

News Briefs

General Developments

Inquires 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, Administration Building, A635, Gaithersburg, MD 20899; telephone: 301/975-3572.

NIST HELPING IN SEARCH FOR A MORE FIRE-SAFE CIGARETTE

As part of a team of experts from government, industry, and public health and safety organizations, researchers from NIST are working to help reduce the losses from fires started by cigarettes. The work is being done under the Fire Safe Cigarette Act of 1990 with funding from the U.S. Consumer Product Safety Commission. According to the National Fire Protection Agency, each year cigarettes start more than 230,000 fires and cause more than 1,600 deaths, 4,300 serious injuries, and \$443 million of property damage. NIST researchers will develop a standard test method that can be used to measure how likely a cigarette is to ignite soft furnishings, such as mattresses. The researchers also will use their expertise in computer modeling to learn more about the physics of ignition and to build a user-friendly model to predict ignition propensity. The project will be completed in August 1993. In an earlier, related study, NIST tested thousands of commercial and experimental cigarettes and identified changes that could significantly reduce the chance of igniting soft furnishings.

SCIENTISTS TRACK POLLUTANTS WITH RARE ISOTOPE TAGS

From the Blue Ridge Mountains to the Grand Canyon, visibility-reducing haze is clouding views in our national parks. Many are quick to blame coal-fired power plant emissions as the main cause

of this problem. Researchers now can use a technique developed cooperatively by NIST and the University of Maryland to evaluate how power plant emissions affect air quality up to hundreds of miles away from the source. Scientists spike power plant emissions with rare-earth elements, such as neodymium or samarium, that have an isotopic abundance different from that occurring in nature. These tags attach to fly ash particles and can be collected downwind from the power plant. Laboratory analysis can confirm whether the particles actually came from the suspect power plant. The tags tell scientists not only where the particles originate but also how concentrated they are. The July 1 issue of *Analytical Chemistry* describes this work in greater detail.

FIRST LABS ACCREDITED FOR GOSIP CONFORMANCE TESTING

NIST has announced the first laboratories to be accredited to test Open Systems Interconnection (OSI) products for conformance to the U.S. Government OSI Profile (GOSIP). GOSIP, issued as Federal Information Processing Standard (FIPS) 146, defines a set of data communications rules called "protocols," which enable computer systems developed by different vendors to communicate and the users of different applications on these systems to exchange information. The National Voluntary Laboratory Accreditation Program (NVLAP), administered by NIST, accredited the laboratories in the field of computer communications software. The use of NVLAP-accredited laboratories is required by the U.S. GOSIP Testing Program for testing products for conformance to GOSIP. Laboratories are accredited for 1 year, and accreditation is renewable annually. For information on NVLAP, contact Jeffrey Horlick, A124 Building 411, NIST, Gaithersburg, MD 20899, 301/975-4020. For information on the U.S. GOSIP Testing Program,

contact Jean-Philippe Favreau, B141 Technology Building, NIST, Gaithersburg, MD 20899, 301/975-3634.

1991 ANNUAL DIRECTORY OF ACCREDITED LABS AVAILABLE

Manufacturers, exporters, builders, and procurement and regulatory officials will want a copy of 1991 Directory of Accredited Laboratories (SP 810). The directory lists more than 1,000 domestic and foreign laboratories accredited by the NIST National Voluntary Laboratory Accreditation Program (NVLAP) for specific test methods as of July 1, 1991. Current fields of testing: acoustics, asbestos fiber analysis, carpet, commercial products (paint, paper, plastics, and seals and sealants), computer applications, construction materials, electromagnetic compatibility and telecommunications, personnel radiation dosimetry, solid fuel room heaters, and thermal insulation. The labs are listed alphabetically, by field of testing, and by state. Send a self-addressed mailing label to NVLAP, A124 Building 411, NIST, Gaithersburg, MD 20899, 301/975-4016, fax: 301/975-3839.

GETTING MORE X-RAY DIAGNOSTIC POWER

Researchers from NIST and industry have begun a cooperative research and development agreement to support the development of new x-ray instruments for industrial and medical applications. NIST will help test patented prototypes of a new computerized tomography (CT) x-ray scanner and an enhanced-power x-ray tube. Based on a novel design using Compton-scattered x rays, the scanner will be part of a portable CT system that is cheaper and more versatile than current models. The new tube is anticipated to be more than twice as powerful as current tubes, offering longer tube life and higher throughput for both medical and industrial applications. "The radiation measurement facilities at NIST are unique and have the flexibility we need, and we also benefit from the NIST expertise in radiation measurement and source characterization," according to an industry representative.

REPORT ON U.S./U.S.S.R. STANDARDS WORKING GROUP

The aim of the Standards Working Group (SWG) of the Joint U.S./U.S.S.R. Commercial Commission is to explore mutually advantageous avenues of cooperation, including promotion of international standards and product acceptance criteria. SWG, established in September 1990 by the U.S.

Commerce Department and the U.S.S.R. Ministry of Foreign Economic Relations, is co-chaired by NIST and Gosstandart. Emphasis at the first meeting in the United States was placed on exchanging information on standards and conformity assessment in both countries. First Meeting of the Standards Working Group of the Joint U.S./U.S.S.R. Commercial Commission, March 11-13, 1991 (NISTIR 4572) contains presentations by government officials and private-sector standards developers to provide Soviet members insight into U.S. standardization activities. Also included are materials submitted by the Soviets on legislative initiatives under development. Available from the National Technical Information Service, Springfield, VA 22161. Order by PB #91-194498 prepaid for \$34, foreign \$66.

CHEMICAL "DATING GAME" PINPOINTS AIR EMISSIONS

When scientists probe an air sample to determine what contaminants are present, they often face a dilemma: Where do these impurities come from? NIST is helping to answer this by refining a technique best known for pinpointing the age of archaeological objects. Called radiocarbon dating, the method compares the abundance of carbon-14 (C-14) in the sample to that of carbon-12. C-14 is naturally distributed throughout living matter, but when an organism dies, its C-14 level gradually decreases. This "yardstick" allows scientists to separate "living" carbon sources (burning wood, for example) from "dead" ones (fossil fuels such as gasoline). Recently, NIST helped the Environmental Protection Agency (EPA) sort winter pollution sources in Boise, Idaho, a city chosen for its auto emissions and many residential woodstoves. NIST researchers found that two collection sites in Boise showed high concentrations of wood-related pollution, as much as 80 percent. They are now analyzing this data for definitive conclusions and are helping the EPA conduct a similar study in Roanoke, VA.

DIRECTORY OF STATE/LOCAL LAB PROGRAMS PUBLISHED

Directory of State and Local Government Laboratory Accreditation/Designation Programs (SP 815) will help construction, building, environmental, and health and safety officials locate various state and local laboratory accreditation and similar programs. The directory is a guide to 21 state systems and 11 municipal programs across the country designated by government agencies to carry out

their responsibilities for testing products and services. Entries include information on how the laboratories are assessed. Part of a series to provide industry with information on standards-related endeavors, the directory is available by sending 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 conformity assessment directories also is available.

VALIDATED PROCESSOR LIST NOW DISTRIBUTED BY NTIS

The Validated Processor List (VPL) identifies COBOL, FORTRAN, Ada, and PASCAL programming language processors that have been validated for conformance to Federal Information Processing Standards (FIPS). The List also identifies SQL (structured query language) processors that have a registered test report and references the applicable FIPS. The List includes, for the first time, GOSIP conformance testing registers as well as POSIX conformance testing laboratories and validated products. The VPL will be distributed as a standing order for \$68 annually by the National Technical Information Service, Springfield, VA 22161. Order by PB#91-937301/AS. Comments or questions on VPL should be addressed to Judy B. Kailey at NIST on 301/975-3274.

NIST SIGNS CRADA ON NETWORK MANAGEMENT

NIST has signed a cooperative research and development agreement (CRADA) with a private company to work on improving understanding of the role and effectiveness of integrated network management systems. Projects involve experimenting and monitoring key network management functions within Integrated Services Digital Network (ISDN) and local area network environments. The CRADA also covers experimentation with network management tools for exchanging and defining management information. Under the agreement, the private company and NIST will develop a proof-of-concept integrated network management system based on the NYNEX Allink Operations Coordinator and the Logica Data Architects C3 commercial products. For information, contact Patricia N. Edfors, Computer Systems Laboratory, B154 Technology Building, NIST, Gaithersburg, MD 20899, 301/975-3758.

PROPERTIES OF MATERIALS PROGRAM EXPLAINED

NIST has an active electromagnetic properties of materials program to meet the needs of the electronics and microwave industries. These companies require accurate information on dielectric and magnetic materials used in printed circuit boards, capacitors, microwave components, sensor windows and radomes, for example. Improved characterization of these materials permits closer tolerances and leads to cost savings for designers and manufacturers of electronics and microwave products that use these materials. NIST aims to develop or improve measurement methods, reference materials, and a database on commonly used materials. NIST also participates in national and international intercomparison. Paper No. 22-91 explains the program and is available from Jo Emery, Div. 104, NIST, Boulder, CO 80303, 303/497-3237. Technical information is available from Claude M. Weil, Div. 813.02, NIST, Boulder, CO 80303, 303/497-5350.

SEARCHING FOR BRAKES AND ACCELERATORS IN CANCER

Scientists are sorting out subtle, but critical differences between treated and non-treated cancer cells with a new way of evaluating chemotherapy drugs. In research at NIST, the system reveals the appearance and disappearance of certain cellular proteins following treatment with interferon or tumor necrosis factor. Some of the changes occur in oncogene and suppressor gene products, the proteins which accelerate or brake the progression of cancer. The system could be used to identify protein changes for any number of chemotherapeutic agents, says a NIST biologist. The ability to identify how proteins respond to specific drugs could one day allow doctors to tailor a patient's treatment according to the sub-cellular traits of his or her tumor. The NIST scientist and his collaborators at the John Wayne Cancer Institute hope to define the basic mechanism chemotherapeutic agents use when they spring into action against a cancer cell.

NEW GUIDE CAN HELP BETTER DESIGN VAVs

A building air-delivery system known as variable air volume, or VAV, can save energy dollars by delivering just the right amount of air to areas that need it. However if a VAV is poorly designed or

improperly operated, problems can develop such as poor air circulation, noise, inadequate amounts of outdoor air, or too much hot or cold air. Researchers from NIST inspected VAV systems in numerous GSA buildings and conducted tests in three of them. The results were incorporated in a guide to the design, control and commissioning of VAV systems. The guide also includes "check lists" to help design a new VAV system or alter an existing one. While the guide was developed for GSA, it should be widely useful in the design community. Variable Air Volume System Design Guide (NISTIR 4605) is available from the National Technical Information Service, Springfield, VA 22161 for \$15 prepaid. Order by PB 91-216655/AS.

NEW PUBLICATION ISSUED ON TRANSPARENT FILE ACCESS

A new publication, *Issues in Transparent File Access* (NIST Special Publication 500-186), will assist managers, programmers, and users in government and industry in understanding, evaluating, managing, and using the Transparent File Access (TFA) Standard (IEEE 1003.1-1990) and system to access remote file systems. Transparent file access means remote files are accessed as though they were local. The report discusses the semantic, performance, and environmental issues met during the development of the TFA standard. The 86-page report illustrates some issues with examples and demonstrations using NFS (Network File System), the most widely used implementation for accessing remote files on a network. The publication is for sale by the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. Order by PB-91187831. The price is \$4.75.

UPDATE PLANNED FOR CATALOG OF CODE SETS

Users of the Catalog of Widely Used Code Sets, Federal Information Processing Standard (FIPS) 19-1, are asked to help locate organizations maintaining code sets that should be included in a planned revision. The catalog lists and describes code sets—social security numbers, zip codes, and the airport destination on luggage tags, for example—and offers users a central source for selecting needed code sets. Candidate code sets include international, national, or federal standards; those which apply throughout an industry;

or those which have a significant number of users. If your organization maintains code sets or you know of others that do, please contact Elizabeth Lennon at 301/975-2832 for submission procedures. Copies of FIPS 19-1 are available from the National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, VA 22161; (703) 487-4650. Order number is FIPSPUB19-1 and price is \$17.00.

PYRITE ORE STANDARD AVAILABLE FOR BIOPROCESSORS

Ore producers that use microorganisms to process minerals can obtain a new reference material for determining the rate of biological attack on pyrite and as a bioleaching substrate. Reference Material (RM) 8455, Pyrite Ore for Bioleaching Studies, provides assurance to users in different laboratories that they are investigating the same material. The rate of bioleaching of iron by the microorganisms, *Thiobacillus ferrooxidans*, which attack pyrite, is 12.4 ± 4.0 mg of iron per L per h and reported for information only and not certified. The rate was determined by NIST and eight cooperating laboratories in accordance with ASTM Test Method 1357-90. RM 8455 is available for \$80 in 100 g bottles in vacuum-sealed foil pouches from the Standard Reference Materials Program, Room 204 Building 202, NIST, Gaithersburg, MD 20899, 301/975-6776, fax: 301/948-3730.

ON-LINE TECHNOLOGY HELP FOR SMALL BUSINESSES

In cooperation with the Small Business Administration (SBA), NIST has awarded six grants to establish pilot programs to give small businesses improved access to public and private technology, services, and expertise. Matching fund grants of \$200,000 will go to state Small Business Development Centers (SBDCs) in Missouri, Oregon, Pennsylvania, Texas, and Wisconsin. The Maryland SBDC, which is planning a more limited program, will receive a \$50,400 grant. The grants are for 1 year and may be renewed for an additional 2 years, depending on available funds. They are part of an SBA effort to demonstrate to small businesses the value of increased access to commercial, on-line data services and technical information services. NIST manages the program for the SBA as part of its responsibility to foster the transfer of appropriate technology to small and medium-sized businesses.

EIGHT STATES TO RECEIVE TECH TRANSFER PLANNING GRANTS

NIST has chosen eight states to receive matching fund grants to help create plans for new, statewide programs to coordinate existing state and federal technology extension services. As part of the NIST State Technology Extension Program, grants will go to Arkansas (\$23,250), Florida (\$78,200), Massachusetts (\$70,003), Mississippi (\$99,648), Montana (\$50,000), Oklahoma (\$98,010), Oregon (\$82,481), and Texas (\$98,843). The coordination programs should ease the access of small and medium-sized businesses to a variety of services that seek to improve competitiveness through the application of science and technology.

HOW TO USE DIAMOND TURNING WITH "IMPOSSIBLE" METALS

Researchers at NIST and Los Alamos National Laboratory have demonstrated the unheard-of feat of machining near-optical-quality surfaces on significant areas of stainless steel using diamond turning. Diamond-turning machines increasingly are used in manufacturing optical components used in such things as compact disk readers, bar code scanners, and other applications requiring complex shapes, but only certain materials have been considered suitable for diamond-turning. Potentially useful materials such as stainless steel, titanium, and molybdenum have been impossible to work with because the diamond-cutting tool degrades and breaks down too quickly. The new technique uses a specially modified machine with both the tool and workpiece cooled to cryogenic temperatures, suppressing chemical reactions between the steel and the diamond tool that play a major role in the degradation of the tool.

RESEARCHER CRACKS CHEMICAL MYSTERIES OF COAL

Scientists know that high temperature and pressure slowly convert decaying plants into coal, but the exact chemical mechanisms remain somewhat of a mystery. A NIST chemist has discovered clues to this mystery through studies on the thermal chemical properties of coal. He recently found a weak chemical bond that triggers coal formation, and also is studying the black, sooty byproducts of coal combustion, known as polycyclic aromatic hydrocarbons. He has found ways to predict chemical reactions for these large, complex molecules. The

chemist's research is providing information that may help energy producers find more economic and less polluting ways of converting coal into oil or natural gas. For his contributions to coal chemistry, he will receive the 1992 American Chemical Society's Henry H. Storch Award in Fuel Chemistry.

PROPOSED DIGITAL SIGNATURE STANDARD PUBLISHED

As the federal agency responsible for developing standards to assure privacy of unclassified information in federal computer systems, NIST published its proposal for a Digital Signature Standard (DSS) in the Aug. 30 Federal Register. The DSS will allow federal agencies to verify the integrity of electronic data and the sender's identity. The government has filed for a U.S. patent on this technique and plans to seek foreign patents. NIST seeks comments by Nov. 29 on the proposal from the public, industry, and federal, state and local government users. After considering the comments, NIST will submit the proposed standard to the Commerce Secretary for review and approval. Technical questions should be referred to Miles Smid, 301/975-2938.

HIGH-INTEGRITY SOFTWARE LECTURE SERIES RESUMES

Increasing reliance on computers—for example, in medical devices, automobile components, and robots in manufacturing—requires assurance that these systems will operate reliably and exactly as intended, even when other systems fail. NIST's lecture series on high-integrity systems resumed in early October with a talk by Laszlo A. Belady entitled "The Engineering of Software for High Integrity." The series focuses on problems and potential solutions in building and operating high integrity systems. Scheduled speakers will address management processes (life cycle methodology, risk management, costing), development processes (formal methods, object-oriented design), and assurance processes (software reliability, clean-room techniques, formal verification). The lecture series, open to the public free of charge, serves to alert federal and industry managers, technical staff, and users about issues they must face in managing valuable information resources. For information, contact Dolores Wallace, 301/975-3340.

ANTENNA MEASUREMENT SERVICES IMPROVED

Responding to requests from industry and other government agencies, NIST has expanded its antenna measurement services above 30 GHz. The swept frequency gain measurement service now includes the 33–50 GHz band and covers 1–50 GHz with gain values with an accuracy of ± 0.3 dB or better for this frequency range. In addition, NIST has the capability to measure fixed frequency gain and polarization for 33–65 GHz and to measure antenna patterns for 33–50 GHz. Researchers currently are working to increase the swept frequency gain service to 65 GHz; this should be available in about a year. Paper No. 36-91 outlines the high-frequency antenna measurement services and is available from Jo Emery, Div. 104, NIST, Boulder, CO 80303, 303/ 497-3237. For technical information, contact Michael H. Francis, Div. 813.05, NIST, Boulder, CO 80303, 303/497-5873.

NEW “USERS’ GUIDE” TO NIST AVAILABLE

NIST has issued a new, comprehensive guide to the Institute’s many research opportunities, facilities, and services. The guide summarizes major NIST research programs that could be the basis for cooperative research and development agreements with industry; describes the major specialized research facilities at NIST available for industrial use—several of which are unique in North America or the world; and lists services to industry offered by the Institute. Detailed descriptions, project managers, and phone numbers are given for each item. Copies of Research. Services. Facilities. are available with a self-addressed mailing label from the NIST Public Affairs Division, A903 Administration Building, NIST, Gaithersburg, MD 20899, fax: 301/926-1630.

ION MICROSCOPE HELPS MAP ATOMS IN AEROSPACE ALLOYS

NIST chemists have mapped the arrangement of lithium atoms on a speck of metal alloy approximately the width of a human hair. Lithium composition maps offer the aerospace industry an inside look at the strengths and weaknesses of alloys that may be used to manufacture the next generation of airplanes. Using the ion microscope, NIST collaborated with Lehigh University to study enrichments and depletion of lithium within an aluminum-lithium alloy. The data they collected also enabled the scientists to calculate how quickly lithium atoms diffuse through the aluminum alloy. Adding

small amounts of lithium to aluminum makes an alloy that’s stronger and lighter than pure aluminum. The problem is that the high temperatures necessary for alloy processing tend to drive lithium out and weaken the alloy. Information from lithium composition maps could help the aerospace industry overcome this problem and develop effective thermal processing techniques for advanced alloys.

NIST, INDUSTRY TO PROPOSE COATINGS CONSORTIUM

A committee from NIST and industry will propose a coatings technology consortium at a workshop Dec. 3-4 at NIST in Gaithersburg, MD. Last May, NIST explored the idea of a consortium to find a new way to detect flaws on painted metal products in a production line. After discussions with manufacturers of coatings and coating equipment, automobiles, appliances, and roll-coated metal, that idea has been broadened. The proposed consortium would develop critical technologies needed to control the entire coatings process—including inspecting raw materials, controlling the application process, and evaluating the finished product. These technologies might include hardware and software for machine vision, high-speed vision processing for real-time inspection, and devices to measure the thickness of a coating. NIST has organized and managed several industry-government consortia. For information or to register for the workshop, contact Jonathan Martin at 301/975-6717 or Theodore Vorburger at 301/975-3493.

POLYMER COMPOSITES PROCESSING SENSORS IDENTIFIED

The driving force for process control sensors is the need by the U.S. polymer composites industry to improve the efficiency and reliability of fabrication to increase competitiveness. The most promising on-line sensor techniques are ultrasonic, dielectric, spectroscopic, and optical. NIST researchers identified and analyzed these process control methods in a report, Assessment of the State-of-the-Art for Monitoring Sensors for Polymer Composites (NISTIR 4514). While each sensor has its own research and developmental requirements, the most important technical and scientific issues are common to all methods. Major short-term needs are to build more rugged and reliable equipment that can withstand the harsh manufacturing environment and to develop better relationships between sensor data and information needed for process control. For a copy of the report, send a

self-addressed mailing label to Donald L. Hunston, A209 Polymer Building, NIST, Gaithersburg, MD 20899, 301/975-6837.

NIST UPDATES TIME SERVICES PUBLICATION

Precise time and frequency information is needed by electronic instrument and equipment manufacturers, electrical power companies, radio and TV stations, telephone companies, and air traffic controllers, to name a few. NIST has provided this information since its first shortwave radio station, WWV, went on the air in 1923. That station still operates but the range of services has been expanded. NIST Time and Frequency Services (SP 432) provides an updated summary of shortwave and low-frequency radio broadcast services, the broadcast formats for WWV, WWVB and WWVH, GOES satellite time services, the NIST frequency measurement service, and the automated computer time service. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock No. 003-003-03084-8 for \$2 prepaid.

OSI ROUTER INTEROPERABILITY TESTING PERFORMED

As part of a research program to advance OSI routing technology, NIST has performed interoperability tests on equipment using the Open Systems Interconnection (OSI) Intermediate System to Intermediate System Intra-domain Routing Exchange Protocol. Several organizations participated in the Cooperative Testing Program. NIST will document the test scenarios and general results of the testing to provide comments to implementors; to guide standards communities in refining base standards, implementors' agreements, and user group profiles; and to solicit reactions on developing testing and evaluation methods. The U.S. Government OSI Profile (FIPS 146-1) provides the blueprint for federal procurement of multivendor, interoperable computer networking products. For information, contact Doug Montgomery, 301/975-3630; dougm@osi.ncsl.nist.gov.

ELECTROMETER DETECTS CHANGE IN CHARGE ONE TEN-THOUSANDTH THE CHARGE OF AN ELECTRON

NIST scientists have designed and constructed an electrometer based on the principles of single-electron counting. The device has an intrinsic

charge sensitivity of one ten-thousandth the charge of an electron, corresponding to an energy sensitivity over a 1 Hz bandwidth of $30 h/2\pi$. The scientists used a recently acquired writing scanning electron microscope to fabricate the electrometer from two very small tunnel junctions connected in series, with a third terminal capacitively coupled to a very small island in between the junctions. Each junction is only about 100 nm on a side. Electric charge applied to the third terminal controls the current-voltage characteristic of the pair of junctions in a manner that is periodic in charge, the period being equal to the electron charge. The operating temperature is nominally 40 mK. The technology offers the possibility of a quantum-based current standard to match the quantum standards for voltage (implemented by Josephson-junction arrays) and resistance (based on the quantized Hall effect).

COHERENT OSCILLATION OF JOSEPHSON-JUNCTION ARRAY DEMONSTRATED FOR FIRST TIME

A NIST scientist has demonstrated coherent oscillation of a 10×10 array of Josephson junctions, voltage tunable from 60 to 210 GHz. The maximum power generated was $0.4 \mu\text{W}$ at 150 GHz. This achievement represents the first successful operation of a phase-locked array having its power output a substantial fraction of that theoretically predicted. The significance of this fraction is that it demonstrates that phase locking among the junctions is nearly perfect. For many loads of practical interest, the resistance of a typical single Josephson junction of about 1Ω results in a very large mismatch in impedance. Coupled with the very low power level developed in a junction, the mismatch severely limits the class of loads that can be used. The new NIST work can be considered as a feasibility demonstration for the potential of larger arrays to develop significant power levels. The capability of the array to be voltage tunable offers a practical source covering frequencies for which alternatives are very expensive and very difficult to construct. For example, such an array could be used as the local oscillator for heterodyne detection. Development of coherent arrays may also provide some elucidation of the basic physics underlying Josephson oscillations. A patent application has been filed.

AUTOMATED SYSTEM DEVELOPED FOR ANALYZING PERFORMANCE OF JOSEPHSON-JUNCTION INTEGRATED CIRCUITS

A NIST scientist has devised and implemented an automated system for evaluating and testing the operation of complex superconducting integrated circuits. The system provides 96 channels that can be connected selectively to pads on a chip under test in response to operator instructions, eight of these connections being made through high-bandwidth (7 GHz) coaxial lines. Each channel incorporates a 12-bit digital-to-analog data converter that permits test currents to be applied in response to a digital control signal and a 12-bit analog-to-digital converter that reads a corresponding voltage. The system is controlled via IEEE-488 bus protocols through a personal computer that can store data from all channels simultaneously and display up to 16 independent waveforms on its monitor. Provision is made to shield the chip under test from electromagnetic noise from the digital components and other sources of noise, such as the power supply. Future plans include the addition of a word generator and a logic analyzer to permit the system to evaluate single-flux-quantum logic circuits.

ALGORITHMS DEVELOPED FOR ESTIMATING PERMITTIVITY AND PERMEABILITY OF MATERIALS

Optimized algorithms for the simultaneous estimation of the permittivity and permeability of materials have been developed by NIST scientists. When used in conjunction with network analyzers, these algorithms provide new methods that can reliably characterize high-permittivity and high-permeability materials over a frequency range of 300 kHz to 18 GHz and that are applicable to both one-port and two-port transmission lines, which serve as specimen holders for the measurements. Former methods required at least two specimens of the material to be evaluated, were limited to a single frequency, and could not measure high-permittivity or high-permeability materials because of multi-mode fields and numerical instabilities in the reduction algorithms. Network analyzers are used to measure scattering parameters of a coaxial transmission line, with and without material specimens in the line. More than one analyzer may be required depending on the frequency range of interest. The algorithms are then used to find the optimal parameter estimates in a system of non-linear equations based on the measurements. A

constrained non-linear optimization procedure forms the basis for the computation of the values of permittivity and permeability.

SONAR TRANSDUCER ARRAY ACCEPTANCE TESTS IN NIST ACOUSTIC ANECHOIC CHAMBER

NIST scientists collaborated with the Naval Underwater Systems Center (NUSC) and its contractors in performing critical (self-noise, cross-talk, etc.) pre-sea-trial acceptance tests of a sophisticated multielement passive sonar system towed transducer array. Such tests are needed to verify the absence of spurious signals which, if present, could lead to false indications of, or failure to detect, distant submarines and ships. NIST staff used the recently enhanced measurement capabilities at very low signal levels with extremely low-noise, high-sensitivity accelerometers and microphones to demonstrate that the interior of the large acoustic anechoic chamber at NIST is much quieter than sea state zero, is relatively vibration-free, and is, therefore, well-suited for the pre-sea-trial tests. These tests were so convenient and revelatory of subtle aspects of system performance that similar tests at NIST on another array of a different design will be performed.

RADIATION DOSIMETRY FOR ISOTACTIC NEUROSURGERY WITH THE LEKSELL "GAMMA-KNIFE"

A collaboration between NIST and three clinical radiation oncology centers has resulted in an improved treatment planning procedure involving radiochromic film dose mapping with high spatial resolution. It introduces a relatively new method of treating deep-seated intracranial lesions using a non-invasive technique by focusing an array of 201 gamma-ray beams from a helmet fitted to the patient. This device, now in use in several medical centers in the United States, has been called the Leksell "Gamma-Knife," after its inventor, the Swedish neurosurgeon Lars Leksell. A vital step in the procedure is the accurate and precise mapping of radiation dose distributions in a skull phantom immediately prior to radiation treatment of the patient. Two NIST scientists have pioneered the use of radiochromic films for dosimetry and clinical radiography of radiation therapy sources and are co-authors of a paper on the Gamma-Knife with other medical physicists. The paper was presented at the 1991 annual meeting of the American Association for Physics in Medicine.

MODELING OF MAGNETOCALORIC EFFECT IN NANOCOMPOSITES

NIST scientists have developed the theory and written computer programs to model the magnetocaloric effect over a wide range of magnetic fields and temperatures for two types of nanocomposites: (1) those containing non-interacting superparamagnetic nanoclusters, and (2) those in which the nanoclusters are ferromagnetically interacting. The calculations demonstrate that superparamagnetic materials offer the possibility of extending the upper useful temperature limit of paramagnetic materials for low-temperature magnetic refrigeration, such as might be needed for cooling the new high-temperature superconductors. The calculations for the ferromagnetically interacting superparamagnetic materials are carried out using both mean-field theory and Monte Carlo simulations, and demonstrate that interacting superparamagnetic clusters can give significant magnetocaloric cooling over large temperature ranges, with potential implications for room-temperature magnetic refrigeration. The results of the modeling are being used for guidance in the development of appropriate nanocomposite materials.

RESEARCH SUPPORTS THE DEPARTMENT OF DEFENSE (DoD) COMPUTER-AIDED ACQUISITION AND LOGISTIC SUPPORT (CALS) PROGRAM

Three new publications document NIST's continuing technical assistance to the DoD CALS program. NISTIR 4494, SQL3 Support for CALS Applications, focuses on Structured Query Language (SQL) 3, a planned standard for major new SQL enhancements which is expected to be adopted as a national, international, and federal standard in the mid-1990s. NISTIR 4524, Raster Graphics Conformance Testing, evaluates the alternatives for identifying and selecting a conformance testing laboratory for raster graphics in support of CALS. NISTIR 4547, A Standard Generalized Markup Language Encoding of the Office Document Architecture Document Application Profile, describes NIST's encoding of the Office Document Architecture Document Application Profile in the Standard General Markup Language to illustrate similarities between the two international standards in support of CALS.

Standard Reference Materials

MELT FLOW RATE STANDARD AVAILABLE FOR POLYMERS

Researchers now have a better way to calibrate and evaluate the performance of instruments to measure the melt flow rate of polymer materials. Standard Reference Material (SRM) 1474, Polyethylene Resin, is certified for melt flow rate using procedure A in Section 8 of ASTM Method D 1238-86. SRM 1474 is supplied as white pellets of polyethylene in a 60-gram unit. Available for \$211 per unit from the Standard Reference Materials Program, Rm. 204 Building 202, NIST, Gaithersburg, MD 20899, 301/975-6776, fax: 301/948-3730.

THIN-FILM DEPTH PROFILE STANDARD AVAILABLE

Manufacturers have a new calibration tool for determining the sputtered depths and sputter erosion rates in the surface analysis of materials on semiconductors and other substrates. The calibrated structure of Standard Reference Material (SRM) 2136, Chromium/Chromium-Oxide Marker Layer, Thin-Film Depth Profile Standard, is useful for verifying correct instrument operation, monitoring ion beam current-density stability, and producing sputtering conditions that achieve maximum interface resolution. The SRM consists of eight chromium thin-film layers on a polished silicon substrate; each interface is composed of a thin chromium oxide layer estimated to be 2 to 3 monolayers thick. The seven outermost chromium layer thicknesses are certified; the thickness of each layer is nominally 30 nm. Available for \$673 from the Standard Reference Materials Program, Room 204 Building 202, NIST, Gaithersburg, MD 20899, 301/975-6776, fax: 301/948-3730.

NEW STANDARDS CAN IMPROVE MEDICAL LAB ACCURACY

A decade after it was introduced, NIST scientists are issuing an improved version of one of medicine's most popular standard reference materials. The 10 year-old SRM, an extremely accurate yardstick for measuring cholesterol, glucose, sodium, potassium and other constituents in blood, is being replaced with an expanded set of samples to increase the reliability of laboratory test results. The new set of reference materials contains six vials of freeze-dried human serum, three with

normal levels of organic and inorganic compounds, and three with elevated levels. The original set contained only normal levels. The new SRM allows labs and equipment manufacturers to calibrate their instruments at two points rather than one. It was developed with input from the College of American Pathologists and the clinical laboratory community. SRM 909a is available for \$179 from the Standard Reference Materials Program, Building 202, Room 204, NIST, Gaithersburg, MD 20899; phone: (301) 975-6776.

NEWEST BOTANICAL STANDARDS ARE “JUST PEACHY”

Apples and peaches may make great pies, but NIST scientists favored the leaves for two new botanical Standard Reference Materials (SRMs). Ground apple and peach leaf samples will help analytical laboratories around the world improve the accuracy and reliability of their results. NIST scientists pulverized leaves from Georgia peach groves and Pennsylvania apple orchards to a fine powder and then analyzed their content of 20 chemical elements, such as aluminum, arsenic, mercury, and lead. The new SRMs were designed for laboratories that regularly measure plant samples, agricultural products, living tissues, or similar biological compounds. Laboratories use the SRMs, which come with certified chemical composition values, as control samples and to evaluate the reliability of their methods. The apple leaf SRM (1515) and peach leaf SRM (1547) are available for \$174 each from the Standard Reference Materials Program, Room 204 Building 202, NIST, Gaithersburg, MD 20899, 301/975-6776.

COMMON COMMERCIAL ASBESTOS STANDARD, SRM 1866a

The Standard Reference Materials Program announces the renewal certification of SRM 1866a, Common Commercial Asbestos. This NIST certified SRM consists of a set of three common bulk mine-grade asbestos materials and one synthetic glass fiber sample. The three asbestos types in the SRM set are chrysotile, grunerite (Amosite), and riebeckite (crocidolite) and are typical of the asbestos found in bulk samples during routine asbestos inspections of building materials. The glass fiber sample serves as non-asbestos-containing material (blank) to check for contamination that would affect the accuracy and limits of detection of asbestos analyses. The optical properties of this SRM were characterized by light microscopy so that it may serve as a primary

calibration standard in the identification of asbestos.

These samples will be particularly useful to laboratories involved in the National Voluntary Laboratory Accreditation Program Bulk Asbestos Analysis Accreditation Program for developing and evaluating techniques for identifying the various types of asbestos commonly found in building materials.

TRACE ELEMENTS IN WATER, SRM 1643c

The Standard Reference Materials Program announces the renewal certification of 1643c, Trace Elements in Water. The SRM, certified by NIST, is intended primarily for use in evaluating the accuracy of trace element determinations in filtered and acidified fresh water and in calibrating instruments used for making these determinations. This SRM consists of 500 mL of water in a polyethylene bottle that simulates the elemental compositions of fresh water. It is certified for 24 elements at the trace level, including most of the elements listed on the U.S. Environmental Protection Agency (USEPA) toxic substance list. The determination of trace constituents in a simple matrix such as water at the 10^{-9} g level is very difficult. This SRM is required to provide comparability of measurements made by the USEPA, regulatory agencies (state and local), and industrial laboratories. SRM 1643c also can be used in baseline studies to determine whether a fresh water aquatic environment has been degraded.