
News Briefs

General Developments

NIST SIGNS AGREEMENT WITH STATE FIRE MARSHALS GROUP

NIST and the recently established National Association of State Fire Marshals have signed an agreement to formalize a number of cooperative fire safety activities already in place and to set up several new ones. NIST has long worked with fire marshals in many states, including the investigation of major fires. Recently, a group of marshals and NIST staff worked together to define national fire research needs and priorities. As part of the new agreement, the two organizations will establish a database accessible by computer network containing technical information necessary to run fire models such as NIST's HAZARD I. Also, the agreement calls for a deputy fire marshal to work at NIST as a way to transfer technology to the fire community. Other activities will include joint fire safety research, especially on issues of national interest such as smoke toxicity.

INTEGRATED COOPERATIVE PROGRAM EXPANDED

NIST has expanded a cooperative program to bring together federal agencies and private organizations to develop prototype systems in Open Systems Interconnection (OSI), Integrated Services Digital Network (ISDN), and computer security. Program goals include facilitating the development and commercial availability of OSI, ISDN, and security mechanisms and services; providing a facility for users, developers, and vendors to jointly define, develop, and test systems in telecommunications, network management, and security; and coordinating funding from federal agencies. Program information and guidelines are available by writing the

Integrated OSI, ISDN, and Security Program, B154 Technology Building, NIST, Gaithersburg, MD 20899. Fax requests to 301/948-1784. General program information is available from Patricia Noonan Edfors, B154 Technology Building, NIST, Gaithersburg, MD 20899, 301/975-3758.

NEW COMPUTER SECURITY SERIES PUBLICATION ISSUED

The first publication in a new series on computer security, entitled Bibliography of Selected Computer Security Publications: January 1980-October 1989 (NIST/SP-800/1) has been issued. Compiled by Rein Turn and edited by Lawrence E. Bassham III, the 200-page document serves as an excellent resource for individuals interested in computer security issues. The citations are listed under 10 categories: general, management, foundations, access control, trusted systems, database security, communication and network security, cryptography, privacy, and pre-1980 publications. Included in the bibliography are appendices with the addresses of all journals and magazines referenced in the bibliography and a list of key words. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by SN #003-003-03060-1 for \$11 prepaid.

USERS' GUIDE TO DIODE LASERS

NIST and University of Colorado researchers have produced a guide for atomic physicists who want to use diode lasers in their work. The review article appeared in a recent issue of Review of Scientific Instruments. Traditionally, physicists have used dye lasers to tune to particular atomic transitions. But semiconductor diode lasers have many advantages: they are smaller, more efficient, less expensive, and very reliable. They have reasonable power, and their wavelength coverage is steadily increasing. "It is now possible to have a diode laser system which will produce more than 10 mW of tunable light

with a bandwidth of 100 kHz for a cost of less than \$1,000," the researchers report. They discuss basic diode laser characteristics, advantages, and limitations. They also explain how to purchase the correct laser, tune it to the desired frequency, and control the laser's frequency. The guide, paper No. 68-90, can be obtained from Jo Emery, Div. 104, NIST, Boulder, CO 80303, 303/497-3237.

PRODUCING HYDROGEN SLUSH

NIST researchers have constructed an auger-type generator for producing hydrogen slush, the preferred fuel for the National Aerospace Plane. Until now the freeze-thaw method has been the most common for producing hydrogen slush, but it has several disadvantages not present with the auger-type method. For example, freeze-thaw produces hydrogen slush in batches whereas auger is a continuous process. The NIST-developed generator features a large (approximately 18 cm diameter) auger with a supercritical helium flow loop that simulates the performance of a helium refrigerator. Paper No. 6-91 discusses design and construction and is available from Jo Emery, Div. 104, NIST, Boulder, CO 80303.

APPARATUS FOR MEASURING COEFFICIENT OF FRICTION

NIST researchers have developed a novel apparatus to measure the coefficient of friction in oxygen environments. It will be used specifically to study problems with ball bearing wear in the high-pressure oxygen turbo pump of the space shuttle main engine. Although designed to last 7 1/2 h, these bearings often fail after 45 min of use. The NIST apparatus can handle loads up to 900 kg, and friction measurements can be made in inert atmospheres or in flowing oxygen at temperatures from 80 to 1030 K. To meet the various requirements, two measurement cells, one hot and one cold, were developed. One cell, made of high-temperature nickel alloy and cooled by ambient air, is used from room temperature to 1030 K. The other cell, made of high-purity nickel and cooled by nitrogen gas, operates from 80 to 523 K. Paper No. 8-91 describes the apparatus and is available from Jo Emery, Division 104, NIST, Boulder, CO 80303, 303/497-3237.

OUTREACH PROGRAMS HELPING INDUSTRY

NIST's Advanced Technology Program (ATP) will help industry to develop and apply generic technology it needs to commercialize new products and manufacturing processes, said the NIST Visiting Committee on Advanced Technology in a 31-page

report to the Secretary of Commerce. The committee was established by the Omnibus Trade and Competitiveness Act of 1988 and given the responsibility to review and make recommendations regarding the general policy, organization, budget, and programs of NIST. Its 1990 Annual Report of the NIST Visiting Committee on Advanced Technology gives special attention to NIST's new industrial outreach programs, including the ATP and the Manufacturing Technology Centers program. The report also reviews progress in the institute's science and engineering programs, discusses NIST's industrial relations policies, and examines the agency's budget picture and organizational plan. Available by sending a self-addressed, stamped envelope to Dale Hall, A527 Administration Building, NIST, Gaithersburg, MD 20899.

STM BUILDING OF ROOM-TEMPERATURE NANOSTRUCTURES

The vision of custom-building atomic-scale structures—perhaps "nanomachines" or ultra-high-performance electronic devices—by individually manipulating atoms with a scanning tunneling microscope (STM) has inspired a number of recent experiments. The most dramatic results to date have involved positioning individual xenon atoms on a very cold (-269°C) surface. Practical applications of that technique are somewhat limited because it requires that the surface be maintained at cryogenic temperatures, and only works with a limited class of atoms. NIST researchers recently demonstrated a novel room-temperature procedure for manipulating atoms or molecules on surfaces that promises much more general application. By generating an electric field at the tip of the STM probe, they induced cesium atoms adsorbed on typical semiconductor substrates to collect under the probe tip, forming novel structures that would not otherwise occur by simple adsorption. Details are reported in the March 8 issue of *Science*.

DEVICE PROMISES BETTER TRACKING OF DRUGS, VIRUSES

A prototype device that shows promise as a reliable detector of drugs, pollutants, bacteria, and viruses in humans has been developed at NIST. Called the liposome-based flow injection immunoassay (LipoFIIA) system, the device uses a component of the human immune system to measure the amount of a specific chemical compound from complex mixtures such as blood and urine. Automated, reusable, and fast, the system improves on the

performance of many other commercially available instruments. An analysis takes minutes instead of the hours or even days required by other methods. The LipoFIIA system is as much as 100 times more sensitive than comparable devices, allowing analyses at levels as low as parts per billion. It uses liposomes—submicroscopic, balloon-like globules—to detect how much of a given substance is in a biological sample. Antibodies, similar to the proteins the human body uses to recognize and latch onto foreign substances, also play a major role. The system recently passed clinical trials at the National Institutes of Health.

IGNITION CHARACTERISTICS STUDIED

At the request of the National Aeronautics and Space Administration, NIST is studying the ignition and combustion characteristics of selected alloys in pressurized oxygen. A number of serious accidents and fires have involved the ignition and combustion of metals in oxygen systems. As the operating pressure in these systems increases, the potential for disaster also increases due, in part, to the increased reaction rate of materials with oxygen. To reduce this potential, the ignition and combustion characteristics of metals must be known. In the past, NIST researchers have studied the characteristics of the iron-based alloy UNS S66289 and the nickel-based alloy UNS N07718. Most recently, NIST reported on the characteristics of the nickel-based alloy UNS N07001 in Ignition Characteristics of the Nickel-Based Alloy UNS N07001 in Pressurized Oxygen (NISTIR 3947). Available from the National Technical Information Service, Springfield, VA 22161. Order by PB #91-144428 for \$17 prepaid.

PROTOCOL DEVELOPED TO ANALYZE ALTERNATIVE REFRIGERANTS

NIST researchers have developed a protocol for scientists studying alternatives to fully halogenated chlorofluorocarbons (CFCs). These CFC fluids, used for many years as refrigerants and propellants, must be replaced because they are thought to be contributing to ozone depletion in the atmosphere. In searching for alternative fluids, extensive experimental measurements of the replacements' physical properties are needed to evaluate their performance. Sound interpretation of these measurements requires that all components of the fluids be known. Impurities in the samples can plague an experimental measurement and ruin interpretation of results. The protocol, Strategy for Chemical Analysis of Alternative Refrigerants

(NIST TN 1340), provides for verifying sample identity, characterizing major impurities, and determining the concentrations of impurities. A protocol and apparatus for high-temperature, high-pressure thermophysical property measurements are also described. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-03062-7 for \$5 prepaid.

"EXPECT" AUTOMATES INTERACTIVE PROGRAMS

"Expect," a software tool for automating interactive programs, is available on request from NIST. Expect, originally designed to automatically log in NIST's Automated Manufacturing Research Facility computers, runs on UNIX systems but can also control non-UNIX computers and networks. A NIST scientist says the software "uses a script—much like a movie script—to simulate a human interacting with a computer. An important difference is that, unlike a movie script, Expect scripts can describe alternatives and then 'play' differently each time as they adapt to the situation." Since April 1990 over 1,600 sites have requested Expect. Requests should be sent to Don Libes, A127 Metrology Building, NIST, Gaithersburg, MD 20899 or library@cme.nist.gov.

GRANTS ANNOUNCED TO ADVANCE INDUSTRIAL TECHNOLOGY

Commerce Secretary Robert A. Mosbacher recently announced the first grant awards under the Commerce Department's Advanced Technology Program (ATP), which he said could lead to the birth of revolutionary products and processes in key U.S. industries and help boost the country's trade and competitiveness. Eleven new research and development programs were selected for funding under the ATP in fundamental industrial technologies including improved manufacturing techniques for electronics (such as x-ray lithography); optical recording; a variety of hardware and software technology for computers; high-temperature superconductivity; machine tool control; and novel laser designs. The awards will provide approximately \$9 million in first-year grants to initiate nearly \$100 million in R&D programs over the next 5 years. The research and development programs selected for funding are:

Volume Holographic Mass Storage Subsystem—
Microelectronics & Computer Technology
Corporation

- Nonvolatile Magnetoresistive Semiconductor Technology—Nonvolatile Electronics, Inc.
- Short-Wavelength Sources for Optical Recording—National Storage Industry Consortium
- Tunable Deep UV and VUV Solid-State Laser Source—Light Age, Inc.
- New User-Interface for Computers Based on On-Line Recognition of Natural Handwriting—Communication Intelligence Corporation
- Printed Wiring Board Interconnect Systems—National Center for Manufacturing Sciences, Inc.
- Advanced Manufacturing Technology for Low-Cost Flat Panel Displays—Advanced Display Manufacturers of America Research Consortium
- Fabrication and Testing of Precision Optics for Soft X-Ray Projection Lithography—AT&T Bell Laboratories
- Solid-State Laser Technology for Point-Source X-Ray Lithography—Hampshire Instruments, Inc. & McDonnell Douglas Electronic Systems Co.
- Advanced Compensation Techniques for Enhancing Machine-Tool Accuracy—Saginaw Machine Systems, Inc.
- Advanced Thallium Superconductor Technology—E.I. du Pont de Nemours & Co.

TWO SITES NAMED FOR TECHNOLOGY TRANSFER CENTERS

The Industrial Technology Institute in Ann Arbor, MI, and the Kansas Technology Enterprise Corporation of Topeka, KS, were selected to establish regional manufacturing technology transfer centers. The two organizations now will negotiate cooperative agreements with NIST for approximately \$1.5 million each for the first year, which they will match. "The establishment of Michigan and Kansas centers means that small and medium-sized businesses in the two areas soon will have improved access to the advanced manufacturing technology and processes they need to compete and prosper," Commerce Secretary Robert A. Mosbacher said. "The new centers complement the efforts of centers in Ohio, South Carolina, and New York, which are already working with the Commerce Department to modernize America's industrial sector through technology transfer." The NIST manufacturing technology centers act as clearinghouses between industry and sources of manufacturing technology.

COMMENTS SOUGHT FOR MACHINE TOOL STANDARD

Comments are invited on a proposed American Society of Mechanical Engineering (ASME) standard to provide machine tool builders and users a uniform method to evaluate performance of metal-cutting machining centers. A NIST mechanical engineer who heads the ASME committee that drafted the voluntary industrial standard, says "A single national standard will give buyers a more credible way to selecting manufacturers. Manufacturers, at the same time, will have a clear way for verifying their improvements in the marketplace." "Methods for Performance Evaluation of Computer Numerically Controlled Machining Centers" is based on research at NIST, Lawrence Livermore National Laboratory, the University of North Carolina (Charlotte), and the University of Florida (Gainesville). Contact Denver Lovett, Fabrication Technology Division, NIST, Gaithersburg, MD 20899, 301/975-3503.

ELECTROMAGNETICS PUBLICATIONS LISTED

Two new bibliographies list all publications (1970-July 1990) by staff in two NIST divisions. A Bibliography of the NIST Electromagnetic Fields Division Publications (NISTIR 3945) deals with measurement methods and standards for antennas; dielectric properties; electromagnetic interference and susceptibility; microwave power, impedance, and attenuation; near-field antenna measurements; noise; remote sensing; time domain reflectometry; and waveform measurements. *Metrology for Electromagnetic Technology: A Bibliography of NIST Publications* (NISTIR 3946) covers measurement methods and standards for laser systems; optical fibers and communication equipment; cryoelectronics; magnetics; superconductors; and other unusual electrical engineering materials. Available from the National Technical Information Service, Springfield, VA 22161. Order NISTIR 3945 by PB #91-132241 for \$23 prepaid and NISTIR 3946 by PB #91-132266 for \$17 prepaid.

MULTIMEDIA COURSEWARE PUBLICATION ISSUED

The federal government and other U.S. organizations are likely to invest billions of dollars to develop multimedia training materials for use in computer-based interactive training systems. *Multimedia Courseware in an Open Systems Environment: A Federal Strategy* (NISTIR 4484), discusses the federal strategy for creating an environment in which high-quality portable courseware is

available as commercial off-the-shelf products competitively supplied by vendors. The strategy comes from the Department of Defense Portable Courseware Project, which requires standard software interfaces. Available from the National Technical Information Service, Springfield, VA 22161. Order by PB #91-143362 for \$17 prepaid.

1992 OSI WORKSHOP SCHEDULES RELEASED

NIST announced the 1992 workshop schedules for implementors of Open Systems Interconnection (OSI). The 1992 meeting dates for the workshops to reach implementor agreements on OSI computer network protocols are March 9-13, June 8-12, Sept. 21-25, and Dec. 14-18. Hosted by NIST and held in Gaithersburg, MD, the workshops will cover protocols in seven layers of the ISO Reference Model. Attendance is limited by space requirements. Registration is on a first-come, first-served basis, and a fee will be charged for attending the workshops. For registration information, contact Brenda Gray, 301/975-3664; individuals with technical questions may contact Tim Boland, 301/975-3608.

NIST/ASM COMPLETE ALLOY PHASE DIAGRAM PROGRAM

Marking the completion of a successful \$10 million program between government and industry, officials from ASM International presented the second edition of the Binary Alloy Phase Diagrams to NIST recently. The three-volume compendium, designed to help engineers and materials users worldwide, contains more than 3,000 alloy phase diagrams—"road maps" describing what happens when two elements are combined at various temperatures. The data represent the results of a 10 year effort by ASM and NIST to assess the quality of all previous work in the field. Under a 1981 agreement, NIST was responsible for providing quality control and technical guidance to more than 50 technical experts worldwide. The new edition replaces a smaller one, which had become an internationally accepted source of critically evaluated standard reference data on alloy phase diagrams. For information, contact the Alloy Phase Diagram Program, ASM International, Materials Park, OH 44073, 216/338-5151.

AUTOMATION DECISIONS EASIER WITH AUTOMAN 2.0

AutoMan 2.0, a new version of the personal computer software package that supports complex automated manufacturing investment decisions, should make life easier for industry managers. The

revised program enables users to see graphically the results of investment alternatives. AutoMan 2.0's sensitivity analysis feature depicts how investment alternatives would be rated if the importance of any criterion, such as lead time, return, life-cycle cost, or product quality, was changed. The software includes several starter decision models with criteria already specified. Users can apply these models or develop entirely new ones with up to 49 impact criteria. NIST's Office of Applied Economics developed AutoMan 2.0 in collaboration with NIST's Automated Manufacturing Research Facility and the U.S. Navy. Available from the National Technical Information Service, Springfield, VA 22161. Order by PB #91-506568 for \$50 prepaid, plus \$3 shipping.

FIPS PUBLICATION 160 APPROVED FOR C

The Commerce Secretary approved a Federal Information Processing Standard (FIPS) for the programming language C, adopting voluntary industry specifications (ANSI X3.159-1989). This standard specifies the form and establishes the interpretation of programs written in the C programming language. The purpose of the standard is to promote portability of C programs for use on a variety of data processing systems. The standard is used as the reference authority in developing compilers, interpreters, and other forms of high-level language processors. It is also used by computer professionals who need to know the precise syntactic and semantic rules adopted by ANSI. Federal standards for high-level programming languages permit federal agencies to exercise more effective control over the production, management, and use of the government's information resources. For technical details, contact L. Arnold Johnson, A266 Technology Building, NIST, Gaithersburg, MD 20899, 301/975-3247.

COMPUTER GRAPHICS METAFILE TEST SERVICE DEBUTS

On May 1, the Computer Graphics Metafile (CGM) Test Service begins a 1 year trial program. The service will analyze a CGM file to test if it meets requirements that allow the transfer of pictures among different graphical software systems, graphical devices, and computer graphics installation. The testing will benefit both users and vendors by increasing confidence in the performance and quality of CGM products and in successfully interchanging graphics pictures. The two requirements used are the Federal Information Processing Standard (FIPS) 128, "Computer Graphics Metafile," and the Computer-aided Acquisition

and Logistic Support (CALs) Application Profile (MIL-D-28003). An information pack containing details on prices, the test service, and how to submit files is available from Lynne S. Rosenthal, A266 Technology Building, NIST, Gaithersburg, MD 20899, 301/975-3353.

NEW DIRECTORY OF STANDARDS ACTIVITIES AVAILABLE

Standardization Activities of Organizations in the United States (SP 806) summarizes the standards activities of more than 750 organizations in the United States, including federal agencies and approximately 425 private-sector groups. The largest section contains an alphabetical listing of 637 non-government organizations that develop standards or contribute to the standardization process by working with other organizations, or are sources of documents and information. The format provides quick access to information on the type of organization, scope of activities, whether standards are voluntary or mandatory, availability, and key words. Entries for 77 federal agencies, departments, and other organizational components that develop standards are included, as well as a section on sources for information, a subject index, acronyms and initials, former names of some organizations, and names of those in a previous directory no longer involved with standards. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-03070-8 for \$31 prepaid (\$38.75 foreign).

MICROWAVE POWER MEASUREMENT TO BE IMPROVED

NIST expects to announce within a year a new premium calibration service for coaxial microwave power sensors. Advance notice is being provided since users of this service will need to have a thermistor-type bolometer mount built to NIST specifications. This is necessary because some essential design characteristics of commercially available general-purpose thermistor mounts make them incompatible with a microcalorimeter. The special mounts, which may have either a Type N or APC-7 connector, will be measured directly in the NIST microcalorimeter. This will give the customer a reference standard equal to that used by NIST for calibration transfers. By using the proper transfer technique, the customer will be able to calibrate other power sensors with an uncertainty equal to the standard service offered by NIST. Measurement uncertainty for the new service is expected to be approximately one-half to one-third the presently

stated uncertainty of 1.8 percent at 18 GHz. The present service, with some accuracy improvement, will continue to be available. For more information, contact Fred Clague, Division 813.01, NIST, Boulder, CO 80303, 303/497-5778.

106 COMPANIES VIE FOR 1991 BALDRIGE AWARD

NIST announced that 106 companies have applied for the 1991 Malcolm Baldrige National Quality Award. That number includes 38 manufacturing firms, 21 service companies, and 47 small businesses. Last year, 97 companies applied. The award, named for the late Commerce Secretary Malcolm Baldrige, was established by legislation in August 1987. It promotes national awareness about the importance of improving quality management and recognizes quality achievements of U.S. companies—though the award is not for specific products or services. Firms applying must undergo a rigorous examination. On-site visits for those passing an initial screening will take place in September and will be followed by an announcement and award ceremony in the fall. In previous years, the awards have been presented by the president during a ceremony in Washington, DC. The award program is managed by NIST with the active involvement of the private sector. A maximum of two awards may be given annually in each of three categories: manufacturing, service, and small business.

FEDERAL LAB ACCREDITATION PROGRAMS GUIDE AVAILABLE

The Directory of Federal Government Laboratory Accreditation/ Designation Programs (SP 808) is designed to help users from government, commerce, and industry locate federal laboratory accreditation programs and the organizations designated by the agencies to assist them in carrying out their responsibilities for testing products and services. Thirty-one lab accreditation programs are listed, as well as 13 federal programs with limited types of assessment. Entries are organized by agency, department, or independent commission and contain a program description, date initiated, authority, fields of testing accredited or designated, products affected, program requirements, availability of publications, and accreditation criteria. A limited number of copies are available. Send a self-addressed mailing label to Standards Code and Information Program, A633 Administration Building, NIST, Gaithersburg, MD 20899, 301/975-4031. A list of other standards-related and certification directories also is available.

IONIZING RADIATION CALIBRATION PROGRAM AVAILABLE

NIST has established a program to accredit laboratories to perform ionizing radiation calibration services under the National Voluntary Laboratory Accreditation Program (NVLAP). The program is designed for users of instruments to ensure the protection of workers in medical facilities, defense plants, and nuclear fuel-cycle operations. The program was requested by the Departments of Energy and Defense and other federal labs that provide the types of secondary calibration services included in the program. Laboratories will be accredited by NIST for 1 year and can maintain accreditation by demonstrating compliance with NVLAP criteria through on-site assessment every 2 years and annual proficiency testing. For information, contact Nancy M. Trahey, Chief, Laboratory Accreditation Program, A124 Building 411, NIST, Gaithersburg, MD 20899, 301/975-4016, fax: 301/975-3839.

INTERCOMPARISON OF POWER MEASUREMENTS CONDUCTED

Precise measurement of optical power is crucial to proper performance of modern optical communication systems. Power measurements need to be traceable to national standards, and standards from various countries should show good agreement. In a recent intercomparison of power standards among laboratories in the United States (represented by NIST), United Kingdom, Germany, and Australia, the maximum difference between any two laboratories was 0.36 percent and the maximum deviation of any one laboratory from the average ranged from 0.19 to 0.26 percent. Limited to wavelengths and power levels useful for optical fiber measurements, the intercomparison was made of responsivity scales at wavelengths of 1300 and 1500 nm—the wavelengths of interest to the optical fiber telecommunication community. The intercomparison served as a pilot study for a larger intercomparison now under way, which involves 14 countries. Paper No. 13-91 gives the conclusions of the pilot study. Available from Jo Emery, Division 104, NIST, Boulder, CO 80303, 303/497-3237.

FOURTH GENERATION LANGUAGES REPORT ISSUED

Use of fourth generation languages (4GL) has increased in data processing organizations, especially where end-users take on more programming responsibility. (4GL generally refers to nonprocedural, end-user-oriented computer languages.)

Since no standards exist for 4GL, managers who select a given 4GL need a method to determine how well it will meet organizational, application, and user requirements. This 60-page report, Functional Benchmarks for Fourth Generation Languages, contains functional benchmarks (as opposed to performance benchmarks), which consist of a testing method and descriptions of tests to evaluate a particular 4GL. There are two levels of test result evaluation: the ability of the 4GL to perform a task; and the ease of performing it. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-03071-6 for \$3.25 prepaid.

LASER DAMAGE SYMPOSIUM PROCEEDINGS PUBLISHED

The proceedings of the 21st Annual Symposium on Optical Materials for High-Power Lasers (Boulder Damage Symposium), held Nov. 1-3, 1989, are now available. Laser Induced Damage in Optical Materials: 1989 (SP 801) describes sessions held on materials and measurements, surfaces and mirrors, thin films, and fundamental mechanisms. The emphasis was on new frontiers and developments, particularly on materials for high-power apparatus, and primarily in the wavelength range from 10.6 μm to the ultraviolet. Highlights include surface characterization, thin-film substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. Full text and illustrations of all papers presented at the symposium are included in the 670-page book. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-03061-9 for \$30 prepaid.

ACTIVE GLASS INTEGRATED OPTICAL DEVICE DEMONSTRATED

NIST scientists have designed, fabricated, and demonstrated the successful operation of an active glass integrated photonic device that demonstrates the potential for new active multifunction components fabricated in rare-earth doped glass. This technology combines many of the attractive aspects of the well-established rare-earth doped optical fibers with the dense packing and integration possibilities provided by methods that have already been worked out for silicon integrated circuits. The device is known as a 1-by-2 Y-branch splitter. The NIST active splitter compensates for the loss of signal amplitude that occurs in passive devices when the signal from a single channel is split into two.

Splitters are used in optical broadcast networks to fan the output from a single channel to N output waveguides. A feed optical fiber attached to the input waveguide launches light into it; other fibers are attached to the N output channels. The splitter is designed to disperse light uniformly from the input fiber to the output fibers. In the passive splitters now in use, the signal amplitude per channel is reduced by 1/N. The NIST active splitter is fabricated in neodymium-doped glass and provides for signal gain through separate optical pumping. Demonstration of the splitter operation has shown that the 3 dB splitting loss otherwise expected in a 1×2 splitter can be compensated for fully. In addition, the NIST device has been operated as a multi-output integrated photonic laser. In this mode, the Y-branch splitter is folded on itself through optical feedback to form two phase-locked lasers operating simultaneously. NIST is extending these concepts to more complex devices and developing metrology to support them; for example, a nondestructive interferometric technique has been developed to measure precisely the optical path length of the component branches.

NEW STRUCTURES AND PROPERTIES DATABASE AND ESTIMATION PROGRAM RELEASED

A NIST scientist has completed a major new personal computer software product, with an affiliated database that has just been made available for distribution by the Standard Reference Data Program.

NIST Standard Reference Database 25, Structures and Properties Database and Estimation Program, presents a program that allows the user to use either a mouse or the keyboard to draw a molecular structure or substructure on the screen. Evaluated thermochemical data on the species can then be retrieved from a database that contains information on 5,000 chemical compounds. If data are not available for the compound of interest, the program includes software that can calculate values of enthalpies of formation, vapor pressures, and boiling points from widely used estimation procedures. Properties are estimated solely from the molecular structures drawn by the user, and the features of the program include automatic perception of rings and long-range interactions, determination of symmetry number corrections, and the computation of equilibrium constants for user-created chemical reactions. The program, which requires 3.2 megabytes of disk space, 640 K RAM,

and EGA, VGA, or Hercules graphics adapter, also allows for data searches by chemical formula, name, and Chemical Abstracts Registry Number. The cost is \$240.

ELLIPSOIDAL-MIRROR ANALYZER AT SURF-II

NIST recently commissioned an ellipsoidal mirror analyzer (EMA) at the NIST-SURF-II synchrotron light source. This instrument is a unique charged-particle energy analyzer that produces two-dimensional images of the emission from solids. This "display-type analyzer" shows the intensity of emission as a function of the angle from surface normal.

The heart of the instrument is an ellipsoidal mirror: a concave mirror that is elliptical in one plane and spherical in the perpendicular direction. A charged particle emitted from a sample placed at one of the foci reflects back from the mirror to the other focal point with its angular information intact. This reflection and an additional retarding-field provide the energy analysis. The particles are detected using pulse-counting techniques that provide a two-dimensional image.

The EMA permits simultaneous measurement of the energy, angle, and mass of an emitted particle; the latter coming from the use of time-of-flight techniques. By collecting all the pulses, angle-integrated spectra can be obtained. In the imaging mode, the "angle-resolved" spectra are unique. These images give a cross-sectional (*k*-space) view of the occupied states at a particular energy.

Initial images of electron and ion emission have been obtained from Ru(0001). The Ru *4d* bands give images with dramatically different symmetries, depending on the initial binding energy of the state imaged. Present effort is focused on improving image transfer rates to give the enhanced signal-to-noise necessary to image monolayers of adsorbed molecules.

LASER ATOMIC LENS

Researchers at NIST have recently shown analytically that nanometer-sized spots of atoms can be produced by focusing an atomic beam with a laser. In a soon to be published paper they examine the focusing effects of a hollow, tube-shaped ("donut"-mode) laser beam on an atomic beam. When the laser beam is focused, such that the inside diameter attains a minimum at some point in space, it was found that this region acts as a lens for a neutral atom beam traveling down the axis of the laser beam.

The origin of the force exerted by the laser lies in the dipole moment induced in the atoms by the oscillating laser field. This dipole moment feels a force when the laser intensity has a gradient, as is present inside the hollow laser beam. In order for the force to be sizeable, the laser frequency must be tuned near a resonance in the atomic absorption spectrum.

One of the most intriguing properties of this laser-atomic lens is that, if the dimensions of the laser and atomic beams are kept small (of order 1 μm), spot sizes as small as 1 nm (0.001 μm) can in principle be obtained. In this situation, one of the major contributions to the spot size is diffraction of the atoms arising from their De Broglie wavelength. Such small spot sizes suggest a number of possible applications, such as microscopic atomic deposition, atomic microscopy, and precision measurements.

NEW X-RADIOGRAPHY FACILITY

NIST has installed a new, high-current, high-energy, industrial radiography source. The new facility, available to all NIST researchers as well as outside industry users, greatly expands NIST on-site capabilities for industrial radiographic applications. The high energy (420 kV) and high current (10 mA) will permit radiographic imaging through 10 cm of steel. In a recent application for the American Dental Association Paffenbarger Research Center, zirconium alloy ingots were radiographed to select specimens free of internal casting defects prior to machining.

The x-ray tube is mounted on a movable gantry to permit various beam orientations. The source is rated for 100-percent duty cycle and provides for automatic timing of exposures from 1 to 100 min. It may also be operated manually for any period. The stable, high-current device is also well suited for x-ray fluorescence studies in basic physics.

MEASURING GRAIN ORIENTATIONS IN THE SEM

A system for determining the crystallographic orientation of grains as small as 0.2 μm in any polycrystalline material has been installed on a scanning electron microscope at NIST. Orientation information increases understanding of the structure and properties of a number of materials systems, for example, high T_c superconductors, interfaces in electronic packaging systems and fiber-reinforced composites, and thin films. The

specimens require very little specialized preparation beyond the production of a clean surface. Electron backscatter diffraction patterns are recorded in real time using a phosphor screen and low-light video camera. Analysis of the orientation information is carried out using software written here over the last year. Given the crystal structure of the material, the software is capable of automatically indexing the pattern once the positions of three or more zone axes have been measured. Additional hardware and software currently being installed will perform digital image processing and produce patterns of much higher quality, which will improve the accuracy of the technique.

HIGH-STRENGTH COMPOSITE INTERMETALLIC ALLOYS

In aerospace applications, there is an urgent need for low-density structural materials with high-temperature strength and low-temperature ductility. Titanium aluminides provide several alloy phases that show promise in these directions. By producing a composite of two such alloy phases, NIST scientists have developed a new intermetallic heterophase alloy with expected superior mechanical properties.

This development is based on the idea of combining two titanium aluminide ternary phases having complementary properties. The two phases were found to be in thermodynamic equilibrium with each other at elevated temperatures, thus providing stability in use. The phases combine to produce a high-strength composite microstructure. A variety of fine microstructures can be achieved by the use of different cooling and heating schedules.

REFERENCE DATA FOR FIRE MODEL VALIDATION

Fire models are becoming accepted for product design and building code use. The establishment of the accuracy of such models is thus as important as their creation. The NIST fire program, the international leader in fire and fire hazard modeling, has just completed documentation of five sets of real-scale fire tests, over 125 tests in all. These involve a variety of combustibles burned in enclosures ranging from a single room to a seven-story building. An upcoming report will include this information as well as a brief history of room fire testing, delineation of the model validation process, a discussion of the key measurements in validation testing, and

guidance for comparing experiment with prediction. The data from these tests will be available from NIST (via INTERNET), enabling fire modelers around the world to test their models uniformly.

NEW AUTOIGNITION MEASUREMENT METHOD

NIST scientists have developed and tested a new apparatus for making short-duration autoignition measurements of hydrocarbon fuels under conditions where the fuel/air stoichiometry, the nature of the hot metal surface, and the contact time are well-controlled. The work was sponsored by the U.S. Air Force Engineering and Services Laboratory. Finding serious problems with current closed-container methods, NIST scientists developed a flow-through device that provides much more reliable data on the importance of fuel structure effects. A key innovation is the ability to use various evenly heated metal foils as the igniting surface. They performed over 1,100 autoignition temperature determinations for 15 fuels, three metal surfaces, and three stoichiometries. The measured temperatures generally decrease slightly for larger hydrocarbons (with the C₂ hydrocarbons being quite low) and for richer mixtures. For the metal surfaces, the decreasing order of autoignition temperatures is nickel > 304 stainless steel > titanium. The data are consistent with literature suggestions that branched alkanes should be more resistant to autoignition than the linear isomers. A report on the work concludes with a discussion of the implications for engine knock and recommendations for further study.

FEDERAL INFORMATION PROCESSING STANDARDS (FIPS) REVISED

The Secretary of Commerce approved a revision to FIPS 120, Graphical Kernel System (GKS), which will be published as FIPS 120-1. FIPS 120, which adopts American National Standard Graphical Kernel System (ANS GKS), ANSI X3.124-1985, was modified to add a requirement for validation of GKS implementations acquired by the federal government. The standard specifies a library or toolbox package of subroutines to produce and manipulate two-dimensional pictures.

Also approved was a revision to FIPS 54, Computer Output Microform (COM) Formats and Reduction Ratios, 16 mm and 105 mm, to be published as FIPS 54-1. Effective July 1, FIPS 54-1 adopts American National Standard for Information

and Image Management—Specifications for 16 mm and 35 mm Roll Microfilm, ANSI/AIMM MS14-1988, which specifies the image arrangement, size, and reduction ratios for 16 and 105 mm microforms generated by computer output microfilmers.

FIPS 9-1, Congressional Districts of the United States, provides the structure of numeric codes for representing congressional districts and similar areas defined for the various Congresses of the United States. A reissue of FIPS 9 incorporating technical changes, FIPS 9-1 is used in the collection, processing, and interchange of coded data by federal agencies.

NIST PUBLISHES VALIDATED PROCESSOR LIST

A new publication, NISTIR 4500, Validated Processor List, identifies COBOL, FORTRAN, Ada, and Pascal programming language processors that have a current validation certificate and those SQL language processors that have a registered test report. The list also includes GOSIP conformance testing registers. Processors scheduled for validation or processors having a current validation certificate or test report may be offered or delivered by vendors in response to requirements set forth in solicitations by federal agencies. The list is updated and published quarterly.

HIGH-TEMPERATURE JOSEPHSON JUNCTIONS FOR CRYOELECTRONIC INTEGRATED CIRCUITS

NIST has designed and fabricated a form of Josephson junction from high-critical-temperature superconductor material. This step completes the demonstration of capability to fabricate all the components needed for cryoelectronic integrated circuits such as ultrasensitive magnetic field detectors and microwave detectors and constitutes a significant step toward fabrication of more complex circuits such as high-speed digital processors, analog signal processors, and even voltage standard arrays. Because high- T_c superconductors do not require cooling with the expensive and difficult-to-obtain liquid helium required for low- T_c superconductors, capability to fabricate operating integrated circuits from high- T_c superconductors will promote their practical application and is expected to give rise to a range of commercial products. The NIST development contributes to a growing perception that successful commercialization will be possible.

In addition to the Josephson junctions, in the form of microbridges of high- T_c superconductor/normal metal/high- T_c superconductor, NIST has fabricated insulated crossovers between high- T_c layers, contacts between resistors and high- T_c elements, and contacts between one high- T_c element and another. The microbridges are formed by in situ deposition of YBCO and silver-gold alloy from different directions onto a substrate having a 100 to 500 nm step previously formed by ion milling. The step shadows the superconductor, leaving a gap which is crossed by the unshadowed normal metal. Device length, critical current, and resistance are controlled by forming the Josephson weak link on the edge of the step.

NIST ANNOUNCES SPECIAL-TEST SERVICE FOR HIGH-ACCURACY ELECTRICAL INSTRUMENTS

Special test measurement services to support precision multifunction calibrators, digital multimeters (DMMs), and low-voltage ac-dc transfer standards are now offered by NIST. These services have been developed in response to requests from users of a new class of highly accurate, stable, commercial DMMs and multifunction/multirange calibrators that have appeared in the marketplace in the past several years. Organizations frequently require calibration by NIST when they purchase these instruments to use them as laboratory standards for calibrating other instruments.

NIST measurement services for multifunction, multirange instruments had been available previously for the ac voltage function from 100 mV to 1 kV. Following the development and implementation of the necessary physical standards and measurement techniques, these services have been broadened to support the ac current, dc voltage and current, and dc resistance modes found on many of the new calibrators and DMMs. In addition, the ac voltage range has been expanded to lower voltage values between 1 and 100 mV, and the scope of low-voltage ac calibrations has been broadened to include ac-dc difference devices. The NIST calibration system is automated, employing standards that themselves are calibrated against higher-echelon standards maintained by NIST. The accuracies and ranges for these multifunction calibrations cover the capabilities of instruments known to be commercially available through early 1991.

NIST AND AIR FORCE APPROVE MOU ON INTELLIGENT CONTROL SYSTEMS

The Air Force Manufacturing Technology Directorate (MTD) and NIST have signed a Memorandum of Understanding (MOU) for the development of an open system architecture for real-time intelligent control systems. This MOU establishes the framework for cooperative research whose goal is the improvement of the national competitiveness of the aerospace manufacturing industry.

Under this MOU, MTD and NIST will identify and evaluate specific problems and research opportunities related to intelligent control systems, develop improved or new practices and standards, and conduct research to support these activities. The first joint efforts under this MOU involve research being conducted by NIST on the Air Force's Next Generation Controller (NGC) Program. This program has adopted the NIST NASREM control architecture for the NGC. NIST is assisting the Air Force in mapping the control modules for an intelligent machine tool controller into the NASREM architecture.

SURFACE ROUGHNESS OF TURNED PARTS IN REAL TIME

As part of real-time process-control strategy being implemented in the Quality in Automation (QIA) project, an investigation has been carried out at NIST to study the feasibility for pulsed ultrasound to resolve average roughness values and discrete asperities of less than 1 μm . A range of ultrasonic frequencies and beam dimensions was applied to turned sample surfaces using both scattering and profiling techniques. As a result, the ability to resolve an average surface roughness R_a value of less than 0.5 μm on a stationary 50 mm-diameter turned aluminum part has been demonstrated.

ELECTRON TRANSFER REACTIONS OF CYTOCHROME C ON MOLECULAR MONOLAYERS

A NIST scientist and university colleague have developed a new experimental strategy for studying the long-distance electron transfer reactions of the protein cytochrome *c*. Protein electron transfer is vitally important in controlling the bioenergetics of photosynthesis and respiration. In their approach, thin (25 Å), compact molecular monolayers terminated by carboxylic acid groups are formed by self-assembly on gold electrode surfaces. These

monolayer surfaces bind cytochrome *c* molecules irreversibly, thereby holding them a fixed distance from the gold electrode. The interfacial electron transfer rate from the gold electrode across the monolayer film to cytochrome *c* is then measured electrochemically. The researchers estimate an electron transfer distance of $\sim 30 \text{ \AA}$ from both the electron transfer kinetic data and structural models of the monolayer-cytochrome *c* complex. The significance of this work is that the distance dependence of electron transfer can now be studied rigorously and easily by varying the thickness of the self-assembled monolayer. Moreover, the experiments show that self-assembled monolayers can be used to molecularly engineer surfaces to control the adsorption of biomolecules. This work is detailed in the *Journal of the American Chemical Society* 1991, 113, 1847-1849.

HIGH-TEMPERATURE SUPERCONDUCTOR THIN FILM

Thin films of high-temperature superconducting oxides are likely to play an extremely important role in many technologies, and research on the production of thin films is proceeding at a rapid pace. Scientists at NIST are currently producing thin films of $\text{DyBa}_2\text{Cu}_3\text{O}_7$, a superconducting oxide with a transition temperature of 89-90 K, by evaporation of the constituent elements in an ultra-high vacuum environment. This method, similar to the molecular beam deposition methods employed in the semiconductor industry, provides the control necessary to allow one to assemble the thin films in an almost atom-by-atom manner. In addition to studies employing a wide variety of high-resolution electron-microscopies (transmission and scanning electron microscopies), this growth method is coupled to in situ electron spectroscopic diagnostics for investigating the electronic and atomic structure of the oxides as grown. This combined approach will provide NIST scientists with the tools necessary to study in detail the growth of these materials, the correlation between growth conditions and superconducting properties, and chemical aspects of possible processing steps necessary for the success of high-temperature superconducting technologies.

RADIOCARBON (^{14}C) MEASUREMENTS USED TO TRACE ATMOSPHERIC ORGANIC POLLUTANTS

NIST researchers have succeeded in apportioning the significant contributions of residential wood combustion and motor vehicle emissions to organic aerosols collected during the winter in Boise, Idaho. This work was a collaboration with the EPA as part of their Integrated Air Cancer Project. The origin of these aerosols was important in terms of visibility degradation and their potential for causing human health problems, since this material may have contained mutagenic compounds. The technique used by NIST scientists includes micro-analytical methods to prepare organic extracts of fine particulate material for accelerator mass spectrometry (AMS) ^{14}C measurements. The group has advanced the ^{14}C AMS measurement process to a sensitivity measured in sample size to about $30 \mu\text{g}$ carbon. Through the use of NIST Standard Reference Materials, a high level of quality assurance has been established throughout the process of isolating and measuring the organic fraction.

HOW DO YOU MAKE A METAL OUT OF ATOMS?

As manmade structures become increasingly smaller and smaller, eventually we will be dealing with materials consisting of only a limited number of atoms. In this limit, where quantum effects become the rule, an intriguing question of importance in possible future atomic size devices is: will very small metal atom structures still exhibit metallic characteristics? Would they conduct electricity like normal metals? NIST scientists have found that one- and two-dimensional structures of cesium atoms on III-V semiconductor surfaces exhibit insulating characteristics; metallic properties are not present until three-dimensional structures form.

The ability to probe the electronic properties of atomic-size structures has become possible with the spectroscopic abilities of the scanning tunneling microscope. This ability allows NIST scientists to examine with atomic resolution the spectrum of electronic states near the Fermi level of nanometer-sized structures. This is accomplished by recording the tunneling current flowing into and out of electron energy levels of a specimen as a function of voltage applied between the tip and sample; the voltage controls which energy levels are examined. Cesium structures on GaAs and InSb(110) surfaces were studied because NIST

scientists discovered that, as the cesium density increases, this system exhibits such structures as a one-atom-wide linear chain, a one-atom-thick two-dimensional film, and finally, a three-dimensional overlayer. Tunneling spectra on these structures show a band gap in the electronic energy levels that narrows in going from the linear chains to the two-dimensional film. Because of the band gaps these structures are insulating, even though they are composed of "metal" atoms. True metallic characteristics, as evidenced by an absence of a band gap, were not observed until three-dimensional structures of cesium were formed. This work has spurred experimental and theoretical interest in both U.S. and European communities in trying to understand the insulating behavior of these intriguing systems.

NIST DEVELOPS RADIOACTIVITY STANDARDS FOR HOLMIUM-166 AND RHENIUM-188 BONE-SEEKING PHARMACEUTICALS

Holmium-166 and rhenium-188 are bone-seeking radionuclides of therapeutic interest for improved cancer treatment. Holmium-166 is under investigation by drug manufacturers, while rhenium-188, available from Oak Ridge National Laboratory, is receiving considerable attention from the same manufacturers. NIST standards are needed for these nuclides to allow proper assays for the investigational new drugs and for use in new drug applications to the FDA.

Both radionuclides were standardized for activity by the method of $4\pi\beta$ liquid-scintillation efficiency tracing with tritium. For applications in nuclear medicine, the clinical users of a radionuclide require accurate half-life and decay scheme information. Therefore, measurements were made on the photon emission rates of the principal x and gamma rays using semiconductor detectors. Half lives measured with the NIST primary ionization chamber were 26.77 ± 0.01 h for the holmium-166 and 17.01 ± 0.01 h for the rhenium-188. Calibrations for both radionuclides are now available from NIST.

TENSILE CREEP OF SILICON NITRIDE

High-temperature deformation is one of the important properties in determining lifetime and reliability of advanced ceramics. NIST researchers have recently completed the tensile creep data collection process on a candidate heat engine silicon nitride. Substantial transient effects have been

observed. A creep rupture analysis shows all the data fit a Monkman-Grant type curve, wherein the time-to-failure depends only on the creep rate. Preliminary lifetime predictions indicate this material will withstand an applied stress of approximately 50 MPa for the DOE-prescribed temperature and time limits of 1370 °C for 1 year. Analysis of all the data currently available on silicon nitride shows that it also fits the Monkman-Grant formulation and, in fact, fits within a narrow band, regardless of composition or the presence of reinforcement such as whiskers.

COMPUTER MODEL FOR THE ANALYSIS OF CORROSION MEASUREMENTS

Scientists at NIST have developed a computer model for the analysis of electrochemical corrosion measurements. Currently, curve fitting to an equivalent electric circuit is usually employed for analysis, but a physical interpretation of the electric circuit in terms of the corrosion processes simulated is often difficult. For the NIST model, a system of equations describing the physical processes is used to calculate the response of the electrochemical cell to the perturbations imposed by an experiment. The curves calculated by the computer can be compared to the experimental results. The main advantage of this approach is that interpretation is straightforward, allowing a direct assessment of the processes that determine corrosion behavior. This work is continuing with the aim of treating more complicated systems.

MAGNETIC SEMICONDUCTORS SUPERLATTICES

A research effort involving researchers from NIST and the University of Notre Dame, in which neutron diffraction has been used for the study of magnetic semiconductors, has shown for the first time the dependence of the crystalline and magnetic structure on epitaxial strain in alternating layer superlattices of MnSe with ZnSe and MnSe with ZnTe. In these materials the zincblende crystalline structure, which does not exist in the bulk, is stabilized. It has been discovered that when MnSe is grown with ZnTe, the epitaxial strain "tunes" the tetragonal distortion so that new incommensurate antiferromagnetic structures are stabilized. In addition, the strain alters the first-order phase transition in MnTe so that it becomes second order. These materials are of technological interest for electro-luminescence and tunable infrared sensors.

COMBUSTION IN MICROGRAVITY

Researchers at NIST recently developed a theoretical model and computer simulation of ignition and flame spread over a thin paper in a microgravity environment. The model consists of complex heat and mass transport, flow motion, and chemical reactions in the gas phase and in the condensed phase. At present such calculations are only feasible without gravity. The results indicate that ignition can occur in air but there is no transition to flame spread. The transition can occur in 35 percent oxygen concentration or higher. This project is supported by NASA's Microgravity Science Program and the results can be used for fire safety in the Shuttle and in the Space Station.

NIST INVESTIGATES DESIGN OF HEAT EXCHANGERS FOR AIR CONDITIONERS WITH REFRIGERANT MIXTURES

NIST researchers built and incorporated into a central residential air-to-air heat pump a new type of refrigerant-to-air heat exchanger designed specifically for refrigerant mixtures. In tests of the full heat pump, efficiency was increased by 14 percent compared to the unit with the conventional R-22 refrigerant. NIST scientists had previously demonstrated more than 30 percent increases in efficiency with similar equipment and refrigerant mixtures; however, all previous research focused on refrigerant-to-water heat exchangers where counterflow is accomplished easily to take advantage of the temperature changes when refrigerant mixtures boil or condense at constant pressure. The challenge for conventional air-to-air heat pumps that predominate the residential market was to accommodate the counterflow design without large pressure drops in the air stream and the attendant large fan power required. A cross-counterflow design was used along with the binary mixture R22/R114. A modified design procedure was also developed and verified in the course of this research to allow equipment to properly size these types of heat exchangers in future equipment.

NIST DEVELOPS INTERDISCIPLINE INTEGRATION PROCEDURES FOR ISO STANDARDS IN PRODUCT DATA EXCHANGE

A NIST scientist recently published integration procedures used in the specification of product data requirements for computer-aided information systems. Traditionally, the specification of product data requirements has been segregated by discipline boundaries inhibiting the exchange of information and impeding such approaches to product development as concurrent engineering. Providing an integrated specification of generic product data requirements establishes the foundation upon which data exchange and sharing are possible both across disciplines and throughout the life cycle of a product. The integration procedures enable the users of computer-aided systems to contribute to the development of an integrated specification that accommodates their common data requirements. The integration procedures have been adopted by the Project Management Advisory Group of the International Organization for Standardization (ISO) Technical Committee on Industrial Automation Systems (TC 184) Subcommittee on Manufacturing Data and Languages (SC4) responsible for ISO 10303, informally referred to as STEP (Standard for the Exchange of Product Data).

ADVANCED ACCESS CONTROL SYSTEM DEVELOPED

NIST has developed the Smartcard Access Control System (SACS), which provides more effective security than conventional password-based access control. SACS requires users to have a valid smartcard and a correct personal identification number to be granted network access.

SACS incorporates advanced features, including cryptographic authentication, secure data storage, support for automatic key distribution, and the capability to generate message authentication codes. SACS is the first smartcard application designed through use of formal verification, a mathematical technique which demonstrates conformance to a specification with much greater precision than conventional software verification techniques.

NIST HOSTS WORKSHOP FOR IMPLEMENTORS OF OPEN SYSTEMS INTERCONNECTION (NIST/OSI WORKSHOP)

On March 11-15, NIST and the IEEE Computer Society co-sponsored the NIST/OSI Workshop, part of a continuing series to develop implementation specifications from international standard design specifications for computer network protocols. The workshop attracted around 300 participants.

Highlights of the workshop included a proposal for a new special interest group on conformance testing and the review of a European document on that subject. Minor changes were made to the text of the stable implementation agreements document in the areas of X.400, message handling systems; file transfer, access, and management; and the lower layers of the OSI Reference Model. In the working document, new text was generated in the areas of transaction processing, network management, and office document architecture.

OMNITAB 80 SOFTWARE RELEASED FOR PUBLIC DISTRIBUTION BY NIST

OMNITAB 80 Version 7.00 maintained by NIST was delivered to the National Technical Information Service for public distribution. The software package consists of procedures written in FORTRAN source language and test problems to assist in implementing OMNITAB on any large mainframe computer. The OMNITAB system is operational at NIST on the Cyber 855 on the SUN and SUN-SPARC workstations and will be available on the new Cray. A users' manual and complete documentation are provided.

OMNITAB 80 Version 7.00 is a highly integrated general-purpose programming language and statistical software computing system. Conceived in the early 1960s by NBS and implemented in collaboration with the NBS Computation Laboratory, OMNITAB was the first data analysis system based on the idea of worksheets (spreadsheets). It has been maintained and modernized by Statistical Engineering since about 1966. The system provides statistical analysis, numerical analysis, matrix/array analysis, and plotting capabilities. The user can also perform simple and complex arithmetic and trigonometric calculations, data manipulation, and special function calculations.

Standard Reference Materials**NEW STANDARD AVAILABLE FOR METAL PRODUCERS**

Standard Reference Material (SRM) 347, Magnesium Ferrosilicon, is a new standard in a group of ferroalloy SRMs developed by NIST for quality assurance in the steel industry. The ferroalloy is primarily used in the production of ductile iron. The new standard is for evaluating chemical and instrumental methods of analyses and for calibrating instruments. SRM 347, in the form of a powder (0.1 to 0.2 mm) with certified values for 15 elements, including rare earths, is available for \$112 per 100 g unit from the Standard Reference Materials Program, Room 204, Building 202, NIST, Gaithersburg, MD 20899, 301/975-6776, fax: 301/948-3730.

U.S. COMPANY TO MARKET NIST SRM

A leading manufacturer of analytical laboratory instrumentation, has recently agreed to market Standard Reference Material (SRM) 869, Column Selectivity Test Mixture for Liquid Chromatography (Polycyclic Aromatic Hydrocarbons), as part of its product line.

SRM 869 is a result of research carried out over the past 5 years at NIST. This SRM contains three chemical probes that provide a sensitive measure of column selectivity. These probes belong to a class of compounds known as polycyclic aromatic hydrocarbons, and their retention behavior correlates strongly with subtle changes in bonding chemistry used in column preparation.

SRM 869 provides researchers with a much needed tool for assessing differences in generically identical liquid chromatographic columns. Such inconsistencies in column performance often make it difficult to reproduce published results. Chromatographic tests utilizing SRM 869 permit columns to be classified into groups with similar retention behavior, thus facilitating column selection. Because SRM 869 provides an indication of overall column selectivity, a single experiment can indicate the suitability of a specific column for the analysis of various complex mixtures, thus increasing laboratory productivity by reducing methods development time.

NEW SRMs FOR THE MARINE ENVIRONMENT DEVELOPED

Two new Standard Reference Materials (SRMs) have been issued to support the measurement of pollutants in the marine environment. SRM 1941, Organics in Marine Sediment, and SRM 1974, Organics in Mussel Tissue (*Mytilus edulis*), were developed at the request of both state and federal agencies involved in marine environmental monitoring to provide an accuracy base for their national marine monitoring programs. Sediment collected in the Baltimore harbor was air dried, pulverized, and sieved to provide a homogeneous material for distribution as SRM 1941. For the preparation of SRM 1974, approximately 2,400 mussels collected from the Boston harbor were cryogenically pulverized and homogenized. Since SRM 1974 was prepared as a fresh frozen homogenate, it is representative of the tissue matrix generally used in analytical procedures for marine samples and represents the first fresh frozen biological SRM issued by NIST.

Both SRMs were analyzed using gas chromatography-mass spectrometry and liquid chromatography with fluorescence detection to provide certified values for the concentrations of selected polycyclic aromatic hydrocarbons (PAHs). Additional measurements by gas chromatography provided non-certified values for polychlorinated biphenyl (PCB) congeners and chlorinated pesticides such as the DDTs.

Even though the primary use of both SRMs is for the measurement of organic contaminants, inorganic analysts will also find them useful as natural matrix trace element reference materials. Non-certified concentrations for over 30 trace elements were determined at NIST primarily using neutron activation analysis. SRMs 1941 and 1974 are the first environmental matrix SRMs that have NIST-assigned concentrations for PAHs, PCB congeners, chlorinated pesticides, and inorganic constituents on the same material.

NEW PHOTOMASK LINEWIDTH STANDARD

NIST has issued a new bright-chrome on glass photomask linewidth standard SRM 476. This new standard is a companion to the older antireflecting-chrome SRM 475, which has been available for almost a decade. It consists of a series of calibrated lines and spaces ranging from a nominal 0.9 to 10.8 μm as well as a series of pitch (i.e., center-to-center) patterns designed for the microelectronics industry in calibrating their optical instruments that measure the critical dimensions on the photo-

masks used to pattern integrated circuits and devices. A submicrometer antireflecting-chrome photomask standard, designated SRM 473, is also being developed that will extend this range down to 0.5 μm and up to 30 μm . All of these photomask standards are calibrated on a new automated system that has improved the precision and accuracy of the calibration and reduced the calibration time for each photomask from 2 weeks (for SRM 475 on the old manual system) to less than one 24-hour day (on the new automated system).

CERTIFICATION OF A NEW NIST TOTAL DIET STANDARD REFERENCE MATERIAL

As a result of growing public demands for food quality surveillance programs, there is an increased need for reference materials to improve the quality of chemical analysis for foods. A recent example of this is the recent legislation in the United States on nutrition labelling. In addition, nutritional considerations such as bioavailability are resulting in new design of reference materials requiring specialized kinds of foods. To meet some of these needs, NIST has just released Standard Reference Material (SRM) 1548, Total Diet. This SRM was prepared with foods obtained from collections of the U.S. Food and Drug Administration's Total Diet Study, which represent that consumed by a 25-year-old American male. The foods were weighed, composited, freeze-dried, blended, radiation sterilized, and packaged in bottles. This material has now been certified for fat, protein, (Kjeldahl) nitrogen, ash, cholesterol, fiber and caloric content (bomb calorimetry), sulfur, phosphorous, chlorine, sodium, potassium, calcium, magnesium, iron, zinc, manganese, copper, selenium, and cadmium. Information values are available for additional trace elements, including tin, aluminum, boron, lithium, nickel, molybdenum, lead, and rubidium. Additional reference materials to address future needs in the field are under consideration.

Standard Reference Data

NEW MOLTEN SALTS DATABASE AVAILABLE FOR PC USERS

The new molten salts database, designed for personal computers (PCs), provides rapid access to approximately 750 compilations on the properties of 320 inorganic salts in the molten state, including

density, surface tension, electrical conductance, and viscosity. This information will be helpful for researchers engaged in the development of new high-temperature advanced materials for aerospace products and for scientists performing high-temperature and high-pressure physical property measurements. Information can be obtained by chemical formula or by browsing through the collection of carefully evaluated data to find the system of choice. NIST Standard Reference Database 27, Thermodynamic and Transport Properties of Molten Salts, is available for \$190 and is designed for use on any AT- or XT-Class PC with a color monitor. The information occupies 250 kilobytes, which can be stored on a hard disk. To order, contact Standard Reference Data Program, A320 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-2208, fax: 301/926-0416.

STANDARD REFERENCE DATA PRODUCTS CATALOG UPDATED

The NIST Standard Reference Data Products 1991 Catalog (NIST SP 782, 1991 Ed.) provides scientists and design engineers with the latest information on the data computations, publications, and computerized databases available from the NIST Standard Reference Data Program and other sources. Critically evaluated data compilations are available in the following areas: analytical chemistry, atomic physics, chemical kinetics, materials properties, molecular structure and spectroscopy, thermodynamics and thermochemistry, and the thermophysical properties of fluids. Since 1968, the NIST Standard Reference Data Program has been responsible, under an act of Congress, for coordinating on a national basis the evaluation of numerical data in the physical sciences. The evaluation of chemical and physical properties of substances and materials is carried out in the National Standard Reference Data network of data centers. To obtain a copy of SP 782, 1991 Ed., send a self-addressed mailing label to Standard Reference Data Program, A320 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-2208.