acting for federal or local authorities in evaluating designs submitted for official approval. The building designs evaluated included a hospital, large exhibition hall, international airport terminal and hangars, and a medieval castle. Use of NIST fire models to demonstrate equivalency is becoming common in the United States as well; recent examples include a major expansion of McCormack Place in Chicago and the Mall of America (the largest shopping mall in the world) in Minnesota.

PANEL ENVISIONS FEDERAL INTERNETWORKING AS COMPONENT OF NATIONAL INFORMATION INFRASTRUCTURE (NII)

In its recently released draft report, the Federal Internetworking Requirements Panel gives its vision of federal networking as a seamless component of the NII, providing a full range of communications connectivity among federal agencies and between the federal community and the public. The interagency panel was established by NIST in November 1993 to reassess federal requirements for open systems networks.

The panel's draft report asserts that no single protocol suite meets the full range of federal requirements for data internetworking. The Internet Protocol Suite and Open Systems Interconnection both have strengths and weaknesses, as do proprietary protocols, according to the study. The panel said that each community within the government should pursue the solution to meeting their mission requirements as a primary goal without a specific technical solution being imposed on them. In addition, agencies need to consider interoperability, existing infrastructure, and cost. Standards alone are not sufficient to meet these goals; federal agencies need to be supported by available products and infrastructure. Rather than technical solutions, agencies need a process that provides guidance to assist them in deciding how to best meet their requirements.

The panel will forward its final recommendations to NIST which develops and maintains Federal Information Processing Standards for federal use in computer and related telecommunications systems.

NEW PUBLICATION RELATES VIRTUAL ENVIRONMENTS TO MANUFACTURING

NISTIR 5343, *Applying Virtual Environments to Manufacturing*, presents case studies of recent, state-of-the-art work that exemplifies the application of virtual environments in one or several aspects of manufacturing. Virtual environments are a collection of technologies that offer the opportunity to integrate the human into a computing system. Although virtual environment technologies are still difficult and expensive to use, people are adapting them to real work situations. Case studies presented by industry, academia, and government.

NIST PUBLISHES PROCEDURES FOR REGISTERING COMPUTER SECURITY OBJECTS

NISTIR 5308, General Procedures for Registering Computer Security Objects, defines the principles of operation for the Computer Security Objects (CSOs) Registration Authority. A CSO is the definition or representation of a resource, tool, or mechanism used to maintain a condition of security in computerized environments. NIST established the register for CSOs to provide stable object definitions identified by unique names. Use of the register will enable the unambiguous specification of security parameters and algorithms to be used in secure data exchanges.

GAMS CONNECTS TO THE WORLD WIDE WEB

The NIST Guide to Available Mathematical Software (GAMS) is now accessible on the World Wide Web (WWW). This means that GAMS information is now available to anyone on the Internet using WWW browsers such as Mosaic.

GAMS is an on-line cross-index of mathematical and statistical software available for use by NIST staff. Some 9000 problem-solving software modules from nearly 80 packages are indexed in GAMS. The primary indexing mechanism is a tree-structured taxonomy of mathematical and statistical problems developed by the GAMS project. The system also operates as a virtual software repository, providing redistribution of abstracts, documentation, and source code of software modules that it catalogs; however, rather than operate a physical repository of its own, GAMS provides transparent access to multiple repositories operated by others.

WWW is an international hypermedia information initiative that aims to make a large universe of network-based documents easily accessible. WWW provides information in a variety of formats, including hypertext, searchable indexes, gopher, FTP, and Usenet news. Users can access the web from any machine on the Internet using a variety of browsers now available at no cost, the most widely known of which is Mosaic, developed at the National Center for Supercomputing Applications at the University of Illinois. GAMS was placed on the web by developing an HTTP gateway for the existing GAMS network information server, which uses a private protocol. All GAMS information is provided through the GAMS server on gams.nist.gov.

The new hypermedia interface is now one of many mechanisms to access GAMS information. Among these are its own command-line and X11-based graphical user interface clients. These clients interact with the GAMS server using TCP/IP socket-based communication. Source and binary versions of these clients can be downloaded from enh.nist.gov; NIST staff can mount binary versions directly on their workstations using NFS. Other GAMS services include a gopher information server and anonymous telnet access.

NEW REPORT HIGHLIGHTS BENEFITS, BARRIERS OF NII

Commerce Secretary Ronald H. Brown has released for public comment a report that focuses on ways that the National Information Infrastructure—commonly referred to as the “information superhighway” can be used to strengthen the U.S. economy and improve quality of life. As an interconnection of computer networks, telecommunications services and applications, the NII has the potential to significantly improve the way people use information in their jobs and other aspects of their daily lives. The report, *Putting the Information Infrastructure to Work*, closely looks at some of the opportunities and obstacles in seven key applications of the NII: manufacturing, electronic commerce, health care, education, environmental monitoring, access to library information and government services. To obtain a copy of NIST Special Publication 857, contact the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 94-163383.

NEWS FROM NIST NOW ACCESSIBLE THROUGH GOPHER

News releases, fact sheets, news capsule newsletters (such as this publication and the bimonthly *Science Beat* for science/technology journalists) and other media materials produced by NIST's Public Affairs Division are now available electronically from the NIST gopher (gopher-server.nist.gov). PAD items are found under the “NIST News & General Information” section of the gopher. A “Recent News Releases” submenu offers the current issues of *NIST Update* and *Science Beat*, and all PAD news materials for a 2 week period. Archived copies of news releases, *NIST Update* and *Science Beat* also are available. If you do not have access to a gopher client, you may use the NIST service by telnetting to “gopher.nist.gov” and logging on as user “gopher.”

Direct Uniform Resource Locators—or URLs—for PAD materials are:

- [gopher://gopher-server.nist.gov:79/1/](http://gopher-server.nist.gov:79/1/) (for the NIST general information and news files)
- [gopher://gopher-server.nist.gov:79/1/menus/thisweek](http://gopher-server.nist.gov:79/1/menus/thisweek) (for current news releases and newsletters).

WORLD GETS A SECOND TO SPARE ON JUNE 30

For the 19th time since 1972, the world's timekeepers gave us some extra time this summer. At precisely 23 hours, 59 minutes, 60 seconds Coordinated Universal Time or 7:59:60 p.m. EDT on June 30, 1994, one second was added to the world's time in order to keep super-accurate atomic clocks in step with the Earth's rotation. In the United States, this correction was made in atomic time-keeping systems at NIST in Boulder, CO, and at the U.S. Naval Observatory in Washington, DC. The adjustment was necessary because the Earth's rotation varies several thousandths of a second daily, putting planetary time behind that of atomic clocks (with accuracies of several billionths of a second per day). The leap second allows the poorer timekeeping Earth to "catch up" to the clocks' exact precisions.

UNITED STATES/CANADA/MEXICO ESTABLISH NORAMET AND NACC

NIST, the National Research Council (NRC) of Canada and the Standards Council of Canada (SCC), and the National Center for Metrology (Centro Nacional de Metrologia, or CENAM) and the Director General for Standards (Dirección General de Normas, or DGN) of Mexico have signed memorandums of understanding to establish two organizations: NORAMET and the North American Calibration Cooperation (NACC). They will serve as a framework to promote closer cooperation between the three North American countries in areas of metrology and calibration laboratory accreditation as part of an overall effort to reduce non-tariff barriers to trade. NORAMET will be a North American regional collaboration in national measurement standards and services. The NACC effort will be directed to the development of mutual confidence in national calibration laboratory accreditation programs. NACC also will provide the regional structure to negotiate calibration agreements with similar organizations in other regions of the world such as EUROMET, and the European

Cooperation for Accreditation of Laboratories (EAL). For information, contact the Office of International and Academic Affairs, A505 Administration Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-3089, fax: (301) 975-3530, e-mail: OIAA@micf.nist.gov (via Internet).

NEW SERVICE TO ASSESS METROLOGY SOFTWARE

Data-analysis software in coordinate measuring systems was long considered an inscrutable "black box," the source of only negligible errors. However, experience and case studies show that the software can be a significant source of measurement error, causing manufacturers to accept out-of-tolerance parts or reject good ones. A special test service now under development at NIST should help eliminate this problem. Expected to begin later this year, the Algorithm Testing and Evaluation Program will provide makers and users of coordinate measuring systems with an independent check on how accurately their software calculates a part's geometry from a sample of coordinates on the part's surface. This assessment, done with a NIST-developed tool field tested by more than 50 U.S. companies, will enable customers to quantify measurement uncertainties and identify extreme situations especially prone to errors. Test procedures embody emerging national standards being developed by NIST and the American Society of Mechanical Engineers. The new program will be the first U.S. calibration service for dimensional metrology software. For more information, contact Cathleen Diaz, A127 Metrology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2889, fax: (301) 258-9749, email: diaz@cme.nist.gov (via Internet).

PUZZLE OF SUPERCONDUCTOR AC LOSS MEASUREMENT RESOLVED

Work carried out by a NIST scientist has resolved a puzzle relating to energy loss measurements in superconducting wire and led to a revision of the qualification procedure for superconducting wire for the International Thermonuclear Experimental Reactor (ITER) project. Project personnel have major concerns about the heat load caused by ac losses in the ITER superconducting magnet windings. As a result, an important specification for U.S. manufacturers of superconducting wire is the size of the hysteresis loss.

For the past 2 years, metrologists have faced the problem that different laboratories report differing values for the hysteresis loss for samples of the wire type to be used in the ITER magnet. To resolve the discrepancies, the NIST scientist measured the energy loss per unit volume on samples of differing geometry. His analysis revealed that the length of the wire sample used in the measurement was important. In particular, he found that the sample length must exceed two or three twist-pitch lengths to get consistent volume hysteresis loss measurements. The scientist plotted data as a function of sample length from all U.S. laboratories participating in an interlaboratory comparison and found that the data points fell on a universal curve. This result was unexpected because energy loss per unit volume is independent of sample length for typical superconductor specimens. As a result of the NIST work, sample length will be an important parameter in the process of qualifying wire for the ITER magnet. In subsequent work, the NIST scientist and a collaborator from the Japanese National Research Institute for Metals, showed that the source of the measurement problem was unintended interfilament contact in the type of superconductor wire selected for the ITER magnet.

NIST CO-SPONSORED WORKSHOP ON INTERFACE STANDARD FOR SMART SENSORS

The use of digital signal processing in transducers introduced the smart sensors to the process market in 1983, bringing significant benefits to the users of such devices. The smart sensor market since then has grown to about \$500 million and maintains a growth rate of 22 % per year. However the \$1000 average price of a conventional smart transducer does not encourage widespread low-cost application. The advance in VLSI technology in recent years allows the integration of digital signal processing into the transducer. It also has reduced the price of some smart sensors very significantly. There are several existing and emerging standards on communication and networking protocol, but none are currently selected as a standard for low-cost smart sensors. A workshop on standard interface for smart sensors was held at NIST March 31 and April 1 to explore the avenues for such a standard. The workshop was co-sponsored by NIST and the TC-9 committee of the Instrumentation and Measurement Society of IEEE with cooperation from SEMATECH and Society of Manufacturing Engineers.

Fifteen invited speakers presented talks on topics in sensor signal conditioning, interface requirements, communication protocols, sensor buses, sensor networking, and sensor user requirements. Some of the topics on sensor-related standards and protocols included the latest development on sensor interfaces, Controller Area Network, Society of Automotive Engineer's J-1850 standard, Lonworks and LonTalk Protocol, Fieldbus, DeviceNet, WorldFip, and SEMATECH's Device Interoperability Standard for Smart Sensor and Actuators. The topics on users' needs included sensor interface requirements for machine tool, semiconductor devices, open manufacturing systems, electronic remote monitoring, and intelligent vehicle highway system.

Workshop attendees included representatives from sensor and IC manufacturers, users, industry and university researchers, and government agencies. The participants expressed a marketplace need for a sensor interface standard and favored government-industry interaction to work on such a standard. The attendees proposed a future workshop to be held in September.

SYMPOSIUM ON PHYSICAL INTERACTION AND MANIPULATION

Robotics researchers from government, academic, and industrial laboratories met at the Symposium on Physical Interaction and Manipulation in the American Association for Artificial Intelligence 1994 Spring Symposium Series in March at Stanford University. The symposium was organized by NIST and private industry to discuss organizational principles of robust sensory-motor control in uncertain environments.

Scientists from Stanford VA Medical Center explained that their aids for the handicapped were accepted more easily if the users could anticipate their behavior; users were disturbed by complex robot arm motions required by joint singularities. An MIT scientist noted that current actuators have an order of magnitude less dynamic range than muscles.

State-of-the-art results also were presented. A University of Massachusetts uses control theory and reinforcement learning with visual and force feedback to transfer tight-tolerance insertion capabilities among loosely calibrated workcells. A scientist from the University of Pennsylvania uses Discrete Event Systems to coordinate several continuous control regimes. A private industry scientist's PRISM-3 real time stereo and image motion estimation system has been used in success-

ful NASA tests of a robot arm capturing an object in zero gravity.

It was generally agreed that robots must perform robustly, even if functionality must be sacrificed. Fault tolerance and graceful degradation of performance under harsh conditions must be built in from the beginning. The high quality of well-informed discussions earned high praise from participants.

STANDARD FOR COMMUNICATION WITH POSTAL EQUIPMENT DELIVERED TO USPS

In the last 15 years, the process of sorting mail—letters, magazines, packages—has become increasingly automated and is now performed almost entirely by computer-controlled mail-processing equipment. Like factories and mines, mail processing is now experiencing “islands of automation”—the new problem is to get the equipment controllers to communicate with higher level automation systems that define sorting and processing plans and capture processing and maintenance information. NIST developed, for the U.S. Postal Service, a specification for communication between mail-processing equipment and postal automation systems involved in sorting mail. The Postal Equipment Message Specification (PEMS) covers the “application and presentation layers”—message formats, content, and meaning—and is compatible with the ISO 9506 Manufacturing Message Specification. The PEMS was finalized in January and will be required in future mail-processing equipment procurements for the USPS.

NIST CO-HOSTS WORKSHOP TO LAUNCH R&D PROGRAM FOR CUSTOM FOOTWEAR MANUFACTURING

NIST and the South Carolina Research Authority recently co-hosted the first Custom Footwear Manufacturing Workshop in Charleston, SC. At the workshop, attendees discussed the potential creation of a nationwide, collaborative R&D effort to benefit the American footwear industry. The group of participants comprised top-level executives and leading technologists from custom footwear manufacturers and footwear industry suppliers; trade associations for therapeutic footwear and for mainstream ready-to-wear footwear; professional societies representing foot and ankle health professionals; the Textile/Clothing Technology Corp., the

leading national, independent apparel R&D laboratory; the AMTEX Partnership, a collaboration between DOE and the American Textile Consortium; and government agencies.

During the workshop, attendees discussed applicable technologies for custom and therapeutic footwear manufacturing, related business requirements, national impacts on the economy and health care, and potential strategies to launch a nationwide R&D effort. It was decided the best strategy will be to concentrate initial efforts on the technology requirements of therapeutic footwear. Attendees believe that the proper development, commercialization, and, particularly the integration of the advanced technologies discussed will enable cost-effective design, manufacture, and distribution of therapeutic footwear. The resulting cost benefit to national health care, because of the major cost avoidance of much more expensive medical treatment, will be enormous.

Action items to continue the effort were agreed upon at the workshop's conclusion.

BIOLOGICAL MACROMOLECULE CRYSTALLIZATION DATABASE

The NIST/NASA/CARB Biological Macromolecule Crystallization Database (BMCD), prepared by CARB personnel, includes crystal and crystallization data on all forms of biological macromolecules that have produced crystals suitable for x-ray diffraction studies. The Standard Reference Data Center released Version 3.0 of this database in early April. This new version contains listings for 2353 crystal forms of 1557 biological macromolecules. The data and software in the BMCD are designed to assist structural biologists in the development of crystallization protocols. Crystals are used in x-ray structure determinations to assist in protein engineering and rational drug design studies. This new release of BMCD, now co-sponsored by NASA and NIST, includes the NASA Protein Crystal Growth Archive. The archive contains data on crystallization experiments conducted in space. This includes data from both the NASA-sponsored protein crystal growth research and from internationally sponsored microgravity macromolecule crystallization studies. This new data will help scientists study the effects of gravity on protein crystal growth.

The database is available from the Standards Reference Data Program.

INTERNATIONAL PROGRAM DEVELOPED ON GLOBAL ATMOSPHERIC TRANSPORT OF METALS

A cooperative research project between scientists at NIST and the Institute of Spectroscopy in Moscow is presently under way with the visit of two Russian scientists to NIST. The Russian scientists are working with a NIST scientist to develop new methods for the measurement of metallic elements at extreme trace levels—levels below one part in 10^{12} .

The project began in the fall of 1992 when the NIST scientist spent 2 weeks working at the Institute of Spectroscopy with Russian and French scientists to measure the trace element content of glacial ice samples from Greenland and the Antarctic. Such measurements are used to reconstruct the atmospheric global transport of metals and to determine the influence of human activity on such transport. The metal concentrations in such samples are well below a part in 10^{12} , and represent a challenge to state-of-the-art analytical chemistry. During the initial studies, researchers decided to reproduce some of the specialized laser equipment developed at the Institute of Spectroscopy for use at NIST. This affords the opportunity to couple the capabilities of the Russian laser system with other unique spectroscopic techniques used at NIST. This dye laser system was designed and constructed at the Institute of Spectroscopy specifically for chemical analysis, and has capabilities not found in commonly available dye lasers. The duplicate system was purchased by NIST and is now being installed at NIST.

Once the laser is installed and tested, the project is expected to continue with the use of the laser in atomic fluorescence and laser-enhanced ionization spectrometers.

THEORETICAL PREDICTION OF GAS-PHASE CHEMICAL NUCLEATION KINETICS

Ab initio molecular orbital (MO) theory, in conjunction with reaction-rate theory, has been used by scientists at NIST as a new approach to ascertain the thermochemistry and energetics for gas phase nucleation. The primary motivation for the work was to provide a systematic method for obtaining nucleation information relevant to nanometer particle-materials growth or to microcontamination in chemical vapor deposition reactors.

The specific example used for the illustration of this approach was the nucleation of SiO. MO computations were used to compute the structures and

energies of the $(\text{SiO})_n$ clusters, which were then used in reaction rate theory computations to obtain pressure-dependent and temperature-dependent nucleation rate constants. The results recently have been incorporated into a process simulation model used by a private company to predict the onset of particle contamination during the chemical vapor deposition of silicon oxide films. The work, which is continuing at NIST, provides a basis for incorporating theoretical values that can be used in process models to develop strategies to mitigate particle formation during thin-film growth or, alternatively, for controlling particle chemistry during vapor-phase growth of nano-meter particles.

CRADA RESULTS IN NEW, HIGH-POWER, TUNABLE DIODE LASER

NIST researchers in collaboration with a private company have developed new high-power diode lasers designed for both scientific and industrial applications. The laser generates 20 times more power (up to 1/2 W) than previous single-mode tunable laser systems. The laser is designed to replace the argon-ion-laser-pumped Ti:sapphire laser. The new laser system is very small, does not require a pump laser, and requires less than 10 W of input power.

The laser was developed under a CRADA. It has potential applications in frequency doubling, pumping of solid-state lasers, a wide range of spectroscopy, atom cooling and trapping, analytical chemistry, and trace detection of atoms and molecules. While the laser can replace larger, more cumbersome lasers at 20% of the cost, the dramatic reduction in size, complexity, and power consumption should make possible new applications, possibly creating new markets.

NEW LASER SOURCE AT 194 nm

NIST scientists recently collaborated on a major simplification of the 194 nm laser system used for cooling and probing in all of the trapped-mercury-ion experiments. The first source ever operated at this wavelength was developed nearly 10 years ago. The new system typically generates 60 μW to 80 μW of 194 nm power, whereas the old system had an output of between 2 μW and 5 μW . The new system also eliminates two krypton-pumped dye lasers reducing power consumption from 90 kW to 30 kW. The two dye lasers were replaced by a Ti:sapphire laser and a diode laser, both built at NIST.

The next improvement will replace an argon-ion laser with a diode-pumped crystal laser. This will complete the conversion to an all solid-state system simplifying operation and improving reliability. Evolving technology will continue to provide the simplifications required to make the cooled, mercury-ion frequency standard a practical reality.

NOAA-NIST COLLABORATION ON ATMOSPHERIC CHEMISTRY

In a continuing collaboration between NOAA and NIST, red diode lasers are being used to detect NO₃ radicals. This molecule plays an important role in atmospheric photochemistry. In the stratosphere its photochemistry affects ozone depletion, and it acts as a strong oxidizer in the troposphere.

NO₃ has a strong electronic absorption band at 662 nm that can be reached with commercial red diode lasers. In these experiments, a solitary diode laser is used to detect the time-dependent concentration of NO₃ in an excimer-laser photodissociation experiment. Good detection sensitivities are achieved with simple direct absorption measurements. Current sensitivity for NO₃ molecules is about $5 \times 10^{10}/\text{cm}^3$ with a 1 m, single-pass absorption path length. The sensitivity could be improved by subtracting residual low-frequency AM noise, using high-frequency modulation, or multipassing the beam in the absorption cell.

The experiment illustrates the potential of very simple diode laser systems for detecting reactive molecules that play an important role in the laboratory and in the Earth's atmosphere.

INTERNET TIME SERVICE

A new nationally available time service has been established on the Internet by NIST. The servers for this service were developed by a NIST scientist and went into operation in August 1993. The service responds to a pent-up need for modestly accurate time on a wide range of systems connected to the Internet. Use of the system has grown to more than 5000 requests per day in a 3 month span.

Time on the server is maintained within 1 ms of UTC. Users can receive time codes in three common formats. The time codes include advance notice of changes to and from daylight saving time and advance notice of insertion of leap seconds. User software can be downloaded directly from the Daytime directory on the server, which has an Internet address of time.nist.gov.

A special algorithm has been developed for software, which can be used to operate servers at any node on the Internet. The algorithm incorporates the smart-clock concept, a NIST-patented method for improving the performance of a remotely operated clock. Through repeated comparisons with an external standard, the clock in the server is characterized and then corrected regularly. The result is substantially improved clock performance and a gradually diminishing need for comparisons with the external source. This software is available for servers in industrial, government, and academic institutions.

SIGNAL PROCESSING OF ACOUSTIC EMISSION FOR MATERIALS PROCESSING

Collaborating with the University of Maryland, NIST researchers are using statistical signal processing combined with wave mechanics to retrieve and analyze acoustic emission signals from simulated materials processing environments where noise and complex geometries can invalidate conventional methods. Physically based on a vibratory model, the statistical distribution of acoustic power reverberating in an aluminum plate was examined. A generalized model was developed from which all of the commonly used peak distribution functions could be obtained by simple parameter selection. The researchers also found that in many cases the acoustic power could be measured with increased accuracy by only counting the peaks above a threshold.

WORKING PRESSURES FOR COPPER TUBE JOINTS WITH LEAD-FREE SOLDERS

A 3 year program has been initiated at NIST to develop a reliable set of recommended internal working pressures for soldered copper tube joints. Copper tubing is the prime material used in this country for plumbing, heating, and air conditioning systems. The rated pressures that are currently in use for these systems were developed on the basis of a test program carried out at NIST more than 50 years ago using 50:50 tin-lead and 95:5 tin-antimony solders. The new program, sponsored by the Copper Development Association, utilizes the 95:5 tin-antimony and two new lead-free solders, and will involve tensile and pressure tests on joints fabricated from several sizes and schedules of copper tube, as well as numerous long-term creep-rupture tests at temperatures to 121 °C.

SHORT COURSE ON NEUTRON AND X-RAY SCATTERING HIGHLY SUCCESSFUL

The 1994 short course on "Neutron and X-Ray Scattering Methods in Polymer Science," held in conjunction with the March Meeting of the American Physical Society (APS), was characterized by APS officials as one of the most successful ever given. With an attendance of over 70 and heavy participation from industrial scientists, the course offered a comprehensive overview with emphasis on modern methods using advanced detectors and radiation sources of the sort available at the NIST Cold Neutron Research and 10 m X-Ray Scattering Facilities. These facilities are increasingly used by researchers in the polymer field, and the course was designed to provide the fundamentals needed to make more effective use of these and similar facilities.

Course subjects included a comprehensive introduction to neutron scattering methods, small-angle x-ray scattering, modern methods of neutron and x-ray reflectivity, and application of neutron scattering to deduce microstructure of polymer blends formed in presence of shear fields. Illustrative examples of scattering results from NIST, and private companies were given, and available major facilities for scattering were featured at an accompanying poster session.

RESEARCH LEADS TO BIOMATERIALS WITH REMINERALIZATION POTENTIAL

A new class of polymer composites with remineralization potential resulted from collaborative work between NIST and the National Institute of Dental Research. These novel composites are expected to find use as unique dental sealants, adhesives, and restoratives designed for the stabilization and possible remineralization of defective mineralized tissues, e.g., teeth and bones.

The polymer composite materials utilize a filler of amorphous calcium phosphate (ACP), a key intermediary in the formation of hydroxyapatite (HAP), a major component of bones and teeth. Properties that usually limit the use of ACP in biomedical applications, relative high solubility in aqueous media and rapid conversion to HAP, were exploited to develop polymer-based bioactive composites having remineralizing potential. In the present work, several polymeric composites, based on visible light curable acrylic resins, used powdered ACP fillers that contained various additives to retard premature conversion to HAP in the polymer matrix. A salient property of these materi-

als is their ability to sustain long-term release of calcium and phosphate ions in aqueous media at levels favorable to the formation of HAP in defective tissues. An important feature is that these composites maintain acceptable strength during this process; hence, they are durable for their intended purposes.

PORTLAND CEMENT CONCRETE HYDRATION

The urgency of renewing the nation's aging transportation infrastructure has stimulated new interest in the materials science of Portland cement concrete. Of critical importance is how the material develops its strength as a function of time, chemical composition, and ambient environmental conditions. The hydration reactions in Portland cement are a key in determining the curing time and the strength of the final material; however, it has been difficult to monitor the progress of these reactions and the bonding of water molecules on a molecular scale. NIST scientists, in collaboration with scientists from the Federal Highway Administration, have used quasielastic neutron scattering to measure the state of the water molecules over a period of 245 days from initial mixing to final curing. The results demonstrate that over this period of time, the water transforms from its normal liquid state to a combination of bound hydrogen in the form of hydroxyl groups and water confined to small pores (~1 nm). Further quasielastic scattering studies are currently in progress in collaboration with engineers from the University of New Hampshire and Worcester Polytechnic Institute, as well as the Federal Highway Administration, aimed at understanding the freeze-thaw process in cured cement pastes.

NIST RELEASES NEW MULTIZONE AIRFLOW AND INDOOR AIR QUALITY MODEL

NIST has released a new model in the CONTAM series of multizone airflow and indoor air quality models. The latest version, CONTAM93, can perform airflow and contaminant dispersal analysis on a wide variety of complex multizone building systems. The program employs an element assembly approach to describe a series of well-mixed zones connected by airflow elements such as openings and mechanical ventilation system flows. Additional elements are used to describe contaminant sources, sinks, and filters. While CONTAM93 is based on an existing theory of network airflow

analysis and contaminant dispersal, the most significant change over past versions of CONTAM is the use of a graphic user interface for describing the building, entering the data, and displaying the results. The interface employs a sketchpad and icons to represent zones, openings, ventilation system components, and contaminant sources and sinks. CONTAM93 will be used by building design consultants, indoor air quality analysts, and researchers to predict the airflow and indoor air quality performance of buildings. It is described in detail in NISTIR 5385, CONTAM93 User Manual.

COMPUTER GRAPHICS METAFILE (CGM) TEST SERVICE EXPANDED

On April 1, the NIST CGM Test Service expanded to include validation of CGM interpreters, as well as metafiles and generators, for conformance to Version 1 CGM as specified in the FIPS 128-1, Computer Graphics Metafile, and the Continuous Acquisition and Life-Cycle Support (CALS) CGM Application Profile (MIL-D-28003A). The test service also provides validation of CGM metafiles and CGM generators.

The new service tests whether an interpreter can correctly and completely parse a binary encoded, Version 1 CGM and produce the intended picture. The Interpreter Validation Test (IVaT) Suite, Release 1.0, consists of over 200 CGM files, an operator test script, and a set of reference pictures. Specifically, CGMs are processed by the interpreter and the resulting picture is compared to the expected reference picture. The focus of the IVaT Suite is single-element testing, rather than multiple elements, allowing for incremental testing and the specificity needed to determine whether the interpreter under test meets the test criteria.

NIST issues a certificate of validation for conforming interpreters and a registered report if errors are detected during the validation; all certificates and registered reports are published in a quarterly validated products list. The test suite may be purchased for \$750; the base price for interpreter validation is \$5000. A CGM Information Pack describes the test services in detail.

NIST SPONSORS INTERNATIONAL WORKSHOP ON HARMONIZING CONFORMANCE TESTING FOR PROGRAMMING LANGUAGE AND GRAPHICS STANDARDS

NIST hosted the seventh in a series of international workshops on harmonizing validation procedures for testing implementations for conformance to programming language and graphics standards.

The countries represented at the workshop included the United Kingdom, France, and the United States.

The European participants briefed the workshop attendees on European Commission activities for mutual recognition of testing activities within specific technical areas. Procedures and guidelines have been developed, which include requirements for test method control boards, standard working practices, and standard pro-forma test reports and certificates.

Workshop attendees reviewed the areas of agreement, test method control procedures, and the procedures for registering other computer system environments. Also discussed were procedures for handling challenges to testing, the high costs of developing new test suites, and recommendations for the development of formal test specifications in parallel with development of a standard. The areas on which agreements have been reached from these workshops include test laboratory accreditation, test method controls, test reports, registration, certification, and mutual recognition.

STANDARD HELPS USERS "SIGN" ELECTRONIC DATA

NIST recently announced approval of the Digital Signature Standard, which can be used to indicate that electronic messages and forms are authentic, much as handwritten signatures are used on checks, contracts and other paper documents. Many applications of the National Information Infrastructure, including electronic commerce, will benefit from the authentication service offered by digital signatures. The DSS, known as Federal Information Processing Standard 186, can be used in such areas as electronic mail, electronic funds transfer, software distribution, data storage and electronic data interchange. The government is not

aware of any patents that would be infringed by this standard and will not charge royalties to those using the standard. The DSS applies to all federal departments, agencies and their contractors for the protection of unclassified information when digital signatures are required. Copies of the DSS (FIPS PUB 186) are available from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650.

CRADA PARTNERS SEEK IMPROVED RADIATION DOSE MAPS

NIST and a private company are collaborating on a system that could help deliver more accurate radiation treatments to cancer patients. Through a newly signed cooperative research and development agreement, NIST is evaluating a prototype system for mapping radiation fields in two dimensions. This prototype microdensitometer could potentially give doctors a more accurate picture of how radiation is distributed over a tumor. The system also could help radiotherapists better plan effective treatment that spares adjacent healthy tissue. A microchip video camera gives the system the ability to read films exposed to radiation with high definition and sensitivity to small changes in radiation dose. NIST is evaluating the accuracy of the microdensitometer as well as providing calibrations for radiochromic films used in the system. Assisting in the evaluation are Harvard-Massachusetts General Hospital, the Joint Center for Radiation Therapy, the Mayo Clinic, and Georgetown University. As more sensitive, higher resolution imaging devices are developed for clinical radiology, the microdensitometer could contribute to more accurate treatment planning for complex anatomical regions.

NEW FACILITY PROMOTES BETTER BUILDING MATERIALS

A new laboratory, dedicated by government and industry officials on May 18 at NIST in Gaithersburg, MD, will help improve the quality of construction materials testing—and, in turn, the quality of the materials themselves—around the world. Operated by the Construction Materials Reference Laboratories partnership, the facility was created to meet the growing demand for samples of building materials, such as concrete, cement, soil and asphalt. The CMRL supplies these samples to construction materials testing laboratories that need them to evaluate testing equipment and procedures. Currently, over 8000 samples are distributed annually

to more than 1000 laboratories in the United States, Canada, Mexico, and 14 other countries. The CML also provides an on-site inspection program. An offshoot of a program started at NIST in 1929, the CMRL is sponsored jointly by NIST, the American Society for Testing and Materials, and the American Association of State Highway and Transportation Officials. Fees from laboratories using CMRL services provided funding for the new facility. For information on the NIST lab or the CMRL, contact James Pielert, A365 Building Research Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6704.

UNITED STATES, CANADA RECOGNIZE TEST RESULTS ON DEVICES

Weights and measures officials in the United States and Canada have agreed to mutual recognition of test results and examinations of weighing and measuring devices done by the U.S. National Type Evaluation Program of the National Conference on Weights and Measures and the Legal Metrology Branch of Industry Canada. The program will reduce costs and time delays for device manufacturers and will eliminate duplication of tests performed by the two countries. This will increase the competitiveness for both U.S. and Canadian manufacturers by speeding the time from design to end use in the marketplace. Initially, the program will cover non-complex electronic weight indicating elements, electronic non-computing bench and floor scales up to 500 kg capacity and weighing/load-receiving elements with capacities up to 500 kg. Plans call for extending the U.S./Canadian program to other devices, and to include Mexico under the North American Free Trade Agreement. NCWM receives technical support from NIST through its Office of Weights and Measures. For information, contact NCWM, P.O. Box 4025, Gaithersburg, MD 20855, (301) 975-4012, fax: (301) 926-0647.

LICENSEES SOUGHT FOR NEW LITHOGRAPHY METHOD

A recently patented NIST process for fabricating extremely small metallic structures is now available for licensing. The process, known as "laser-controlled nanolithography," manipulates chromium atoms into precise locations on a silicon surface using laser light. This technique of focusing atoms with a laser opens new avenues for creating smaller and faster electronic devices. NIST researchers have used the process to form parallel rows of

atoms on a silicon surface. The rows, visible by atomic-force microscopy, are approximately 65 nm wide, 35 nm high and 212 nm apart. The nanometer-lithographic process could be refined to form more complex three-dimensional structures. Request technical and licensing information on docket no. 93-019, laser-controlled nanometer-lithography, from Nancy Hale, Office of Technology Commercialization, B256 Physics Building, NIST, Gaithersburg, MD 20899-0001, fax: (301) 869-2751.

RADIATION MEETING TO HIGHLIGHT MEASUREMENT QUALITY

Issues surrounding quality assurance of radiation measurements for manufacturing, environmental, medical, and other industries will be the focus of the third annual meeting of the Council on Ionizing Radiation Measurements and Standards, or CIRMS, hosted by NIST on Nov. 16-18, 1994, in Gaithersburg, MD. Presentations will address the concept of a new national approach to measurement quality assurance, including aspects such as characterization and traceability of radiation sources, and comparability of measurement quality assurance programs. Discussions at this meeting are expected to make significant contributions toward improving efficiency and effectiveness of MQA programs and practices. The registration fee is \$135. For technical information, contact Bert Coursey, C229 Radiation Physics Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-5584, fax: (301) 869-7682, e-mail: coursey@micf.nist.gov (via Internet). To register, contact Tammie Grice, B116 Administration Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-3883, fax: (301) 948-2067, e-mail: grice@micf.nist.gov (via Internet).

Standard Reference Materials

STANDARD REFERENCE MATERIAL 1980— POSITIVE ELECTROPHORETIC MOBILITY (+ μ E) STANDARD

Positive electrophoretic mobility is an important property of particle suspensions in electrolytes. Mineral and chemical process industries, waste treatment facilities, and clinical and pharmaceutical laboratories measure this property to control the flocculation-dispersion characteristics of such suspensions.

The Standard Reference Materials Program announces the availability of SRM 1980, certified for positive electrophoretic mobility at $(2.53 \pm 0.12) \mu\text{mcm}/(\text{V} \cdot \text{s})$. The SRM material consists of 500 mg/L goethite ($\alpha\text{-FeOOH}$) saturated with 100 $\mu\text{mmol/g}$ phosphate and suspended in a 5×10^{-2} mol/L sodium perchlorate electrolyte solution at pH 2.5.

STANDARD REFERENCE MATERIALS 1818a AND 1819a—TOTAL CHLORINE IN LUBRICATING BASE OIL AND SULFUR IN BASE OIL

Total chlorine and sulfur in lubricating base oils and other fossil fuel products are of great environmental importance. Chlorine is found in re-refined products generated from used oil feedstocks; chlorinated aromatics are found in industrial oils; and additive packages used in lubricating oils have been found to contain PCBs. Sulfur in base oils affects the oxidation stability of petroleum products and must, therefore, be accurately measured for product quality control.

To meet this need, the Standard Reference Materials Program announces the availability of renewals for two earlier, but now out-of-stock, SRMs. SRM 1818a is a set of five lubricating base oils certified for total chlorine concentration; SRM 1819a is a series of similar oils certified for sulfur contents. The certified concentrations of chlorine in SRM 1818a are (31.62, 60.6, 78.2, 154.4, and 234) $\mu\text{g/g}$, respectively. The certified values of sulfur in SRM 1819a are (423.5, 741.1, 4022, 4689, and 6135) $\mu\text{g/g}$, respectively.

NEW MARINE SEDIMENT SRM ISSUED

In 1989 a Standard Reference Material, Organics in Marine Sediment (SRM 1941), was developed by scientists at NIST at the request of the National Oceanic and Atmospheric Administration (NOAA). NOAA requested this SRM to assist in providing quality assurance for organic contaminant measurements as part of one of their national marine pollution monitoring programs. SRM 1941 was widely used for NOAA and the Environmental Protection Agency (EPA) mandated marine environmental programs. The popularity of SRM 1941 led to its early depletion, and a new material, SRM 1941a, Organics in Marine Sediment, recently has been issued as a replacement for SRM 1941.

Sediment material for SRM 1941a was collected from the same location in the Baltimore harbor as the material for SRM 1941 and was then freeze-

dried and sieved to provide a homogeneous material. In the original SRM 1941, certified concentrations (i.e., values determined by two or more independent analytical techniques) were reported for only 11 polycyclic aromatic hydrocarbons (PAHs), and noncertified concentrations (i.e., values generally determined by only one technique) were provided for selected polychlorinated biphenyl (PCB) congeners and chlorinated pesticides. To increase the usefulness of the new sediment SRM, the list of certified constituents has been expanded. SRM 1941a has certified concentrations for 23 PAHs, 21 PCB congeners, six chlorinated pesticides, and sulfur. In addition, noncertified concentrations are provided for 17 aliphatic hydrocarbons, 27 inorganic constituents, percent total organic carbon, and 24 additional PAHs, PCB congeners, and chlorinated pesticides. With a total of 120 certified and noncertified constituents, SRM 1941a is the most extensively characterized natural matrix SRM issued by NIST.

Standard Reference Data

NEW SRDP PRODUCTS CATALOG NOW AVAILABLE

The NIST Standard Reference Data Products Catalog 1994 (NIST Special Publication 782), provides scientists and engineers with the latest information on 94 current computerized databases and published data compilations that are available from the NIST Standard Reference Data Program and other sources. For more than 31 years, NIST has been providing critically evaluated data to researchers in science and industry to improve the design efficiency of chemical processes, identify potential toxic substances in the environment, improve materials durability and calculate the performance of chemical reactors. Data compilations are available in the following areas: analytical chemistry, atomic and molecular physics, biotechnology, chemical kinetics, materials properties, process engineering, thermodynamics and thermochemistry, thermophysical properties of fluids, as well as special databases of binary images and structured forms. To obtain a free copy of SP 782 (1994 edition), send a self-addressed mailing label to SRDP, A320 Physics Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2208, fax: (301) 926-0416.

MASS SPECTRAL DATABASE INNOVATIONS ANNOUNCED

Two important software innovations have been made to the NIST/EPA/NIH Mass Spectral Database, a major international resource for analytical chemists and environmental scientists to use in identifying unknown substances. The database is available from NIST for scientific instruments and personal computers. The innovations include a new "Dynamic Link Library" system that offers distributors a prepackaged program that can be incorporated directly in mass spectrometers without any reformatting or indexing. The PC version has been updated with new features that provide a more efficient way of searching to reduce the chance that a correct match will be missed. The library of 74000 electron mass spectra of 62235 chemical compounds is one of the most widely known standard reference data products from NIST. For information in the 1994 Mass Spectral Database, Standard Reference Database 1, or 1A, Version 4.5 for PCs, contact the Standard Reference Data Program, A320 Physics Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2208, fax: (301) 926-0416, or e-mail: srdata@enh.nist.gov (via Internet).