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NIST
PUBLICATIONS

INTERNATIONAL AND ACADEMIC ACTIVITIES FOR FY 1997/1998



Special Publication 940

United States Department of Commerce
Technology Administration
National Institute of Standards and Technology
Office of International and Academic Affairs

1997/1998

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The National Institute of Standards and Technology was established in 1988 by Congress to "assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries."

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry's competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency's basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department's Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST's research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Publications and Program Inquiries Desk, 301-975-3058.

Office of the Director

- National Quality Program
- International and Academic Affairs

Technology Services

- Standards Services
- Technology Partnerships
- Measurement Services
- Technology Innovation
- Information Services

Advanced Technology Program

- Economic Assessment
- Information Technology and Applications
- Chemical and Biomedical Technology
- Materials and Manufacturing Technology
- Electronics and Photonics Technology

Manufacturing Extension Partnership Program

- Regional Programs
- National Programs
- Program Development

Electronics and Electrical Engineering Laboratory

- Microelectronics
- Law Enforcement Standards
- Electricity
- Semiconductor Electronics
- Electromagnetic Fields¹
- Electromagnetic Technology¹
- Optoelectronics¹

Chemical Science and Technology Laboratory

- Biotechnology
- Physical and Chemical Properties²
- Analytical Chemistry
- Process Measurements
- Surface and Microanalysis Science

Physics Laboratory

- Electron and Optical Physics
- Atomic Physics
- Optical Technology
- Ionizing Radiation
- Time and Frequency¹
- Quantum Physics¹

Materials Science and Engineering Laboratory

- Intelligent Processing of Materials
- Ceramics
- Materials Reliability¹
- Polymers
- Metallurgy
- NIST Center for Neutron Research

Manufacturing Engineering Laboratory

- Precision Engineering
- Automated Production Technology
- Intelligent Systems
- Fabrication Technology
- Manufacturing Systems Integration

Building and Fire Research Laboratory

- Structures
- Building Materials
- Building Environment
- Fire Safety Engineering
- Fire Science

Information Technology Laboratory

- Mathematical and Computational Sciences²
- Advanced Network Technologies
- Computer Security
- Information Access and User Interfaces
- High Performance Systems and Services
- Distributed Computing and Information Services
- Software Diagnostics and Conformance Testing

¹At Boulder, CO 80303.

²Some elements at Boulder, CO.

NIST Special Publication 940

NIST International and Academic Activities for FY 1997/1998

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Office of the Director
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Gaithersburg, MD 20899**



April 1999

**U.S. DEPARTMENT OF COMMERCE
William M. Daley, Secretary**

**TECHNOLOGY ADMINISTRATION
Gary R. Bachula, Acting Under Secretary for
Technology**

**NATIONAL INSTITUTE OF STANDARDS AND
TECHNOLOGY
Raymond G. Kammer, Director**

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Executive Summary

The National Institute of Standards and Technology (NIST) has the unique responsibility of ensuring that U.S. industry has access to the measurements and standards that it needs to compete in a global market. Because advancing technology is a significant stimulus for developing new measurement capabilities and new standards, NIST maintains a world class research and development program to support emerging measurement needs. In addition, NIST's measurement capabilities help support U.S. regulatory agencies in their efforts to ensure the health and safety of U.S. citizens abroad. Therefore, NIST has found it advantageous to participate in international activities. NIST targets its international activities on those areas in which U.S. industry needs a broader metrology base than that which currently exists. When NIST scientists and engineers have a history of cooperation with their counterparts from other countries, it is generally easier to adopt consistent measurement systems. Thus, participation in international Science and Technology (S&T) arrangements significantly enhances NIST's ability to achieve its mission. NIST accomplishes its mission through a portfolio of programs, including the measurement and standards programs, the advanced technology program, the manufacturing extension partnership, and the national quality program. The coordination of all international and academic activities in these programs is the responsibility of the Office of International and Academic Affairs (OIAA).

In the past two years OIAA has hosted many distinguished high level visits including the President and Vice-President of the Physikalisch-Technische Bundesanstalt (PTB), the Director of the Bureau International Poids et Mesures (BIPM), a Senator from the Mexican Chamber, the Minister of Commerce for Mexico, the Minister of Commerce and Industries of Haiti, the President of the Egyptian National Institute of Standards, the Director General of the Mendeleev Institute as well as the Directors of several of the National Measurement Laboratories including those from Denmark, the Netherlands, the United Kingdom, Ecuador, Mexico, and China.

In the past year, OIAA has expanded its outreach efforts by developing a comprehensive homepage on the World Wide Web (WWW). The OIAA homepage serves not only the NIST community but also our partners elsewhere in the United States and abroad. The information provided on the OIAA homepage includes: information on the international and academic activities at NIST, links to other national metrology institutions and standards bodies, a directory of all NIST international agreements, a database of measurement comparisons in which NIST staff have participated, links to organizations which fund international S&T cooperation, and information for NIST travelers. It is our intention to make this Special Publication available on the WWW and to continue to update and amend our homepage to meet the needs of our customers.

In January 1997 OIAA initiated the development of a laboratory wide international comparison database. With the cooperation of the laboratories, information on international comparisons NIST has been involved in the last 10 years, either formally or informally, was collected into a database. The first version of this database was published on the OIAA WEB page in September 1997. An updated version of the database was placed on the WEB in December 1997. Since that time the database project has expanded to include direct participation from the laboratories, Technology Services and our partner National Measurement Institutes (NMIs) in the European Union (EU). Dr. Robert Hebner, Acting Deputy Director, has called for a more detailed database that would not only allow NIST to identify international comparisons NIST is involved in, but also provide NIST with the capability to predict future international comparison needs. The timescale for completion of this expanded project is 2000.

OIAA has also implemented a strategy whereby NIST cooperates with regional bodies of NMI's rather than purely through bilateral relationships. These regional bodies include the Interamerican System of Metrology (SIM), the European Metrology Program (EUROMET), the Asia-Pacific Metrology Program (APMP), the Eastern Europe Metrology Program (COOMET), the Southern African Development Cooperation in Metrology (SADCMET) and a proposed Middle East and North Africa Metrology Program (MENAMET). NIST is a member of SIM, which includes the Americas and the Caribbean.

This Special Publication provides a summary of NIST's 1997 international and academic activities. The first two sections on International Affairs and Academic Affairs address activities which affect NIST-wide programs. The international activities of each of the major Operating Units (the seven laboratories, Technology Services (TS), Manufacturing Extension Partnership Program (MEP), the National Quality Program and the Advanced Technology Program (ATP) are described in subsequent chapters. Appendix 1 lists all of the international agreements NIST has with foreign institutions.

OIAA hopes you find this Report useful and welcomes your comments and suggestions on future issues.

Dr. B. Stephen Carpenter
Director, Office of International and Academic Affairs

Table of Contents	Page
International Affairs (109)	1
Academic Affairs (109)	20
National Quality Program (102)	22
Program Office (106)	23
Advanced Technology Program (470)	24
Manufacturing Extension Partnership Program (480)	25
Building and Fire Research Laboratory (860)	26
Chemical Science and Technology Laboratory (830)	31
Electronics and Electrical Engineering Laboratory (810)	35
Information Technology Laboratory (890)	40
Manufacturing Engineering Laboratory (820)	43
Materials Science and Engineering Laboratory (850)	47
Physics Laboratory (840)	55
Technology Services (200)	59
Appendix 1: International Agreements	64
Appendix 2: Organizational Chart	74
Appendix 3: Abbreviations	75

International Affairs (109)

Contact Point: Dr. Claire M. Saundry

The mission of the Office of International Affairs (OIA) is to provide advice on international science and technology affairs, including the management of international programs, and the interpretation of foreign policy guidelines set by the Departments of State and Commerce; serve as liaison between NIST and the international science and technology offices of other Government agencies, foreign governments and international bodies; provide NIST representation on various delegations to international meetings and on committees; manage NIST bilateral and multilateral cooperative programs; represent the Director in the negotiations of international agreements; serve as the focal point for foreign visitors and guest researchers; provide assistance to NIST travelers visiting foreign laboratories and institutions; and arrange for NIST services to users in friendly countries (15 U.S.C. 273).

International Agreements Signed in Fiscal Years 1997 & 1998

Canada

On October 15, 1997 Dr. Richard Wright, Director, Building Fire and Research Laboratory, signed an Agreement with the Institute for Research in Construction of the National Research Council for cooperation in areas of common interest. The Agreement remains in effect for two years.

Egypt

On December 16, 1996 Robert Hebner, Acting Deputy Director, NIST, and Venice Gouda, Minister of Scientific Research, signed a Memorandum of Understanding (MOU) for cooperation in the measurement sciences and standards-related activities between NIST and the Egyptian National Institute of Standards. This MOU will provide a mechanism for scientific and technical cooperation in chemistry, physics, and engineering measurement sciences, standards-related measures, and conformity assessment. This MOU will remain in effect for five years.

Germany

A Cooperative Project among NIST, Fachinformationszentrum Karlsruhe (FIZ) and Gmelin-Institute fur Anorganische Chemie der Max-Planck-Gesellschaft zur Forderung der Wissenschaften was signed on June 24, 1997. The purpose of the Project is to develop a crystallographic structural database for inorganic substances. The Project expires on December 31, 2002.

Italy

On October 10, 1996 the Physics Laboratory signed an Implementing Agreement (IA) with the Istituto Elettrotecnico Nazionale Galileo Ferraris (IEN) and the Politecnico di Torino (PT) to develop a set of cesium-fountain frequency standards (atomic clocks). The IA remains in effect for five years.

Japan

On February 17, 1997 an Implementing Agreement was signed with the National Aerospace Laboratory / Kakuda Research Center to compare measurement techniques to determine the thermal conductivity of ceramic coatings on metallic substrates. The IA falls under the U.S.-Japan Agreement for Science and Technology and remains in effect for two years.

The Consignment Agreement with the Real World Computing Partnership of the Ministry of International Trade and Industry (MITI) was renewed on March 14, 1997 by Judson French, Director, Electronics and Electrical Engineering Laboratory for one year. The Agreement is for a joint optoelectronics project. NIST's role in this project is to select, supervise and control the U.S. Broker (facilitator between the user with a novel design and the suppliers who perform fabrication). The Agreement was renewed again on March 31, 1998 for another year.

A Record of Discussion (R of D) with the National Research Laboratory of Metrology was signed on March 27, 1997. The R of D describes the continuing intercomparisons of hardness standards conducted in the Materials Science and Engineering Laboratory.

An R of D with the National Institute of Materials and Chemistry was signed on January 12, 1998. The R of D describes the continuing research on quantitative surface analysis for catalysts by electron spectroscopy in the Chemical Science and Technology Laboratory.

Kazakstan

On November 26, 1996 Robert Hebner, Acting Deputy Director, NIST, signed a Memorandum of Understanding (MOU) with the Committee for Standardization, Metrology and Certification. This MOU will provide a mechanism for scientific and technical cooperation in the fields of standards and metrology. This MOU will remain in effect for five years.

Mexico

In Mexico City, on December 3, 1996, Robert Hebner, Acting Deputy Director, NIST, signed a Memorandum of Understanding (MOU) between NIST and the National Council for Science and Technology (CONACYT), the Secretary of Commerce and Industrial Development (SECOFI) and the National Center for Metrology (CENAM). The MOU provides a mechanism for technical cooperation in chemistry, physics, engineering measurement sciences, standards related activities and interchange of technical information and experiences. This MOU remains in effect for five years.

The Netherlands

On September 22, 1997 Hratch Semerjian, Director, Chemical Science and Technology Laboratory, renewed a Declaration of Equivalence for primary standard gas mixtures with the Netherlands Measurement Institute (NMI). The Declaration was renewed again July 13, 1998 and remains in effect until July 30, 1999.

New Zealand

On July 18, 1997 the National Voluntary Laboratory Accreditation Program (NVLAP) exchanged letters extending the MOU to provide for mutual recognition between the International Accreditation New Zealand (IANZ), formally the Testing Laboratory Registration Council of New Zealand (TELARC), and NIST of testing laboratories that are accredited under laboratory accreditation systems administered by IANZ and NIST. The agreement does not confer recognition upon IANZ under Accreditation Body Evaluation Program (ABEP) and Fastener Quality Act (FQA). The MOU remained in effect until July 17, 1998.

Russia

An Implementing Agreement (IA) to the MOU with the Russian Academy of Sciences (RAS) was signed with the Institute of Crystallography of the RAS on March 28, 1997. The IA is for cooperation to study neutron and X-ray reflectivity properties of the structure and mechanism of formation of Langmuir-Blodgett films. The IA remains in effect for three years.

An IA with the Russian State Metrological and Certification Analytical Center (ANTECH), a unit of the Russian State Committee for Standardization, Metrology and Certification (GOSSTANDART) for cooperation on the NIST X-ray photoelectron spectroscopy database was signed August 20, 1997. The Agreement remained in effect for one year.

On March 23, 1998 the English language version of a Memorandum of Understanding (MOU) with the GOSSTANDART for cooperation in standards, conformity and metrology was signed. The MOU remains in effect for five years.

Saudi Arabia

On May 22, 1997 Robert Hebner signed an MOU with the Saudi Arabian Standards Organization (SASO) for technical cooperation in standards and related activities. The MOU remains in effect until July 28, 2000.

South Africa

In September 1997 Robert Hebner signed the Recognition of Equivalence of the National Standards of the United States and the Republic of South Africa for the SI Unit of Luminous Intensity with the CSIR.

On May 19, 1998 an MOU was signed by Deputy Secretary of Commerce Robert Mallett on behalf of NIST with the CSIR for cooperation in implementing Manufacturing Extension Partnership like programs in South Africa. The MOU remains in effect until August 22, 2001.

South Korea

Project Annex D to the MOU with the Korea Telecom Research and Development Group of Korea Telecommunications Authority was signed on April 9, 1997. The Project is for research on Asynchronous Transfer Mode / Broadband Integrated Services Digital Network (ATM/BISDN) Conformance / Interoperability Testing. The Project remained in effect for one year.

Multilateral

On October 1, 1996 the Chemical Science and Technology Laboratory signed a Statement of Intent with the Danish Institute of Fundamental Metrology and the Hungarian National Office of Measures on the intercomparison of electrolytic conductivity solutions. The agreement remains in effect until January 1, 1999.

On December 10, 1997 Ray Kammer signed a Mutual Recognition Arrangement (MRA) with the Asian Pacific Laboratory Accreditation Cooperation (APLAC). A reassessment of this Arrangement will take place approximately every four years. This agreement supercedes the NVLAP Agreement with IANZ of New Zealand.

On September 2, 1998 Commerce Secretary William Daley signed a Memorandum of Understanding (MOU) for the Versailles Project on Advanced Materials and Standards (VAMAS) on behalf of NIST with France, the United Kingdom, Italy, Canada, Japan, Germany, and the European Union. The MOU remains in effect for five years.

Bilateral Cooperative Activities

American Institute in Taiwan

Under an agreement between the American Institute in Taiwan (AIT) and the Taipei Economic and Cultural Representative Office in the United States (TECRO), formerly the Coordination Council for North American Affairs, NIST and the National Science Council (NSC) of Taiwan have been working together for over twenty years. In 1996, AIT and TECRO negotiated new Guidelines for Cooperation between NIST and NSC which now include cooperation with the Industrial Technology Research Institute (ITRI) in Taipei. These Guidelines were established to provide a mechanism for continued cooperation in the physical sciences between scientists from the territory represented by AIT and the territory represented by TECRO. The "Taiwan Relations Act" (Public Law 96-8, April 10, 1979) authorizes the continuation of commercial, cultural and other relations between the people of the United States and the people on Taiwan. Such relations are conducted by or through AIT, a nonprofit corporation, incorporated under the laws of the District of Columbia. TECRO is the instrument which provides assurances and takes actions on behalf of the people of Taiwan. The new Guidelines were signed by AIT and TECRO in January 1997. Under the AIT -TECRO Guidelines an Implementing Arrangement for cooperation in the field of nanotechnology was signed on December 15, 1998 which involves the Precision Engineering Division of the Manufacturing Engineering Laboratory of NIST and the Precision Instrument and Design Center of Taiwan's NSC.

Argentina

NIST continues its work with the National Institute for Industrial Technology (INTI) and the Secretariat of Science & Technology (SECyT) through workshops in metrology and standards, the exchange of technical experts and a Memorandum of Understanding (MOU) with the SECyT. The MOU was signed June 3, 1994 and remains in effect for five years. Argentina is also a member with the NIST in the Interamerican System of Metrology (SIM). See Multilateral listing for more information on SIM.

Brazil

NIST has supported bilateral activities with the National Metrology and Standards Institute of Brazil (INMETRO). This support has included technical experts from NIST participating in special seminars and workshops. NIST and INMETRO have actively worked together with the Organization of American States (OAS) and Mexico's national laboratory, the National Center for Metrology (CENAM), to promote metrology in the Americas. Technical experts from NIST, supported in part by OIA, participated in the Advanced School for Metrology: Evaluation of Uncertainty in Measurement conference sponsored by INMETRO, the CAPES Foundation, the National Research Council of Brazil and the Brazilian Society of Metrology.

On April 18, 1997 at the U.S.-Brazil Forum NIST and INMETRO discussed future activities to enhance cooperation under the MOU between the two National Measurement Institutes (NMIs). One activity is to provide technical assistance to INMETRO in their effort to set up a Standard Reference Materials Program in Brazil. NIST agreed to continue supporting an exchange program between NIST and INMETRO to bring INMETRO scientists to work in NIST laboratories. Brazil agreed to put on workshop for the U.S. delegation similar to a NIST Standards in Training (SIT) workshop.

Costa Rica

As a part of the effort to strengthen the SIM activities in the Americas, NIST has worked very closely with the Oficina Nacional de Normas y Unidades de Medida (ONNUM) in Costa Rica. Costa Rica, like many of the countries in Central America, is focusing much of its effort on legal metrology rather than scientific metrology. In support of this effort, NIST has provided technical experts to participate in regional workshops hosted by ONNUM on packaging and labeling.

Egypt

Under the Science and Technology Agreements with the Governments of Bosnia, Croatia, the Czech Republic, Egypt, Hungary, the Former Yugoslav Republic of Macedonia, Poland, the Slovak Republic, Slovenia, and Spain, the United States and the participating countries had contributed equally each year to joint funds which supported activities. For each agreement, a Joint Board was established which was responsible for the technical review of joint proposals. Project awards were made on a competitive basis. While Egypt and Spain are still active, in the current tight budget climate no new funds have been designated for Bosnia, Croatia, the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia.

These programs were not established to provide the primary source of funds for domestic research, rather, these funds were intended to support add on costs of bilateral cooperation, such as transportation, equipment, per diem and modest salary support for the foreign scientists, and to provide for exchange visits with U.S. collaborating scientists. Each project required a U.S. and foreign participant. The role of the foreign scientist was that of Principal Investigator with the U.S. participating scientist serving as an active research partner. The U.S. scientist also had primary responsibility for evaluating the scientific progress and merit of the proposal for the United States.

Under these programs, most awards were made for three years, with an annual payment based on the original proposal. When a project was approved, funds for all years of support were set aside by the

financial managers, and years two and three were paid out annually if progress on the research project was satisfactory. Financial support for the U.S. partner was usually limited to travel and per diem.

The Joint Fund programs with Croatia, the Czech Republic, Hungary, the Former Yugoslav Republic of Macedonia, Poland, the Slovak Republic, and Slovenia are focused more on direct interactions between institutes in each country and U.S. institutions rather than interactions at the government to government level. The Joint Fund program with Bosnia was never initiated. The Joint Fund programs with Spain and Egypt are active. The activities of the Egypt Joint Fund Boards are found below. The activities of the other Joint Boards can be found under their country heading in this section.

Under the auspices of the U.S.-Egypt Agreement for Cooperation in Science and Technology, NIST signed a Memorandum of Understanding (MOU) with the Egyptian National Institute for Standards (NIS) at the December 1996 meeting of the U.S.-Egypt Joint Science and Technology Board. To date, cooperation has focused on workshops, training in Measurement Assurance Programs and short-term exchange visits.

At the meeting of the Joint Board in June 1997 Meeting, 25 awards were made to support U.S.-Egypt S&T cooperation. NIST received two of those awards, one to conduct a needs assessment of the Metal Industry, and one to support Project Development Visits. To date, the OIAA has supported three project development visits and funds are still available for interested parties who wish to explore the potential for developing cooperative projects with researchers in Egypt. In addition NIST received funds to support a Workshop in Chemical Metrology and continue activities which were identified as priorities at the June 1996 workshop on Metrology, Standards and Conformity Assessment.

With funding from the Joint S&T Board, NIST supported a five-day workshop in Egypt on the establishment and implementation of Measurement Assurance Programs (MAP) and Electrical Measurement Round Robins in June 1997. This workshop involved public and private sector representatives and served to encourage Egyptian Industry, especially the private sector, to utilize and work closely with the Egyptian NIS. The first Measurement Assurance Program in the area of DC Voltage and Resistance was in early 1998. We hope to expand the MAP effort in 1998/1999.

European Union

OIAA and Directorate General XII (DGXII) of the European Commission have initiated a project to coordinate metrology efforts between NIST and the countries of the European Union (EU). The purpose of this project is to address traceability issues and ultimately enable industries from both sides to sell their products in each other's markets without restrictions. This cooperation will also allow regulatory bodies easy access to the results of comparisons between NIST and European NMIs in order to justify mutual acceptance of their measurement results.

While cooperation between NIST and European National Metrology Laboratories has had a long and mutually beneficial tradition, much of this collaboration takes the form of bilateral activities and is not coordinated with the EU. Recently cooperation has been strengthened by formation of the regional metrology organizations NORAMET and EUROMET. These bilateral and regional collaborations have led to a high degree of harmonization between measurements in Europe and in the United States, and equivalence between the involved institutions is today largely documented. However, this technical collaboration is not fully utilized in support of trade or meeting certain regulatory requirements.

The NIST-EU project will address all measurement quantities relevant for trade between United States and the EU as well as quantities important for public health, safety, and the environment. The first areas to be addressed are avionics, environmental protection, pharmaceuticals, medical devices, electromagnetic compatibility and interference, and occupational health and safety.

As a first step, OIAA developed a laboratory wide International Comparisons Database. The next step was development of a more detailed database that included data from the laboratories involved in the intercomparison and information regarding uncertainties associated with the measurements. The database project has now been expanded to include participation from our partner NMI's in the EU. Another part of this project was the preparation of two case studies to evaluate the measurement needs to meet regulatory requirements. The two areas focused on in the case studies were Avionics and Electromagnetic Interference (EMI). The two case studies will be made available on the WEB. This part of the project was supported through the NIST and the EU, and was overseen by a steering committee with representatives from eight of the EU member NMI's. The Director of OIAA represented NIST. The project was completed in October 1998. Now the project is focused on providing NMI's with the capability to predict future international comparison needs. The timescale for completion of the expanded project is 2000. The expanded project will continue under the auspices of the NIST-EU Memorandum of Understanding that is currently going through the approval processes within the United States and the EU.

The NIST EU Memorandum of Understanding with the Directorate General CII (DGXII) of the EU will provide a framework for scientific and technical cooperation in standards and metrology. Cooperation under the MOU will demonstrate the degree of comparability of equivalent measurements made in each of the NMI's in the countries of the EU. NIST initiated this dialogue to develop a plan to address comparability and traceability issues and ultimately enable industries from both sides to sell their products in each other's markets without restriction. This cooperation will allow regulatory bodies easy access to the results of comparisons between NIST and EU NMIs in order to justify mutual acceptance of their measurement results. Between the United States and the EU, bilateral and regional collaboration has led to a high degree of harmonization of measurements and comparability among the involved institutions. However, this technical collaboration is not fully utilized in support of trade or meeting certain regulatory requirements. The MOU will be signed in FY 1999.

Finland

NIST is exploring a collaboration with Finland in the area of telecommunication research. Toward this end the Director of OIAA had discussions with Nokia, the Helsinki telephone company in August 1998.

Ghana

NIST provides Ghana with technical support in the area of standards and measurement infrastructure development. This support may take the form of technical expert travel to Ghana, providing Standard Reference Materials, or calibrations, and is supported through a loan to Ghana from the World Bank.

Haiti

In August 1998, OIAA participated in a mission to assess the standards and metrology needs of Haiti. The mission found that there is increasing awareness in developing countries such as Haiti of the importance of having a standards and metrology system. Creating a marketplace where products produced and sold meet

specified levels of quality, safety and environmental health can enhance the economic development of such countries.

A standards and metrology system can enhance the reputation of locally made products by assuring buyers that such products meet specified levels of quality and safety. This system allows domestic producers to compete more effectively, not only in their own market, but also in the international marketplace.

Such a system can also encourage foreign investment by reputable companies by "leveling the playing field" for products sold domestically. The knowledge that all domestically sold products and services must meet specified quality and safety levels can provide investors with some assurance that their marketplace share will not be eroded by competition from unsafe products or products of inferior quality which can be priced more cheaply.

Hungary

In May 1997 the U.S.-Hungary Joint Board on Scientific and Technological Cooperation and technical representatives from Hungary and the United States met in Tihany, Hungary. The joint board approved funding for 18 new projects, postponed 5 projects and declined 64 projects. NIST scientists were named as the U.S. Principal Investigator on two of the projects. At the Joint Board meeting held in Washington on May 26, 1998 no new projects were funded. The U.S.-Hungary Joint Fund Board has shifted focus to encourage more institute to institute activities. In support of this goal NIST hosted representatives from the Hungarian Office of Measures after the Board meeting to acquaint them with activities at NIST. For more background on the Joint Fund Programs with Poland, Hungary, the Czech Republic, Slovenia, Croatia, Slovakia, Former Yugoslav Republic of Macedonia, Bosnia, Egypt, and Spain please see the listing under the Egypt heading.

India

The U.S.-India Cooperative Science and Technology (S&T) Program has been one of the U.S. Government's largest and most successful international S&T activities. Currently, there are about 200 active S&T projects supported by the U.S.- India Fund (USIF) in a wide range of research areas involving over twenty agencies of the U.S. Government. This fund was established in 1987 through an agreement between the United States and India to utilize \$110,000,000 of U.S. rupees (former PL480 rupees) for scientific, cultural and educational cooperation. Two thirds of the funding is dedicated to S&T cooperation, and one-third to education and cultural exchanges. The USIF expired on January 7, 1998 but projects funded under the USIF will continue until completed. An interagency group has been discussing setting up a Forum for Science and Technology among other possibilities with the funds remaining in the USIF. These discussions have been suspended.

In light of the May 1998 nuclear explosive tests, the U.S. Government has been conducting a review of its science and technology relationship with India. In this context, a number of factors have been examined, including the role of particular entities or research projects in the areas concerning proliferation.

Israel

NIST serves as one of the three U.S. Government representatives and the only U.S. technical representative on the U.S.-Israel Binational Industrial Research and Development (BIRD) Foundation

Board of Governors which must approve all grants made by the Foundation. The OIAA provides administration of the technical review and selection process for proposals submitted to the U.S.-Israel BIRD Foundation Board.

The BIRD mission is to stimulate, promote and support industrial R&D of mutual benefit to the United States and Israel. BIRD supports U.S.-Israel company partnerships dedicated to developing and commercializing non-defense-related innovative products or processes. The conditional grants are paid directly to the participating companies. BIRD funds 50 percent of the companies' expenses in developing a product to the stage of commercial readiness. BIRD funding is provided in the form of a conditional grant, which does not entitle BIRD to equity or intellectual property rights. If the project is a commercial success, BIRD receives repayments -- a pretax expense to the grantee -- up to a maximum of 150 percent of the conditional grant.

Financial support for BIRD is derived from two sources: interest earned on the \$110 million endowment granted in equal parts by the United States and Israeli governments, and repayment income from companies participating in successful BIRD-funded projects.

The U.S.-Israel BIRD Board meets two times each year in the summer and the winter. At the December 12, 1996 meeting 21 proposals, reviewed by NIST staff, were presented to the Board. Sixteen of these proposals were approved for funding by the BIRD Board. At the July 10, 1997 meeting of the U.S.-Israel BIRD Board of Governors one proposal was withdrawn and 14 of the proposals were approved for funding. At the December 17, 1997 meeting, 16 of 19 proposals were approved for funding, one was withdrawn and 2 were declined. And at the June 15, 1998 meeting 13 of 15 proposals were approved for funding.

Japan

OIAA met with representatives of ETL and NRLM to develop an Implementing Agreement (IA) under the U.S. - Japan Science and Technology Agreement for cooperation on measurement science. The IA provides a framework for scientific and technical research in metrology that demonstrates the degree of comparability between the Agency of Industrial Science and Technology (AIST) of the Ministry of International Trade and Industry (MITI) of Japan. The implementing laboratories for the IA are National Research Laboratory of Metrology (NRLM), the Electrotechnical Laboratory (ETL) and the National Institute of Materials and Chemistry (NIMC). After formal approval by each other's governments, AIST and NIST plan to sign the IA in FY 1999.

Former Yugoslav Republic of Macedonia (FYR of Macedonia)

In October 1995 NIST was a member of the delegation negotiating a Science and Technology Agreement for joint fund activities with the FYR of Macedonia. This was the first agreement signed by these two countries since the dissolution of the former Yugoslavia. Since the signing NIST has been collecting and managing the review process for the proposals in the engineering category. The agreement was ratified by the FYR of Macedonia government and the first meeting of the Joint Board meeting was held in Ochre, FYR of Macedonia in October 1996.

For more background on the Joint Fund Programs with Poland, Hungary, the Czech Republic, Slovenia, Croatia, Slovakia, Former Yugoslav Republic of Macedonia, Bosnia, Egypt and Spain please see the listing under the Egypt heading.

Mexico

In December 1996, NIST renewed its five year MOU with the National Council for Science and Technology (CONACYT), the Secretary of Commerce and Industrial Development (SECOFI) and the National Center for Metrology (CENAM) of the United Mexican States concerning technical cooperation in chemistry, physics, and engineering measurement sciences, standards related activities and interchange of technical information and experiences.

In order to insure that mutually beneficial programs are being developed in an integrated effort, NIST, CONACYT, SECOFI and CENAM held a coordinating and planning meeting in February 1997 in Queretaro, Mexico. This meeting included participants from other Mexican organizations, namely, the Secretary of Education (SEP), U.S. -Mexico Foundation, and SEP-CONACYT Centers, who had special arrangements with our Mexican counterparts in the same areas as identified in the recently signed MOU. This meeting produced a definitive list of projects for the next two years. The areas agreed upon included a post-doctoral program, exchange visits and training, workshops, joint research projects, collaboration on standards and conformity assessment issues, legal metrology, laboratory accreditation, information management, cooperation on international standards-related issues, information dissemination and exchange, intercomparisons, and training in high priority areas of chemical metrology.

NIST continues to provide technical assistance to support the World Bank on its expiring Science and Technology infrastructure loan to Mexico for CONACYT, CENAM, Director General for Standards (DGN)/SECOFI and the Mexican Institute for Industrial Property (IMPI). Also, assistance is being provided to the World Bank in two other loans, namely, the second phase of the science and technology infrastructure loan with emphases on technology development, and a new loan concerning industrial enhancement. NIST is providing technical assistance to the Inter-American Development Bank who is funding an infrastructure development loan for the Instituto de Fundicion y Maquinado de Jalisco that is establishing a dimensional metrology service center. NIST continues its interactions with CENAM through scientist exchanges, training of technical staff, co-hosting seminars, and through technical workshops in Mexico. NIST scientists and engineers continue to provide technical assistance to CENAM and the Center's infrastructure development.

During the past two years NIST and SECOFI have exchanged several visits of technical staff and administrative staff. The technical staff learned about the U.S. legal metrology system and, in addition, obtained ideas for establishing a similar system in Mexico. This visit also provided the staff with the opportunity to learn about the U.S. National Voluntary Laboratory Accreditation Program (NVLAP), the accrediting system operating in the United States for calibration and testing laboratories.

NIST and CONACYT continue cooperating in the Post-Doctoral Fellowship Program that was developed as part of the MOU. Discussions have been conducted regarding NIST's technical assistance to CONACYT on establishing manufacturing technology centers and on establishing legal metrology laboratories with DGN and CENAM.

NIST, in cooperation with the Foreign Commercial Service (FCS) of the International Trade Administration (ITA) in the Department of Commerce, has established a Standards in Trade office at the U.S. Embassy in Mexico City to work with Mexico in identifying standards that could be technical barriers to trade.

NIST scientists participated in a workshop on Statistics in Metrology as part of a series of workshops on industrial statistics sponsored by the Centro Investigacion de Mathematica (CIMAT) in Guanajuato, Mexico. Staff members from NIST, CIMAT and the Centro Nacional de Metrologia (CENAM) presented a week-long program on principles of measurement, statistical thinking, design of calibration experiments, control of measurement processes, reliability, and uncertainty analysis with emphasis on electrical and temperature measurements. The program attracted engineers from several U.S. companies with facilities in Mexico, as well as metrologists from Mexican laboratories.

Palestinian Authority

In 1997 a scientist from the Palestine Standards Organization received standards training as part of their participation in a Standards in Trade Workshop.

Poland

In September 1997 the U.S.-Poland Joint Board on Scientific and Technological Cooperation met in Warsaw, Poland. The joint board decided to finance 28 project proposals and decline 32 proposals. NIST scientists were listed as the U.S. Principal Investigator on three of the projects. The next meeting of the Joint Fund Board was held in September 1998. At this meeting the Board agreed to fund 28 project proposals, three other proposals were provisionally funded pending further review and 30 proposals were declined. NIST scientists were the primary U.S. investigators on four of these proposals. No new projects will be solicited under the fund unless new sources of funding are identified. For more background on the Joint Fund Programs with Poland, Hungary, the Czech Republic, Slovenia, Croatia, Slovakia, Former Yugoslav Republic of Macedonia, Bosnia, Egypt and Spain please see the listing under the Egypt heading.

Russia

Under the Memorandum of Understanding (MOU) between NIST and the Russian Academy of Sciences (RAS) for scientific and technical cooperation in the physical, chemical and engineering sciences, cooperative activities may include exchanges of scientists, information, seminars and joint research activities. This includes provisions for the exchange of scientists, exchange of scientific and technical information and documentation, joint meetings and seminars, and joint projects. OIAA coordinates and provides support for the exchange of scientists on a receiving-side-pays basis. The total length of stay is limited to six person-months. Scientific exchanges are carried out under the principle of mutual benefit and equality. The Director of OIAA visited the RAS in August 1998 to work with them on plans for the celebration of the 20th Anniversary of the NIST-RAS MOU.

South Africa

At the 1996 meeting of the Science and Technology Subcommittee of the Gore-Mbecki Binational Commission, the National Institute of Standards and Technology (NIST) signed an Agreement with the South African CSIR on technical cooperation in chemistry, physics, and engineering measurement

sciences. The purpose of this Agreement is to promote science and technology cooperation in chemistry, physics and engineering measurement sciences between NIST and CSIR. Since CSIR has become the "Gateway Metrology" laboratory for the region, this Agreement may also be useful in promoting the Department's interests in the entire South African region which is growing economically.

A delegation from CSIR visited NIST to discuss cooperation with the Manufacturing Extension Partnership (MEP) Program in April 1997. While in Gaithersburg, the group spent the day with MEP learning about NIST management of the program, evaluation techniques, and review criteria. The delegation also visited two regional Manufacturing Technology Centers supported through the MEP program. They investigated the possibility of partnerships with these centers and training opportunities for South Africans. The delegation from CSIR returned in March 1998. At the March meeting, the two sides prepared an Annex to the NIST-CSIR MOU on Manufacturing Technology Cooperation. Deputy Secretary of Commerce Mallet signed this Annex during his visit to South Africa in May 1998. This Annex provides a framework for cooperation the development of services and support for small and medium manufacturing enterprises in South Africa. Participants in this activity include: NIST MEP, the Thunderbird Foundation, the Industry Network Corporation, the Chicago Manufacturing Center, the Modernization Forum, the International Executive Services Corporation, and the National Science Foundation. The following areas were identified as priorities for cooperation: international networks for business to business and institutional linkages; training and education in support of service provision to manufacturing Small to Medium Enterprises (SMEs); assessment of the efficiency of support to manufacturing SMEs and the institutional framework to provide such support; best practices for extension services; specific tools and methods for extension services; competitiveness enhancement; program design evaluation; feasibility analysis and replication.

It is envisaged that a feasibility study on establishing an East Rand Manufacturing Advisory Center will be the first such project. A delegation from CSIR plans to visit the United States in September 1998 to begin implementation of this activity.

The Annex on Manufacturing Extension was the second Annex to the NIST agreement with CSIR. The first Annex was signed last year during the 50th Celebration of the CSIR's National Measurement Laboratory. At that time, NIST and CSIR signed a historic statement of mutual equivalence for their comparative measurements of the Unit of the Candela.

Five representatives of NIST participated in the 50th Anniversary Celebration of the National Metrology Laboratory, CSIR in August 1997. While in South Africa, they used the opportunity to explore new project development. In addition, NIST staff provided CSIR technical advice concerning establishing a chemical metrology system within South Africa.

The Deputy Director of the Building and Fire Research Laboratory visited South Africa in April/May 1997 for an international conference. While there, he used the opportunity to meet with his counterparts to discuss potential cooperation in the area of building and construction.

In July 1997, the President of CSIR visited NIST to explore the potential for cooperation in material sciences. During his visit to the United States, he also visited General Electric to discuss cooperation in material sciences. He also indicated interest in continuing cooperative activities in manufacturing technology.

A guest researcher from the University of Cape Town began a year-long appointment at NIST in July to study the properties of quasi-crystalline materials. NIST expects two additional CSIR staff members from the National Measurement Laboratory will be guest researchers in the NIST Electronics and Electrical Engineering Laboratory in the near future.

Spain

In the fall of 1997, the Department of State and the Foreign Ministry of Spain announced a call for proposals under the Agreement on Scientific and Technological Cooperation, which entered into force in 1996. The Joint Board met in Madrid March 16-17, 1998 to consider the 332 proposals received for funding. At the Joint Board meeting 36 of the proposals were funded. A NIST scientist was the primary investigator on one of the proposals. For more background on the Joint Fund Programs with Poland, Hungary, the Czech Republic, Slovenia, Croatia, Slovakia, Former Yugoslav Republic of Macedonia, Bosnia, Egypt and Spain please see the listing under the Egypt heading.

Turkey

NIST provides Ulusal Metroloji Enstitüsü (UME) Tübitak Marmara Arastirma Merkezi, Turkey's NMI, with technical support in the area of standards and measurement infrastructure development. This support may take the form of technical expert travel to Turkey, providing Standard Reference Materials or calibrations, and is supported through a loan to Turkey from the World Bank.

Vietnam

As part of the U.S. policy of engagement with Vietnam, the Department of State led an effort to establish linkages in the area of science and technology. Toward that end, the Department of State led a delegation to Vietnam in October 1996 to evaluate the prospects for S&T cooperation, with a particular emphasis on activities that will promote fruitful commercial linkages. OIAA represented NIST on the delegation that included representatives from the Patent and Trademark Office, the National Institutes of Health, the National Science Foundation, the Department of Energy, the Nuclear Regulatory Commission, the Arms Control and Disarmament Agency and the House of Representative's Science Committee staff. Members of the delegation had opportunities to visit facilities and counterpart institutions.

Multilateral Cooperative Activities

Regional program activities

Over the last 40 years five Regional Metrology Organizations (RMOs) have been created: the European Metrology Program (EUROMET), the Central and Eastern Europe Metrology Program (COOMET), the Interamerican Metrology System (SIM), the Asia-Pacific Metrology Program (APMP), and the Southern African Development Cooperation in Metrology (SADCMET); and one is in the process of forming-- the Middle East and North Africa Metrology Program (MENAMET). The RMOs were created to promote regional cooperation in metrology, which has important implications for trade within regions. With the Mutual Recognition Arrangement proposed by the organs of the Convention du Metre, the role of the RMOs takes on a new and increasing critical role in global trade issues especially in the area of technical barriers to trade (TBT). Through the RMOs, the United States is able to leverage its activities and dollars with countries through the world. For example, when NIST conducts a comparison with South Africa we

are connected through the Southern African Development Cooperation in Metrology (SADCMET) to other countries in Sub-Saharan Africa.

For the United States, NIST participates in Interamerican System of Metrology (SIM). This is the metrology organization of the Americas. It was formed in 1979 and is comprised of 34 countries in five subregions, NORAMET, ANDIMET, CAMET, CARIMET, and SURAMET. Dr. B. Stephen Carpenter, Director, Office of International and Academic Affairs (OIAA), chairs the Technical Committee, one of the steering committees of SIM, and serves as the technical advisor to SIM. NIST staff also chairs several of the working groups of the Technical Committee.

NIST interacts with the different regional metrology organizations both on a bilateral basis with the countries in each RMO and on a regional basis through the Joint Committee for Regional Metrology Organizations and the BIPM. NIST recently worked to promote the formation of a new RMO for Northern Africa and the Middle East.

Interamerican System of Metrology (SIM)

(includes NORAMET, ANDIMET, CAMET, CARIMET, SURAMET)

Antigua & Barbuda	Ecuador	Peru
Argentina	El Salvador	Dominican Republic
Bahamas	Grenada	St. Kitts & Nevis
Barbados	Guatemala	St. Lucia
Belize	Guyana	St. Vincent & Grenadines
Bolivia	Haiti	Suriname
Brazil	Honduras	Trinidad & Tobago
Canada	Jamaica	United States
Chile	Mexico	Uruguay
Colombia	Nicaragua	Venezuela
Costa Rica	Panama	
Dominica		

European Union Metrology Program (EUROMET)

Austria	Germany	Norway
Belgium	Greece	Poland
Czech Republic	Hungary	Portugal
Denmark (including Greenland)	Iceland	Slovak Republic
European Commission	Ireland	Spain
Finland	Italy	Sweden
France	Luxembourg	Switzerland
	The Netherlands	Turkey
		United Kingdom

Asia-Pacific Metrology Program (APMP)

Australia	Korea	Sri Lanka
Bangladesh	Malaysia	Taiwan
China	Nepal	Thailand
Fiji	New Zealand	Vietnam
Hong Kong	Pakistan	Egypt, Associate
India	Papua New Guinea	South Africa, Associate
Indonesia	Philippines	Syria, Associate
Japan	Singapore	

Southern African Development Cooperation in Metrology (SADCMET)

Angola	Mauritius	Swaziland
Botswana	Mozambique	Tanzania
Lesotho	Namibia	Zambia
Malawi	South Africa	Zimbabwe

Central and Eastern Europe Metrology Program (COOMET)

Bulgaria	Slovak Republic	Germany
Russia	Poland	Cuba
Czech Republic	Romania	

Middle East and North Africa Metrology Program (MENAMET) (Proposed)

Algeria	Kuwait	Qatar
Bahrain	Lebanon	Saudi Arabia
Egypt	Morocco	Syria
Israel	Oman	Tunisia
Jordan	Palestinian Authority	United Arab Emirates
		Yemen

U.S. /Israel/Jordan Trilateral Industrial Development Initiative (TRIDE)

As part of the Peace Process in the Middle East, the Governments of the United States, Israel and Jordan have contributed equal funds to form the pilot TRIDE Initiative. The purpose of the TRIDE Initiative is to help private sector firms form strategic partnerships to develop a commercial product of mutual benefit to all three countries. NIST represents the United States on the Board of Governors of TRIDE. In the past two years two projects have been reviewed at NIST and have been initiated by the U.S.-Israel Binational Industrial Research and Development Foundation for the Governments of the three countries. NIST is currently working with the U.S. State Department on the second grant to BIRD to run the TRIDE program on planning future activities. A meeting of the TRIDE Board of Governors is scheduled to take place in Jerusalem in December 1998.

G7 Global Information Society Global Inventory Pilot Project (GIP)

NIST also participates in the G7 Global Information Society Global Inventory Pilot Project (GIP) which links distributed National and International inventories of projects, studies and other activities to enable cooperation in achieving the "Information Society." The partners in this activity include the G7 Countries plus others with National Inventories and several non-government organizations. The Information Technology Laboratory at NIST is the U.S. Contact.

Africa became involved in this effort in January 1998 when, at the January 12 GIP Steering Committee teleconference, Mrs. Bounemra from the UN presented the African Information Society Initiative (AISI). This initiative is an Action Framework to Build Africa's Information and Communication Infrastructure adopted in May 1996. A database is being established to monitor the progress of the implementation of the information society in Africa. The members of the GIP Steering Committee embraced this project and will facilitate its development and dissemination through the Web and perhaps with the creation of CD-ROMs for use in remote areas where stand-alone computers are available. This database is expected to become part of the global GIP.

Workshops and Conferences

OIAA supported interactions and travel of NIST experts to places all over the world including China, Russia, India, South America, Central America, Former Yugoslavia, Egypt, and the Caribbean. These interactions support NIST efforts to eliminate technical barriers to trade, harmonize standards and metrology, and promote comparability of measurement capability that supports a global economy.

International Committee Participation

In 1997 NIST professional staff held memberships in 142 international committees in 28 international standards organizations. Activities of committees on which NIST staff hold lead positions are indicated in the specific operating unit chapters. For a complete listing of memberships and activities, refer to the NIST publication, Directory of DOC Staff Memberships on Outside Standards Committees.

Visitors

OIAA serves as the focal point for foreign visitors and arranges for NIST services to users in friendly countries. OIAA identifies areas of mutual interest of the visiting scientists and NIST programs and coordinates presentations by NIST staff that emphasize these mutual interests and foster international cooperation. NIST hosted a total of 925 foreign visitors from 64 different countries in fiscal year 1997, and in fiscal 1998 NIST hosted 817 foreign visitors from 71 different countries. The majority of these visits were coordinated by OIAA.

Fiscal 1997

Argentina	1	France	13	Kyrgyzstan	2	South Africa	12
Armenia	3	Gulf Coordination		Latin America	25	Sweden	22
Australia	7	Council	5	Lithuania	1	Switzerland	3
Austria	4	Georgia	3	Macao	1	Taiwan	32
Belgium	5	Germany	33	Mexico	11	Tajikistan	1
Brazil	31	Ghana	4	Moldova	1	Thailand	6
Bulgaria	1	Greece	2	Netherlands	8	Turkmenistan	1
Canada	10	Hungary	12	New Zealand	2	USA	
Chile	2	India	17	Peru	2	(non-citizens)	22
China	236	Indonesia	10	Philippines	9	Ukraine	12
Croatia	1	Israel	15	Poland	7	United	
Cuba	1	Italy	1	Portugal	1	Kingdom	4
Czech Republic	2	Jamaica	2	Russia	42	Uzbekistan	3
Denmark	7	Japan	16	Saudi Arabia	5	Various	25
Egypt	3	Jordan	8	Singapore	4	Venezuela	3
England	7	Kazakstan	5	Slovakia	1	West Bank/	
Finland	1	Korea	45	Slovenia	1	Gaza Strip	1

Fiscal Year 1998

Argentina	3	Denmark	3	Japan	109	Philippines	7
Armenia	2	Ecuador	2	Jordan	1	Republic of	
Australia	9	Egypt	4	Kazakstan	1	Georgia	4
Austria	7	Finland	5	Korea	24	Romania	5
Azerbaijan	2	France	30	Kyrgyzstan	4	Russia	56
Bahrain	1	Germany	51	Lithuania	1	Saudi Arabia	5
Bangladesh	1	Greece	1	Malaysia	4	Serbia	1
Belgium	7	Guatemala	2	Mexico	11	Singapore	11
Bosnia	5	Haiti	1	Moldova	6	South Africa	7
Brazil	9	Hungary	5	Netherlands	8	Spain	1
Brunei	1	India	6	New Zealand	5	Sri Lanka	1
Canada	4	Indonesia	12	Nicaragua	1	Sweden	30
Chile	15	Ireland	1	Norway	1	Taiwan	35
China	142	Israel	15	Palestine	1	Tajikistan	1
Colombia	1	Italy	4	Panama	2	Thailand	3
Costa Rica	1	Jamaica	1	Paraguay	3	Turkmenistan	1

Ukraine	23	United States	15	Venezuela	3
United Kingdom	31	Uruguay	8	Vietnam	29
		Uzbekistan	4	Yugoslavia	1

Foreign Guest Researcher Program

The Foreign Guest Researcher Program offers scientists from around the world the opportunity to work collaboratively with scientists in NIST laboratories. A foreign guest researcher is any qualified person who is a non-U.S. citizen, is not an employee of NIST, is sponsored by an organization or is self-employed, does not receive Federal funding for the project performed at NIST (other than a subsistence allowance) and participates in an ongoing NIST research program. Foreign guest researchers may be employees of foreign government agencies, state and local governments, industry, nonprofit organizations (including universities), post-graduate researchers, graduate students, or self-employed.

Foreign guest researchers at NIST fall into three categories: those supported by their home institutions; researchers supported through bilateral programs or international organizations; and direct scientist-to-scientist collaboration or support. Although NIST sometimes can provide a modest allowance for U.S. living expenses, guest researcher support generally comes from sponsoring companies or organizations. The Office of International Affairs (OIA) provides assistance with: policy and procedures on foreign guest researcher appointments; visas (serves as the primary point of contact at NIST for the Immigration and Naturalization Service (INS) and the United States Information Agency (USIA)); management of the exchange visitor J-1 program; coordinating hiring of non-U.S. citizens at NIST; tax consultant for non-U.S. citizens; and financial assistance for foreign guest researchers. NIST hosted 605 Guest Researchers in FY 1997 from 65 different countries, and in FY 1998 NIST hosted 631 Guest Researchers from 69 different countries. The following is a list of guest researchers at NIST in fiscal year 1997:

Algeria	2	Ethiopia	1	Lebanon	1	Slovakia	3
Argentina	3	Finland	1	Lithuania	6	Slovenia	2
Armenia	1	France	45	Malaysia	3	South Africa	2
Australia	7	Germany	47	Mexico	19	Spain	7
Austria	4	Ghana	1	Morocco	3	Sri Lanka	1
Bangladesh	2	Greece	2	Netherlands	16	Sweden	5
Belgium	2	Hong Kong	1	New Zealand	2	Switzerland	4
Brazil	6	Hungary	7	Norway	1	Taiwan	21
Burkina Faso	2	India	44	Panama	1	Tanzania	1
Cameroon	1	Iran	4	Peru	2	Thailand	6
Canada	8	Ireland	1	Philippines	1	Tunisia	1
China	64	Israel	28	Poland	20	Turkey	6
Croatia	4	Italy	10	Portugal	3	Ukraine	1
Czech Republic	6	Japan	35	Romania	2	UK	26
Denmark	2	Jordan	1	Russia	54	Uruguay	1
Egypt	2	Korea	44	Saudi Arabia	1		

The following is a list of guest researchers at NIST in fiscal year 1998:

Albania	1	Cyprus	1	Korea	37	South Africa	4
Algeria	2	Czech Republic	5	Lithuania	4	Spain	12
Argentina	3	Denmark	6	Luxembourg	1	Sweden	5
Armenia	2	Egypt	5	Malaysia	2	Switzerland	4
Australia	11	Ethiopia	1	Mexico	12	Syria	1
Austria	1	Finland	2	Morocco	4	Taiwan	20
Bangladesh	2	France	59	Netherlands	15	Tanzania	1
Barbados	1	Germany	69	New Zealand	2	Thailand	1
Belgium	1	Ghana	2	Norway	1	Tunisia	1
Bosnia	1	Greece	2	Pakistan	1	Turkey	4
Brazil	3	Hungary	10	Philippines	1	Ukraine	2
Cambodia	1	India	48	Poland	19	United Kingdom	27
Cameroon	1	Iran	2	Portugal	1	Uruguay	1
Canada	11	Ireland	4	Romania	3	Venezuela	1
China	65	Israel	21	Russia	49	Vietnam	1
Colombia	1	Italy	13	Serbia	4		
Croatia	3	Japan	24	Slovakia	3		
		Kenya	1	Slovenia	1		

Academic Affairs (109)

Contact Point: Dr. Jack J. Hsia

The Office of Academic Affairs (OAA) serves as the focal point for NIST's cooperation with academic institutions, and coordinates all academic affairs of NIST. In particular, OAA administers the NIST/NRC Postdoctoral Research Associateships Program, assists staff of the technical Operating Units in identifying and promoting research collaboration efforts with universities on scientific and technical research projects of mutual interest, interacts with committees within NIST, interacts with outside organizations and other government agencies, and serves as an academic-related resource at NIST.

NIST Postdoctoral Research Associateships Program

NIST's Postdoctoral Program supports a nationwide competitive postdoctoral program administered in cooperation with the National Academy of Sciences (NAS)/ National Research Council (NRC). The Postdoctoral Program brings research scientists and engineers of unusual promise and ability to perform advanced research related to the NIST mission, introduces the latest university research results and techniques to NIST scientific programs, strengthens mutual communication with university researchers, shares NIST unique research facilities with the U.S. scientific and engineering communities, and provides a valuable mechanism for the transfer of research results from NIST to the scientific and engineering communities.

Activities include administering the NIST/NRC Postdoctoral Research Associateships Program, updating yearly the book on Opportunities for Research, arranging NRC staff meetings with NIST advisers and associates, participating in the NRC Laboratories representatives meetings, and providing suggestions for program improvement.

NIST selected 42 associates for FY 97. The distributions are: Electronics and Electrical Engineering Laboratory (EEEL) (4), Manufacturing Engineering Laboratory (MEL) (3), Chemical Science and Technology Laboratory (CSTL) (11), Physics Laboratory (PL) (10), Materials Science and Engineering Laboratory (MSEL) (9), Building and Fire Research Laboratory (BFRL) (3), Information Technology Laboratory (ITL) (2). All associates are supported by NIST central funds except one from MEL, three from MSEL, and two from BFRL supported by Laboratory funds.

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Liaison and Collaboration with Universities

OAA maintains a liaison with the College of Computer Science, Mathematics and Physics and the Department of Electrical Engineering of the University of Maryland, University of Puerto Rico at Rio Piedras, the Engineering Research Institute of Tennessee State University, and the Munsell Color Science

Laboratory of Rochester Institute of Technology. Initial exchange of lecturers has started between NIST and the Rochester Institute of Technology.

In the area of international academia OAA is coordinating the establishment of laboratory program at NIST for the Egyptian Ph.D. candidates at NIS as part of their dissertations. OAA is assisting the Mexico National Council for Science and Technology in establishing a postdoctoral program for Mexican Ph.D's to conduct research at U.S. laboratories including NIST.

Interactions with Committees and Programs within NIST

Members of OAA interact, assist, and collaborate on educational matters with the Student Programs, the Educational Clearinghouse, the Civil Rights Office, the Historically Black Colleges and Universities (HBCU) Committee, the NIST Association for African-American Staff (NAAS), the Association of NIST Asian Pacific Americans (ANAPA), the Association of NIST Hispanic Americans (ANHA), the NIST Committee for Women (NCW), and the Sigma Xi Scientific Research Society.

OAA assisted ITL on the initial draft relating to the collaborative establishment of a Center for Advanced Information Technology. OAA is working with the Executive Board on the establishment of a Professional Research Experience Program at Gaithersburg (PREP-G) to provide laboratory-based research and development experience and financial assistance to undergraduates, graduates, and postdoctorates at the local universities.

Interactions with Outside Organizations and Government Agencies

Extramurally, members of this office represent NIST on academic related matters interacting with the Commission on Professionals in Science and Technology, the Committee on Women, the Maryland Suburban High Technical Council, the Association of American State Colleges and Universities, the National Association of State Universities and Land Grant Colleges, the American Association of Engineering Education, and the National Council of University Research Administrators.

OAA interacts on professional matters with the American Society for Testing and Materials, the Illumination Engineering Society of North America, the Council for Optical Measurements, the International Standards Organization, the International Electrical Commission, and serves as the International President of the International Commission on Illumination with 41 member countries.

OAA interacts with the National Science Foundation (NSF) on one of the TRP/MET projects performed by the University of Florida in Palm Beach Garden.

Academic Resource

OAA serves as a resource for NIST postdoctoral programs and other academic affairs. This Office provided the Technology Administration of the Department of Commerce with information on NIST collaborative programs with universities, the National Institutes of Health with information on research opportunities at NIST for graduates and postdoctorates, and the Mexico National Council for Science and Technology with information about the operation of the NIST postdoctoral program.

National Quality Program (102)

Contact Point: Dr. Harry Hertz

The National Quality Program has proven to be a remarkably successful government and industry team effort, starting in 1987 with industry's assistance in raising more than \$10 million to help launch the program. Since that time, NIST has worked closely with a wide variety of groups to extend the benefits of quality management and stimulate activities nationwide. These organizations run the gamut from trade, professional, and business groups such as the National Association of Manufacturers and the U.S. Chamber of Commerce, to state and local government organizations such as the National Governors Association, to broad-based interest groups like the National Education Association.

The program has helped to stimulate an amazing movement to improve quality among U.S. organizations, including companies, academic institutions; and Federal, state, and local government agencies. Nationwide, interest in the Baldrige model is growing steadily. In 1991, fewer than 10 state and local quality awards existed. Now, more than 40 states have or are establishing award programs. Most are modeled after the Malcolm Baldrige National Quality Award.

More than 25 foreign nations have begun to use the Baldrige criteria as a model for business performance excellence. Many foreign quality awards are based on the Baldrige criteria. The adoption of these criteria is indicative of the fact that these nations recognize the benefits of demonstrated performance excellence as a critical part of achieving competitive improvement. In fact, many early winners of the foreign awards have been subsidiaries U.S. companies, located outside of the United States. The recognition by these countries, through the awarding of these prestigious awards, indicates acknowledgment that the Baldrige criteria represent the pursuit of business excellence, and makes it much easier for U.S. companies to achieve acceptance in foreign markets.

The Malcolm Baldrige National Quality Award Office interacts with the foreign award programs on a regular basis, and shares materials on each other's programs. The Office makes available its criteria, case studies and other a wide variety of training handbooks. In June 1998 the Director of the National Quality Program attended the quality award presentations in Mexico. In addition, in 1997, the Office hosted the annual meeting of the Global Network of Quality Award organizers. The attendees for this meeting included representatives from the following international Award Programs:

Brazil	Mexico	Turkey
Belgium	Netherlands	United Kingdom
Finland	South Africa	Uruguay
India	Sweden	
Israel	Switzerland	

Program Office (106)

Contact Point : Dr. Michael P. Casassa

NIST has undertaken a benchmarking study to assess the adequacy of its laboratory's efforts to support the nation's technology infrastructure in comparison with the efforts of other countries. The Program Office is coordinating this effort with the Laboratories. In line with this effort, the Director's of the Electronics and Electrical Engineering Laboratory, the Chemical Science and Technology Laboratory and the Physics Laboratory visited three laboratories in Japan with missions similar to NIST's, the National Institute of Materials and Chemical Research, the Electrotechnical Laboratory and the National Research Laboratory of Metrology. In June 1997 the Director of the Physics Laboratory and representatives from the Physics Laboratory and the Chemical Science and Technology Laboratory visited the Physikalisch-Technische Bundesanstalt (PTB) and the Bundesanstalt für Materialforschung und -Prüfung (BAM) as part of the benchmarking study. In May 1997 two members of the benchmarking team also made a technical visit to INMETRO, NIST's counterpart agency in Brazil. The visits were conducted to assess the quality and condition of their laboratory facilities as compared to NIST. Marc Desrosiers, Bruce Field, William Ott and Robert Watters published the results of the study in an internal memo in December 1998.

Advanced Technology Program (470)

Contact Point: Dr. Lura J. Powell

Begun in 1990, the Advanced Technology Program (ATP) is a unique partnership between government and private industry to accelerate the development of high-risk, enabling technologies that promise significant commercial pay-offs and widespread benefits for the economy. The ATP is a rigorously competitive cost-shared program that provides multi-year funding to single companies and to industry-led joint ventures to accelerate the development of technologies that would otherwise not be developed in time, or at the same scale and scope, to compete in rapidly changing world markets without the Government as partner. Projects are selected through a merit-based competitive process according to published selection criteria.

The ATP does not fund product development. It supports enabling technologies that are essential to the development of new products, processes, and services across diverse application areas. The ATP supports the development of technologies geared to the commercial market either through general competitions that are open to all technology areas or focused program competitions that accept proposals relevant to the program topic. Past ATP awards have covered a broad spectrum of technologies in areas including computing information and communications, biotechnology, materials, electronics, manufacturing, chemicals and processing, and energy and the environment.

The primary goal of the ATP is to invest in technology development that ultimately results in benefits to the U.S. economy by creating new, high wage jobs, raising productivity levels, and producing environmental, health, and other social benefits. Just as many U.S. companies have substantial operations and employ many people overseas, many foreign firms operate research and manufacturing facilities that employ U.S. workers. The ATP has made awards to foreign-owned, U.S. incorporated companies when their participation in ATP-funded projects is in the economic interests of the Nation. These interests include performance of the proposed R&D activities in the United States; investments in U.S. research, development, and manufacturing; significant contributions to employment in the United States; and procurement of supplies from competitive U.S. suppliers. In addition, the parent company's country of origin must open similar programs to U.S.-owned companies, afford U.S. companies local investment opportunities comparable to those afforded to any other company, and protect intellectual property rights.

Through FY 1998 the ATP has funded 431 projects, of which 136 of 146 joint ventures included foreign-owned, U.S.-based companies, and 16 of 285 single-company awards were to foreign-owned, U.S.-based companies. The ATP has entered into multi-year partnerships with industry for high-risk, enabling research and development at a level of nearly \$2.8 billion between 1990 and 1998--of which ATP's share is slightly less than half.

The ATP places special emphasis on working directly with industry, in contrast to other Federal funding programs that provide primary support for R&D at universities and Federal laboratories. By law only for-profit companies and industry-led joint ventures are allowed to receive ATP awards. But universities, a traditional source of research excellence in the United States, play a significant role in many ATP projects, either as subcontractors to private companies or as members of industry-led joint ventures. Out of the 352 projects selected by the ATP since its inception, 189 of the proposals included plans to involve one or more universities as either subcontractors or joint-venture members. In many of these cases, more than one academic institution was involved. There are over 300 incidents of university participation in ATP projects.

Manufacturing Extension Partnership Program (480)

Contact Point: Mr. Kevin M. Carr

The Manufacturing Extension Partnership (MEP) program is a growing network of services to assist smaller manufacturers in becoming globally competitive. MEP partners Federal support with State and local organizational support. Services are locally driven so that they address the specific needs of area manufacturers. At the same time, MEP is developing common tools and resources to address recurring and consistent challenges faced by all manufacturers nationwide. The MEP program continues to support efforts to establish similar industrial extension programs in various parts of the world. The MEP program staff has given various presentations on manufacturing extension to representatives from Korea, Japan, China, India, and United Kingdom.

Mexico

MEP staff has provided support to the government of Mexico in its efforts to initiate a program to stimulate growth and competitiveness of indigenous industry.

South Africa

MEP staff provides support to the CSIR in its efforts to initiate a program similar to MEP in South Africa. More details regarding this support can be found in the International Activities section as part of the NIST strategy for support and collaboration with South Africa.

Building and Fire Research Laboratory (860)

Contact Point: Dr. Richard N. Wright

The Building and Fire Research Laboratory's (BFRL) mission is to enhance the competitiveness of U.S. industry and public safety through performance prediction and measurement technologies and technical advances that improve the life cycle quality of constructed facilities. BFRL studies building materials; computer-integrated construction practices; fire science and fire safety engineering; and structural, mechanical, and environmental engineering. Products of the laboratory's research include measurements and test methods, performance criteria, and technical data that supports innovations by industry and are incorporated into building and fire standards and codes.

Bilateral Activities

Canada

Richard Wright and Noel Raufaste in the Laboratory Office met with representatives of the National Research Council of Canada's Institute for Research in Construction (NRC/IRC) and have identified the following topics for collaborative work: cybernetic building systems, building envelopes and fire safe materials and composites.

The Building Environment Division and ITL's Statistical Engineering Division, in collaboration with scientists at the National Research Council in Canada have completed an interlaboratory study of guarded hot-plate measurements. NIST and NRC study measured the thermal conductivity of two thermal insulation materials; glass-fiber board selected from SRM 1450c and fibrous alumina silica. The Division is also completing a three-year research project with the NRC/IRC that developed a computer program for promoting acceptable indoor air quality in the design and operation of buildings.

France

In December 1996 Jack Snell of the Laboratory Office traveled to France to explore potential collaborations in the areas of materials, fire and information systems with the Centre Scientifique et Technique du Batiment (CSTB).

Tinh Nguyen in the Building Materials Division collaborates with scientists at the University of Bernard-Lyon/Centre National de la Recherche Scientifique (CNRS) and has co-authored several publications on their work on the use of Fourier Transform Infrared Spectroscopy (FTIR) for studies of the durability of polymer-coated substrates exposed to aqueous environments. Following are the publications generated from this collaboration in the last few years. Effects of Civil Engineering Environments on Interfacial Properties of Polymer/Fiber Composites, Tinh Nguyen, Khaled Aoaudi, David Alsheh, and Joannie Chin, Proceedings, International Conference on Composites Engineering, July 1997, p. 725; Effects of Environmental Exposure on FPR Materials Used in Construction, Joannie Chin, Khaled Aoaudi, and Tinh Nguyen, Journal of Composites Technology & Research, Vol. 19, no.4, p. 205, 1997; Sorption and Transport Characteristics of Water, Salt Water and Concrete Pore Solutions in Polymer/Glass Fiber Composites, Joannie Chin, Tinh Nguyen, and Khaled Aoaudi, submitted to J. Appl. Polymer Science, January, 1998.

Japan

Takashi Kashiwagi in the Fire Science Division conducted microgravity experiments in the Japan Microgravity Center (JAMIC) drop tower with scientists from NASA and JAMIC.

BFRL represents NIST in two thrusts: Earthquake Policy Symposium and Earthquake Disaster Mitigation Partnership of the Joint Initiative on Natural Disaster Reduction within the U.S.- Japan Common Agenda for Cooperation in Global Perspective. The Common Agenda has developed an important means of pooling our resources to address international challenges of common concern to sustainable development and global stability. One of the themes of the Common Agenda is to identify earthquake research and policy issues and seek agreement on cooperative projects to mitigate their impact through improved monitoring and by strengthening research and response countermeasures.

Walter Jones in the Fire Science Division, and Dave Evans and Daniel Madrzykowski in the Fire Safety Engineering Division traveled to Japan to pursue a potential collaboration with the National Research Institute for Fire and Disaster (NRIFD) to conduct full scale verification experiments for which there are no facilities in the United States, and wind tunnel experiments for urban fire spread. It was decided that under the U.S. - Japan Earthquake Disaster Mitigation Partnership the cooperation could be organized around five projects. The next step is to find resources from both sides to pursue research in these areas.

BFRL also participates in two other government wide programs, the U.S.-Japan and the U.S.-Japan (UJNR). The U.S.-side of the Joint Panel Meeting on Wind and Seismic Effects is composed of nineteen Federal agencies who formally cooperate with seven counterpart Japanese agencies and the Japanese design and construction industry. The U.S.-side of the panel is chaired by Richard Wright in the Laboratory Office, and Noel Raufaste of the Laboratory Office is the Secretary General. The Cooperative Program on Natural Resources (UJNR) collaborates with the Building Research Institute and National Research Institute of Fire and Disaster of the Japanese Ministry of Home Affairs.

Korea

In 1995 NIST signed an Implementing Agreement with the Korea Institute of Energy Research to exchange knowledge and conduct joint research in energy technology. In May 1998 John House in the Building Environment Division conducted collaborative research to develop automated real-time performance optimization, fault detection and diagnosis of thermal systems to improve energy efficiency, increase safety and reliability and reduce operating costs associated with these systems.

Poland

Two scientists in the Building Environment Division were awarded grants from the U.S. - Poland Joint Board on Scientific and Technological Cooperation for cooperative projects with Polish scientists. One project involves the development of performance tests and criteria for polymer concrete as a repair material. The second project is with the Technical University of Kracow on a ternary zeotropic mixture with a carbon dioxide component for R-22 heat pump applications.

Saudi Arabia

Joel Zingesser in the Laboratory Office leads BFRL and TS programs aimed at helping Saudi Arabia develop and adopt a building code based on U.S. practices. This bilateral work will help the U.S. construction industry in major developing markets to avoid technical barriers to trade and to promote the application of U.S. technology in international construction markets through the development and adoption of appropriate building and construction practices, codes, specifications, and standards. Work with the Kingdom of Saudi Arabia is being conducted under Memoranda of Understanding between NIST/BFRL and the National Conference of States on Building Codes and Standards and NIST and the Saudi Arabia Standards Organization. A resource document comparing the Saudi-Aramco building code with recent editions of the Uniform Building Code has been prepared by NIST and is being reviewed by SASO in preparation of a Saudi Building Code workshop, February 1998, in Riyadh with U.S. and SASO technical experts.

Switzerland

Consolidated Model of Fire Growth and Smoke Transport (CFAST) was developed by the Fire Modeling and Applications Group. The Ecole Polytechnique Federale de Lausanne selected CFAST for use in safety design calculations for automobile and train tunnels in Switzerland. CFAST is a zone type fire model that predicts the environment in a structure subjected to a fire.

Multilateral Activities

The Process Industry Executive for Achieving Business Advantage Using Standards of Data Exchange (PIEBASE) is an international umbrella organization for process industry active development of Standard for the Exchange of Product model data (STEP) and other standards for industrial data. Mark Palmer of the Computer Integrated Construction Group participates in the PIEBASE executive group and leads the PIEBASE working group two on process plant engineering activity models.

Scientists in the Fire Science Division, working with a guest researcher from BASF in Germany and a guest researcher from Russia, researched a potential replacement for halon fire suppressants. Halon fire suppressants are no longer being produced. Their results are to appear in the journal Combustion and Flame.

International Committee Participation

BFRL is a member of the International Council for Building Research and Documentation (CIB) and actively participates in many of its task groups and working commissions. CIB is concerned with fostering international cooperation and information exchange in building construction and research, technology development and documentation, and as such provides an important channel for international prestandardization activity in this field. Jack Snell (860) serves on the Board of Directors and the Program and Administrative Committees of CIB.

Walter Rossiter of the Building Materials Division is the chair of the International Union of Testing and Research Laboratories for Materials and Structures (RILEM/CIB) Joint Committee meeting on Roofing Materials. The committee has two objectives: to develop a methodology of assessing the condition of

in-place, low-sloped roofing membranes and to determine the state of the art with regard to design, application and maintenance of sustainable low-sloped roofing systems. Rossiter is also a member of the executive committee of American Society for Testing and Materials (ASTM) Committee DO8 on Roofing, Waterproofing and Bituminous Materials.

Barbara Lippiatt of the Office of Applied Economics was an invited member of the U.S. Delegation to the Organization for Economic Cooperation and Development (OECD) conference on Greener Public Purchasing held in Switzerland. Lippiatt presented the Building for Environmental and Economic Sustainability (BEES) methodology at the conference. Lippiatt plans to publish the BEES methodology in the form of Windows-based decision-support software for the Federal procurement community for selecting products that achieve the most appropriate balance between life-cycle environmental, economic and technical performance. This work was sponsored in part by the EPA.

Geoffrey Frohnsdorff of the Building Materials Division is the chair of ISO/TC 59/SC 3/WG 9, Design Life of Buildings. This Working Group, created in 1994, is being elevated to subcommittee status in ISO/TC 59. The objective is to develop standards for assuring that the designed life of a building under the anticipated environmental actions will be achieved and to provide a basis for maintenance management. The committee is producing a standard on "Planning of, and Management for, Service Life of Buildings."

James Pielert of the Building Materials Division is chairman of ASTM Subcommittee C09.92 on International Activities which is the U.S. Technical Advisory Group (TAG) for ISO TC71 Subcommittee 1 on Testing of Concrete. The role of the TAG is to coordinate reviews of draft ISO standards and to submit U.S. standards for consideration by ISO. For the latter, ASTM concrete aggregate and admixture standards have been submitted to Israel, the secretariat of Subcommittee 1. Pielert is also the U.S. delegate to the International Union of Testing and Research Laboratories for Materials and Structures (RILEM). RILEM's purpose is to promote progress in the design, testing, manufacture and use of building materials.

Steven Bushby of the Building Environment Division is convener of ISO TC 205 WG 3 Building Control System Design. The objective of this working group is to develop a multi-part international standard that addresses several issues related to building control systems including control system functionality, communication protocols, system specifications, and project management.

William L. Grosshandler of the Fire Science Division was named Fellow of ASME International.

International Workshops and Conferences

The Forum for International Cooperation on Fire Research (FORUM) is comprised of heads of public and private sector fire research laboratories and organizations sponsoring fire research around the world. Jack Snell in the Laboratory Office is the chair of the Forum, and Richard Bukowski in the Fire Safety Engineering Division is Secretary. The group meets annually to discuss mutual interests, encourage cooperative undertakings, and promote the advancement of fire safety engineering. Typically, the FORUM sponsors a two-day workshop with the host member to highlight some important issue or aspect of fire safety engineering in the host's nation. The FY 96 meeting was held in Norway, and the symposium focused on issues associated with development and implementation of a performance based standard in that country. The FY 97 meeting in Tainjin China addressed issues of fire research and testing, and the codes and standards processes in China.

Natascha Castro in the Building Environment Division received one of the three awards of excellence for a technical paper at the International Appliance Technical Conference held May 12-14, 1997. Her paper was entitled "Energy and Water Consumption Testing of a Conventional Dishwasher and an Adaptive Control Dishwasher."

H.S. Lew of the Structures Division co-organized the International Workshop on Seismic Design Methodologies for the Next Generation of Codes which was sponsored jointly by the U.S.-Slovenia Joint Board for Scientific and Technological Cooperation, OIAA/NIST and the National Science Foundation.

BFRL co-organized the Second International Conference on Fire Research and Engineering (ICFRE2). The conference, held at NIST in August 1997, included 220 participants from 13 different countries.

Chemical Science and Technology Laboratory (830)

Contact Point: Dr. Hratch G. Semerjian

As the Nation's Reference Laboratory, the mission of the Chemical Science and Technology Laboratory (CSTL) is to perform research in measurement science; develop and maintain measurement methods, standards, and reference data; and develop models for chemical, biomolecular, and physical properties and processes. CSTL provides the enabling infrastructure to enhance productivity and competitiveness; assure equity in trade; and improve public health, safety, and environmental quality for U.S. industry, Government agencies, and the scientific community.

Bilateral Activities

Australia

Brent Butler of the Physical and Chemical Properties Division was awarded a visiting fellowship at the Australian National University for one month in March 1998.

Canada

Airflow Canada is a CRADA member of Air Speed Proficiency Testing Program (ASPT), a NIST program with 13 participants. The contact is the Process Measurements Division. The program's goal is to assess the Air Speed measurement performance in the participant's wind tunnels. The data generated will be used to correlate differences between participant measurement performance and NIST standards.

Ellyn S. Beary in the Analytical Chemistry Division is pursuing a collaboration with the National Research Council on isotope dilution mass spectrometry with some focus on isotope dilution electrothermal vaporization inductively coupled plasma mass spectrometry.

Czech Republic

The Analytical Chemistry Division collaborates with the Czech University of Agriculture on development of methods for arsenic speciation by providing samples of algae that have been grown in arsenic enriched water.

Denmark

Cedric Powell in the Analytical Chemistry Division collaborates with scientists at the Odense University on corrections for elastic-electron scattering in new measurements of electron inelastic mean free paths.

Germany

Peter Huang in the Process Measurements Division initiated discussions with scientists at PTB for collaborative experiments to develop new standards for high temperature (above 400 degrees C) humidity measurements and to intercompare current standards for humidity measurements.

The Analytical Chemistry Division collaborates with the Research Centre of Julich in the measurement and value assignment of the mercury and methylmercury content in two NIST Standard Reference Materials (SRMs), oyster and mussel tissue.

The Institute of Ecological Chemistry, Research Centre for Environmental Health participates in a NIST-led interlaboratory comparison of concentration of dioxins and furans in two NIST SRMs, air particulate and sediment.

India

The Biotechnology Division has three ongoing collaborations with institutes in India. Robert Goldberg collaborates with scientists at the Indian Institute of Technology (IIT) on thermodynamic studies related to the shikimic acid metabolic pathway. Anne Plant and the Surface and Microanalysis Sciences Division collaborate with scientists at the Center for Cellular and Molecular Biology in Hyderabad and the Roswell Park Cancer Institute on biomimetic surfaces formed from cell membranes. And Prasad Reddy initiated a collaboration with the Dehli University to study the adenylyl cyclase mycobacterium tuberculosis. Reddy also collaborates with scientists at the Center for Biochemical Technology on the diagnosis and biology of fungal disease, aspergillosis, caused by *Aspergillus fumigatus*, and the University College of Medical Sciences in Dehli on cloning and characterization of calmodulin like protein in mycobacteria.

Italy

Peter Huang in the Process Measurements Division collaborates with the Istituto de Metrologia "G. Colonnetti" (IMGC) to develop new high temperature humidity standards for the range of 20 to 100 degrees Celsius dew/frost point temperature as part of an international intercomparison of humidity standards. IMGC also plans to send its transfer standard hygrometer, which has a range of -95 to 20 degrees Celsius, to test with the NIST standard humidity generators. In addition, the Process Measurements Division, in a study with the IMGC, produced an emf-temperature reference function for platinum versus palladium thermocouples for the temperature range 273 K to 1773 K in air.

Japan

Raymond Mountain of the Physical and Chemical Properties Division is coordinating his simulation studies on solvation effects in supercritical water with experimental studies at the Institute for Chemical Research, Kyoto University.

Cedric Powell in the Analytical Chemistry Division collaborates with scientists at the National Institute of Materials and Chemical Research on a new project under the U.S.-Japan Civil Industrial Technologies Arrangement entitled Quantitative Surface Analysis for Catalysts by Electron Spectroscopy.

Mexico

The Fluid Flow Group in the Process Measurements Division has discussed arrangements for intercomparisons of flow measurement capabilities at CENAM. Joseph Hodges of the Process Measurements Division is also pursuing a collaboration with CENAM on fabrication of triple point cells for use in the NIST cavity ring-down spectroscopy (CRDS) systems for humidity measurements.

The Netherlands

Cedric Powell, a NIST Fellow in the Surface and Microanalysis Science Division, collaborates on experiments with scientists at the University of Delft on a unique instrument. The instrument is a modified transmission electron microscope operating at 100 keV.

Poland

Cedric Powell of the Surface and Microanalysis Science Division collaborates with scientists at the Institute of Physical Chemistry on the NIST Electron-Mean-Free-Path Database.

Patrick O'Hare of the Physical and Chemical Properties Division is pursuing a collaboration with scientists at the Warsaw University of Technology on fluorine-bomb calorimetric studies.

Russia

David Mildner and H. Heather Chen-Mayer in the Analytical Chemistry Division visited several Russian institutes including the Kurchatov Institute and the Physical and Technical Institute of the Russian Academy of Sciences during a North Atlantic Treaty Organization (NATO) sponsored trip for discussions of ongoing collaborations in neutron focusing. Scientists in the Analytical Chemistry Division collaborate with the Kurchatov Institute and are in the process of preparing two papers on the results of this work on cold neutron incoherent scattering for hydrogen detection in industrial materials and the application of Laue-focusing method for neutron radiography in divergent beams. The potential for future work under a NATO grant is also under discussion.

Albert Lee of the Process Measurements Division was awarded a grant from the Civilian Research and Development Foundation (CRDF) to conduct joint research with scientists in Russia on supercritical water oxidation as a waste destruction alternative.

Turkey

Miral Dizdaroglu of the Biotechnology Division has a collaborative research project with the Toxicology Department at Gazi University entitled "Paracetamol-mediated DNA damage in livers of experimental animals." This project has been funded in part by a NATO grant awarded to Gazi University.

United Kingdom

Peter Huang in the Process Measurements Division initiated discussions with scientists at NPL for collaborative experiments to develop new standards for high temperature (above 400 degrees C) humidity measurements and to intercompare current standards for humidity measurements.

Venezuela

Carlos Gonzalez of the Physical and Chemical Properties Division explored possible collaborations with the Venezuelan Center for Scientific Research (IVIC) in development and implementation of novel

computational methods for predicting properties and energetics of molecules important in catalytic chemistry.

Multilateral Activities

Michael Kurylo in the Physical and Chemical Properties Division manages NASA's Upper Atmosphere Research Program (UARP) as part of an interagency agreement between NIST and NASA. Among the principal tropospheric research activities supported under UARP is AGAGE (NASA's Advanced Global Atmospheric Gases Experiment) Network. AGAGE Network is an international measurement activity that focuses on tropospheric abundance of several gases important in stratospheric ozone depletion and global warming. The AGAGE monitoring station in Cape Grim, Tasmania is an important southern-hemisphere site within the network.

The Analytical Chemistry Division participates on the U.S. team to develop a method for on-site sample preparation of soil, water and wipe samples for qualitative determination of chemical warfare related compounds at the request of the Defense Special Weapons Agency (DSWA), Department of Defense. The method is being developed at the request of the Preparatory Commission for the Organization for the Prohibition of Chemical Weapons (OPCW). The other U.S. team participants are Battelle Memorial Institute, the Illinois Institute of Technology Research Institute, the Army Research Laboratory and DSWA. Other foreign participants are the Netherlands, Germany, Finland, and the United Kingdom. One involves development of software that is to be used in on-site inspections by the OPCW in challenge inspections of suspected chemical weapons sites. The Division is also participating in a pilot study to produce a multi - element certified reference (CRM) of Antarctic krill. Participants in this study include representatives from Italy, Spain, Austria, Hungary, Belgium, Argentina and Canada. The Gas Metrology and Classical Methods Group in the Analytical Division collaborates with the Danish Institute of Fundamental Metrology and Hungarian Office of Measures under a Memorandum of Cooperation to intercompare measurements of electrolytic conductivity of solutions.

The Process Measurements Division is conducting an international comparison on pressure with Oficina Nacional de Normas y Unidades de Medida (ONNUM) in Costa Rica and the Centro Nacional de Metrologia (CENAM) in Mexico under the auspices of the Interamerican System of Metrology (SIM). The Process Measurements Division is also conducting an international comparison on pressure with the Jamaica Bureau of Standards (JBS). Other participants to this SIM sponsored comparison include ONNUM, CENAM, INMETRO, and INDECOPI. The division is also participating in a CIPM CCT key comparison of the international temperature scale of 1990 and the CIPM CCT key comparison 3, an international intercomparison of temperature in the range from 83.3 K to 933.4 K. The Division also hosted a workshop on absolute pressure measurements for representatives from Brazil, Costa Rica, Jamaica, Mexico and Peru. These countries represent the five regions within SIM: SURAMET, CAMET, CARIMET, NORAMET, and ANDIMET.

International Workshops and Conferences

Miral Dizdaroglu of the Biotechnology Division was awarded a North Atlantic Treaty Organization (NATO) grant to organize an advanced study institute on DNA Damage and Repair held in October 1997 in Antalya, Turkey.

Electronics and Electrical Engineering Laboratory (810)

Contact Point: Mr. Judson C. French

The Electronic and Electrical Engineering Laboratory (EEEL) provides the basis for all electrical measurements in the United States. EEEL provides practical measurements for the electronics and electrical industry sectors and advertised calibration services and artifact standards (Standard Reference Materials). EEEL conducts research and development to advance the electrical measurement state of the art and emphasizes measurement research and services that are essential to equity in domestic and international trade; the specification of manufacturing material, equipment, and processes; manufacturing process and quality control; and applications supporting the missions of other government agencies.

Bilateral Activities

Brazil

Edwin Williams of the Electricity Division presented two lectures at the Advanced School of Mechanical Metrology. The school was organized by the National Institute of Metrology, Standardization and Industrial Quality (INMETRO). Yi-hua Tang, also of the Electricity Division, assisted INMETRO in establishing the operation of the first Josephson voltage standard system in Brazil.

Canada

The Optoelectronics Division is studying the beam pointing stability of vertical-cavity surface-emitting lasers (VCSEL) supplied by Hewlett-Packard, Honeywell, Motorola and Vixel at the National Optics Institute. This effort is part of a contract to provide DARPA-sponsored VCSEL manufacturers with state-of-the-art measurement procedures and results important to the development of their optical data communication products.

Martin Misakian of the Electricity Division participates in an advisory committee at Hydro-Quebec that provides oversight for laboratory experiments on human perception thresholds for combined alternating and static electric fields and electric field effects on skin tissue in vitro. NIST focuses on the generation and characterization of the exposure parameters as well as other physical parameters.

The Office of Law Enforcement Standards is funding an effort between the FBI Laboratory and the Royal Canadian Mounted Police Laboratory to develop an automobile paint database for the forensic science community.

France

The Electricity Division has several collaborations with institutes in France. Francois Martzloff maintains a collaboration with Mr. A. Rousseau of Soule, France concerning the theory of coordinated performance of surge protection devices. Martzloff is also working with Electricite de France (EDF) to determine the validity of lightning surge recordings related to measurement techniques included in a proposed IEC standard and to begin the formulation of an IEC standard on power quality. James Olthoff and Loucas Christophorou collaborate with researchers at the University of Paul Sapatier in Toulouse on issues related

to the modeling of electron transport using standard electron-collision cross sections. Olthoff also collaborates with researchers at the University of Paris-Sud on the modeling of ion transport in DC Townsend discharges in H₂ and N₂. The Division also participates in a Consultative Committee on Electricity (CCE) sponsored international intercomparison of high resistance measurements with the Laboratoire Central des Industries Electrics (LCIE).

Dylan Williams in the Radio-Frequency Technology Division collaborates with TRW and the Institut d'Electronique et de Microelectronique du Nord (IEMN) to implement an international on-wafer measurement comparison program at millimeter-wave frequencies. Millimeter-wave frequencies are important in wireless communications, automotive electronics and alternatives to conventional cable television technologies.

The Optoelectronics Division participated in a program of the University of Colorado at Boulder to provide courses of study, lectures, and research opportunities in the various fields of instruction and research conducted by the University of Colorado. As participants in the program, NIST provided research opportunities to students Fabrice Badre, Frederic Klein, Oliver Lux, and Frederic Petit of the Louis Pasteur Institute of Technology, Department Mesures Physiques, Schiltigheim, France.

Germany

Francois Martzloff in the Electricity Division has collaborative interactions with Darmstadt University related to the validity of measurement techniques of switching surges. Martzloff is also discussing the potential of different theories related to lightning current dispersion with Dehne and Sohne.

Xiaoyu Li in the Optoelectronics Division collaborated with scientists at Physikalisch-Technische Bundesanstalt to resolve discrepancy between PTB and NIST in high power laser calibrations.

Greece

Loucas Christophorou of the Electricity Division received the Medal of the Phoenix from the President of Greece for his contributions to the areas of atomic, molecular and nuclear physics. This award is the highest honor bestowed upon civilians by the Greek government.

Hungary

Nicolas Paulter in the Electricity Division collaborates with scientists from the Technical University of Budapest on Automatic Waveform Analysis and Measurements Systems (AWAMS). AWAMS are commercial 20 GHz bandwidth, high-speed, equivalent-time sampling oscilloscopes interfaced to desktop computer systems and used in the Electricity Division for providing the NIST pulse waveform measurement services. A grant was established for the Technical University of Budapest so that the work initiated at NIST can be pursued further in Hungary.

India

Francois Martzloff in the Electricity Division collaborates with the India Institute of Science concerning the surge testing of electric appliances.

Ireland

John Suehle Semiconductor Electronics Division collaborates with Analog Devices in Limerick, Ireland on TDDB Characterization and Research of thin SiO₂ Films.

Japan

David Newell in the Electricity Division had a joint project with the National Research Laboratory for Metrology on the measurement of the refractive index of air at the NIST Watt Balance site. Newell worked with scientists at NRLM for a month to determine the source of the 0.3 ppm discrepancy between the measured and calculated index values of the Watt Balance instrument at NIST and to construct an optical interferometer used for volume measurements of silicon spheres in the Avogadro experiment.

Steven Mechels in the Optoelectronics Division spent 10 months at the Optoelectronics Laboratories at the Nippon Telegraph and Telephone Corporation under an agreement for cooperation between NIST and NTT. Mechels studied measurement technology for a variety of silica-based planar light-wave circuits developed at NTT.

The Optoelectronics Division worked with the Electrotechnical Laboratory on impulse response measurements.

A U.S.-Japan Joint Management Committee (JMC), co-chaired by Judson French of the Laboratory Office in the United States and by a representative of the Ministry of International Trade and Industry (MITI) in Japan, administers a U.S.-Japan Joint Optoelectronics Project (JOP). The U.S. JMC includes representatives from the Departments of Commerce (DOC), Energy (DOE), and State (DOS), the National Science Foundation (NSF), and the Defense Advanced Research Projects Agency (DARPA). The JOP permits U.S. or Japanese-developed prototype optoelectronic devices required for advanced computer developments in either country to be made available to researchers through a unique international broker system. Operational since 1995, the JOP has had considerable success.

There is an ongoing interaction between NIST and the National Telegraph and Telephone (NTT) Corporation as outlined in the Agreement for Cooperation between NIST and NTT. Several exchanges of technical staff have taken place throughout the duration of the Agreement.

Mexico

Scientists in the Optoelectronics Division worked with CENAM on optical fiber and laser power measurement intercomparisons.

Russia

Douglas Franzen, Thomas Scott, and Igor Vayshenker in the Optoelectronics Division collaborate with the All-Russian Research Institute for optophysical measurements. The collaboration on optical fiber and power meter measurements was funded by the Cooperative Research and Development Foundation (CRDF).

Spain

Randolph Elmquist in the Electricity Division assisted the Instituto Nacional de Technica Aeroespacial (INTA) in developing a measurement system suitable for the quantized Hall resistance standard.

Switzerland

Paul Williams collaborates with the University of Geneva on examining the problem of measurement disagreements between time and frequency domain measurements of dispersion in optical fibers.

The Netherlands

Neil Zimmerman in the Electricity Division initiated a collaboration with scientists at the Netherlands Measurements Institute (NMI) to test the suitability of thin-film, on-chip capacitors to replace the machined vacuum-gap capacitors used in his experiments.

Turkey

The Optoelectronics Division collaborates with the National Institute of Metrology in developing measurement methods for multimode optical fibers. Of interest are measurements of bandwidth and radiation patterns from the fiber (both far and near fields). They will also collaborate on reflectivity and loss measurements in guided wave structures.

United Kingdom

The Electricity Division assisted Kodak Corporation in New York obtain accreditation to the National Measurement Accreditation System (NAMAS) in the United Kingdom through calibration of Digital Multimeters.

The Optoelectronics Division has several collaborations with institutes in the U.K. Paul Hale has collaborates with the NPL on photo-diode frequency response measurements. Gregory Obarski and Paul Hale collaborate with the Defense Research Agency to measure low values of relative intensity noise (RIN) in distributed feedback lasers at 1550 nm. These measurements will support the CATV industry and EDFA noise figure measurements, as well as help NIST assess the uncertainty in its RIN calibrations techniques.

Multilateral Activities

Nile Oldham in the Electricity Division reported that the Interamerican Comparison of Electrical Units sponsored by the Interamerican System of Metrology (SIM) began in March 1997 with a meeting at NIST of representatives of the five metrology regions in the Americas. The traveling standards for this comparison of five electrical quantities: ac and dc voltage, ac and dc current, and dc resistance, are precision digital multimeters donated by three U.S. Manufacturers. These multimeters were calibrated at NIST and will be used to conduct round robins within each region before being returned to NIST to complete the comparison.

The International Union of Radio Science (URSI) recognized Donald DeGroot of the Electromagnetic Fields Division with its Young Scientist Award at the XXVth General Assembly in France for his work on the application of time-domain instruments to frequency-dependent measurements of microelectronic devices and interconnects.

The European Conference on Electronic Packaging Technology presented George G. Harman in the Semiconductor Electronics Division with the first European Packaging Award for his achievements in the development of wire bonding.

The National Research Institute for Metals (NRIM) and NIST are conducting fundamental and pre-standards research on superconductivity under the Versailles Project on Advanced Materials and Standards (VAMAS) agreement and an agreement with Japan. Loren Goodrich, Electromagnetic Technology Division, traveled to Japan in October 1998 in support of this project.

International Workshops and Conferences

NIST was a co-sponsor of the International Microwave Symposium held June 8-13, 1997 by the Microwave Theory and Techniques Society. This is the first time there has been a co-sponsor for this event. The staff of the Electromagnetic Fields Division was major contributor to the Symposium which included over 8,500 participants from 28 countries.

David Seiler in the Semiconductor Electronics Division was a co-chair for the International Conference on Materials and Process Characterization for Very Large-Scale Integration (VLSI) held in Shanghai, China November 4-7, 1997.

International Committee Participation

NIST is under contract with the Power Electronics Applications Center, Pacific Gas and Electric Company and Delmarva Power Company for research and assistance in power quality issues. One of the contract tasks is aimed at greater participation in the development of international standards concerning power quality.

Martin Misakian in the Electricity Division serves as convener of an IEC working group that is developing an international standard for ELF field measuring equipment and measurement guidance. IEC central office is located in Geneva, and Martin maintains frequent communication with the central office.

Information Technology Laboratory (890)

Contact Point: Dr. Shukri Wakid

The Information Technology Laboratory (ITL) responds to industry and user needs for objective, neutral tests for information technology. These are the enabling tools that help companies produce the next generation of products and services, and that help industries and individuals use these complex products and services. ITL works with industry, research and government organizations to develop and demonstrate tests, test methods, reference data, proof of concept implementations and other infrastructural technologies. ITL's activities support the development and use of information technology systems that are usable, scalable, interoperable and secure. Program activities include: high performance computing and communications systems; emerging network technologies; access to, exchange, and retrieval of complex information; computational and statistical methods; information security; and testing tools and methods to improve the quality of software.

Bilateral Activities

Canada

Stuart Katzke (893), Chief, Computer Security Division, met with representatives of the Communications Security Establishment (CSE) to coordinate NIST activities with CSE with the goal of developing common standards and guidance for computer security. These activities are part of the cooperative activities under the NIST/CSE MOU.

China

During his tenure as a visiting professor at the East China Normal University, Nien Fan Zhang in the Statistical Engineering Division taught a short course entitled "Applied Time Series."

Finland

Omid Kia of the Mathematical and Computational Sciences Division is pursuing a collaborative agreement with the University of Oulu on the subject of hypermedia document analysis, transmission and processing.

Korea

The Advanced Network Technologies Division cooperates under an MOU with the Korea Telecom Research Group (KTRG) on video-on-demand technology and with the Electronics and Telecommunications Research Institute (ETRI) on ATM network routing protocols.

Staff of ITL and a guest researcher from Korea Telecom jointly developed the conformance test suite for the Digital Storage Media Command and Control User to User protocol ISO 13818-6.

Russia

Daniel Lozier in the Mathematical and Computational Sciences Division collaborates with the Russian Academy of Sciences on a project funded under the Civilian Research and Development Foundation (CRDF) titled "Numerical Software for Mathematical Special Functions."

United Kingdom

Daniel Anderson in the Mathematical and Computational Sciences Division collaborates with the University of Southampton on phase-field models for fluids and solidification problems. As a result of this collaboration a review article, "Diffuse-interface models in fluid mechanics", authored by D. Anderson and G. McFadden in the Mathematical and Computational Sciences Division and A. Wheeler at the University of Southampton, will appear in the 1998 volume of Annual Review of Fluid Mechanics.

Multilateral Activities

The Computer Security Division participates in the Common Criteria (CC) project. The CC project is a cooperative effort between countries in North America and Europe to align their respective security evaluation criteria in a CC for testing and evaluation of security systems and products. The common criteria are designed to promote the development of commercial testing of products and international mutual recognition of test certifications, thus expanding the market for high quality, trusted security products and systems. The project aims to advance international mutual recognition of tests and test certifications that will enable vendors to have their products tested in one country and to be able to sell their tested products in other markets without having to be re-tested. Several members of the Division represent NIST at meetings of different parts of the Common Criteria project. Ellen Flahavin represents NIST at meetings of the Common Evaluation Methodology Editorial Board (CEMEB). The CEMEB was established as a joint project by the European Commission (Directorate General XIII/B), the Canadian Communications Security Establishment, the National Security Agency and NIST. The purpose of the project is to develop a methodology for conducting evaluations that apply the CC. The Common Evaluation Methodology (CEM) will provide the required basis for mutual recognition of product and system security evaluations. Ray Snouffer represented NIST at a meeting of the Cryptography Support Working Group of the CC project. The CSWG is charged with incorporating cryptography related requirements into the CC documents. The meeting focused on the development of Cryptographic Key Management and Cryptographic Support.

Jerry Keller in the Automated Production Technology Division and Mary Carroll Croarkin in the Statistical Engineering Division presented a workshop on statistical principles and techniques required for performing high accuracy mass calibrations from 1 kg to 1 mg in May, 1997. His team also prepared the attendees from the CAMET region to participate in an intercomparison study of mass standards within SIM.

James Dray (893) represents NIST on the Open Group Joint Councils Meeting. The Open Group Joint Council develops open industry standards for computer security technologies. NIST is developing the X/Open Single Sign On specification, a central technology in the generic authentication architecture, and the work plan for the emerging Open Group Java/Web security program area. Dray also presented the Minimum Interoperability Specification for Public Key Infrastructure developed at NIST.

Judi Moline in the Information Access and User Interfaces Division represents the U.S. on the Steering Committee for the G7 Information Society Theme 1 Global Information Pilot Project and was co-leader of Theme 10 Global Marketplace for Small and Medium-sized Enterprises.

ITL is developing benchmark tests for automated speech recognition systems as part of an international collaborative project under the sponsorship of the DARPA Human Language Systems Program and the Department of Defense. Research organizations participating in the application of the tests include: AT&T Bell Laboratories, BBN Systems and Technologies (BBN), Boston University, Cambridge University Engineering Department (England), Carnegie Mellon University (CMU), Centre de Recherche Informatique de Montreal (Canada), Dragon Systems, IBM T.J. Watson Research Labs (IBM), International Computer Science Institute, ITT, Centre National de la Recherche Scientifique-Laboratoire d'Informatique pour la Mecanique et les Sciences de l'Ingenieur (LIMSI) (France), MIT Lincoln Laboratory, MIT Laboratory for Computer Science, MITRE Corporation, New York University, Oregon Graduate Institute, Unisys, University of Karlsruhe (Germany), Philips GmbH Research Laboratories (Germany), Sanders-Lockheed, and SRI International.

International Workshops and Conferences

ITL hosted the International Symposium on the Year 2000: Mastering the Millennium Rollover on June 9-10, 1997. The symposium addressed the problems associated with computing systems. Speakers included representatives from Australia, Sweden and the United Kingdom.

ITL works with and supports the International Multimedia Teleconferencing Consortium that is involved in the interoperability testing of ITU protocols for transmitting multimedia data. ITL hosts interoperability testing events and demonstrations, and provides technical support for testing activities.

ITL hosted the Department of Commerce's Public Forum on Certificate Authorities and Digital Signatures: Enhancing Global Electronic Commerce in July 1997. U.S. and international representatives provided perspectives on the evolving business, legal and technical aspects of the evolving infrastructure. Speakers included representatives from Germany, Japan, Sweden and the United Kingdom.

Judi Moline in the Information Access and User Interfaces Division served on the planning committee for the International Global Standards Conference, "Building the Global Information Society for the 21st Century," held in Brussels, October 1-3 1997.

Manufacturing Engineering Laboratory (820)

Contact Point: Dr. Richard H. F. Jackson

The Manufacturing Engineering Laboratory (MEL) serves as a central research laboratory for manufacturing infrastructure technology, measurements, and standards. MEL provides industry-needed manufacturing engineering tools, interface standards, manufacturing systems architectures, and traceability. For example, the industrial measurements of length, force, mass, acoustics, vibration, and product data exchange ultimately rely on traceability to MEL.

Bilateral Activities

American Institute in Taiwan

The Precision Engineering Division explored collaborations on nanotechnology and the Molecular Measuring Machine (M3) project with the Industrial Technology Research Institute (ITRI), Center for Measurement Standards and the Precision Instrument Development Center through the American Institute in Taiwan. The Division also explored collaborations with ITRI on Rockwell hardness standards, nanometrology including calibrated atomic force microscopy (AFM) and laser frequency stabilization.

Canada

Rick Norcross in the Precision Engineering Division is developing a joint CRADA for a large volume welding robot with Servo Robot. NIST plans to develop a large volume six DOF manipulator based on a commercial boom lift, to measure the dynamic output of the manipulator and to develop a dampened mounting jig. Servo Robot plans to develop a real-time sense point shifting method based on dual cameras and to determine how the trajectory can be recorded based on reference marks on the metal rather than on previous positions.

China

Theodore Vorburger in the Precision Engineering Division visited the Harbin Institute of Technology to discuss surface metrology projects with an incoming NIST guest researcher and his supervisor.

Billibon Yoshimi in the Intelligent Systems Division delivered a series of lectures at the Beijing University of Aeronautics and Astrophysics and Sichuan Union University and exchanged information on computer vision and robotics. Yoshimi also explored potential collaborative experiments.

Swee Leong of the Manufacturing Systems Integration Division visited the Black and Decker manufacturing plant in Singapore and discussed a collaboration on the SIMA Production Project. The Division has a CRADA with Black & Decker, Italy.

Japan

John Dagata in the Precision Engineering Division conducted collaborative research related to scanned probe microscopy applications with the Electrotechnical Laboratory (ETL). Dagata has worked in the ETL

laboratory as a short-term AIST Visiting Research Scientist on four separate occasions in FY 1997 and FY 1998. Degata presented the most recent results of this collaboration at the Quantum Functional Devices conference held in Gaithersburg November 5-7, 1997. Publications resulting from this collaboration include J.A. Degata, *Nanotechnology*, 8 A3 (1997), J.A. Degata, T.Inoue, J.Itoh and H. Yokoyama, *Appl. Phs. Lett*, submitted and J.A. Degata, T.Inoue, J.Itoh, K. Matsumoto and H. Yokoyama, *J. Appl. Phys.*, in preparation.

Al Jones of the Manufacturing Systems Integration Division collaborates with the Musashi University on Supply Chain Management.

Germany

The AUTONAV research agreement between the U.S. Department of Defense (DoD) and the German Ministry of Defense for the development of the next generation autonomous vehicle navigation perception and control system was signed November 8, 1996. NIST is one of the collaborators in the project that will develop and implement advance core technology for more intelligent and robust autonomous vehicle navigation control. AUTONAV focuses on obstacle detection, classification, and avoidance. NIST has a separate agreement with DoD. The participants in AUTONAV are Bundesamt fuer Wehrtechnik und Beschaffung, Universitat der Bundeweher Munchen, Dornier GmbH, U.S. Army Research Laboratory, Sarnoff Corporation and NIST. The AUTONAV agreement also involves Mercedes Benz.

Amy Knutilla of the Manufacturing Systems Integration Division collaborates on Process Specification Language with the Fraunhofer Institute.

Italy

Bev Payne in the Automated Production Technology Division collaborates with the IMGC on the design and construction of a new interferometer that will provide multiple reflections from the NIST super shaker and thus improve resolution and usable frequency range for accelerometer calibrations. Zeina Jabbour in the Automated Production Technology Division and the Precision Engineering Division has initiated a collaboration with IMGC in mass standards.

Chuck McLean in the Manufacturing Systems Integration Division collaborates with the Politechno di Milano on specification of interfaces for discrete event simulation systems.

Korea

Chuck McLean and Mike Iuliano in the Manufacturing Systems Integration Division collaborated with the Korean Institute of Science and Technology (KIST) on architectures for Computer-Aided Manufacturing Engineering tool integration.

Mexico

MEL and CENAM collaborate on laboratory intercomparisons of dimensional standards, mass artifacts, accelerometers and microphones. Where possible, these intercomparisons will involve Canada and other

national laboratories. MEL also agreed to assist CENAM establish a homepage on the World Wide Web to address issues and concerns of CENAM's customers in mechanical metrology.

W. Tyler Estler in the Precision Engineering Division is a technical advisor to the Large Millimeter Telescope Project funded by the State of Massachusetts and Mexico.

Russia

Michael Postek and Samuel Jones in the Precision Engineering Division have a continuing collaboration with the Centre for Fundamental Problems in Microelectronics and Hewlett-Packard in Palo Alto, CA in Scanning Tunneling Microscope measurement methodology.

Spain

John Degata in the Precision Engineering Division collaborates with scientists at the Universidad Autonoma de Barcelona to extend the understanding and control of the physical mechanism of scanned probe oxidation.

Multilateral Activities

Zeina Jabbour of the Automated Production Technology Division conducts collaborative research with the Bureau International Poids et Mesures (BIPM) on a new system for measuring solid density.

Jack Stone in the Precision Engineering Division is the lead for NIST's participation in a BIPM sponsored international intercomparison of iodine stabilized lasers. The other participants are CENAM (Mexico), NRC (Canada), JILA (USA) and BIPM. The results of the intercomparison will be published in *Metrologia*.

An intercomparison for Rockwell hardness measurements was begun at NIST June 1998. Thirteen countries participated, and the intercomparison is due to finish at the end of 1999. The Precision Engineering Division is spearheading this effort for NIST.

Jerry Keller in the Automated Production Technology Division and Mary Carroll Croarkin in the Statistical Engineering Division presented a workshop on statistical principles and techniques required for performing high accuracy mass calibrations from 1 kg to 1 mg in May 1997. The team also prepared the attendees from the CAMET region to participate in an intercomparison study of mass standards with in the System for Inter-American Metrology (SIM).

The office of the U.S. Intelligent Manufacturing Systems (IMS) secretariat is housed in the MEL. The Intelligent Manufacturing Systems program is an international research effort focused on next generation manufacturing and processing technologies. Dr. Richard H. F. Jackson is the U.S. representative on the IMS Committee of Experts, which addresses technical matters and issues affecting the approval and conduct of research projects. Research and development under IMS is carried out through a series of projects that are already achieving results. Six regions of the world--Australia, Canada, the European Union, Japan, Switzerland, and the United States--currently participate in IMS. Korea is expected to join in the near future. Each IMS project must have participants from a minimum of three regions. MEL

currently participates in three IMS projects: SIMON, MISSION, and STEP-NC. The IMS MISSION (Modeling and Simulation Environments for Design Planning and Operation of Globally Distributed Enterprises) Project is a multinational IMS project focusing on specifying neutral interfaces for the integration of manufacturing simulation systems. NIST has the lead on this project. This project was initiated in July 1998. The Sensor Fused Intelligent Monitoring System for Machining (SIMON) project involves high speed machining and machining monitoring using smart sensor interfaces. NIST is working with Canada, Germany and Japan on this project.

Theodore Vorburger in the Precision Engineering Division co-authored an invited keynote lecture to the International Institute for Production Engineering Research General Assembly (CIRP) in China with scientists from PTB and Nikon Research Laboratory (Japan).

NIST recently participated in the Wassenaar Arrangement as a technical consultant to the Department of Defense. The Wassenaar Arrangement, led by the State Department, seeks to identify technologies that should have limited export to certain sensitive countries. The Arrangement has participation from 33 countries, including countries of the European Union, Japan, Russia and the United States. The United States is represented by delegates from the Department of Commerce, the Department of Defense and the Department of State.

Al Jones and Frank Riddick of the Manufacturing Systems Integration Division collaborate with Loughborough University, United Kingdom, and the Technical University of Eindhoven, the Netherlands, on reactive scheduling and scheduling system interfaces.

International Workshops and Conferences

The first two workshops of the 1997 International Conference for Enterprise Integration Modeling Technology ('97 ICEIMT) were held at NIST April 16-18, 1997. Thirteen experts attended the Enterprise Organization and Human Issues workshop and nine experts attended the Enterprise Metrics and Strategic Standardization Policy workshop. NIST and the European Commission ESPRIT program co-sponsored the '97 ICEIMT. The conference was held October 28-30, 1997 in Italy. The goal of this conference and the conference held in 1992 was to find ways for the United States and European projects to work more closely to develop the technology and standards to support enterprise integration.

Intelligent Systems and Semiotics (ISAS'97) Conference hosted by MEL's Intelligent Systems Division (823) was the third in a series of annual conferences on intelligent systems held at NIST in Gaithersburg, MD, September 22-25, 1997. The conference was co-sponsored by the IEEE Control Systems Society, the National Science Foundation, and the Army Research Laboratory. The theme of this conference was "A Learning Perspective" with papers presented by a broad cross-section of international researchers representing fields as diverse as biomedical research and cognitive reasoning to evolutionary programming. The conference had an attendance of 105 people with 36 people attending the tutorials.

Materials Science and Engineering Laboratory (850)

Contact Point: Dr. Dale Hall

The Materials Science and Engineering Laboratory (MSEL) provides technical leadership and participates in developing the measurement and standards infrastructure related to materials critical to U.S. industry, academia, government and the public. MSEL's mission is to stimulate the more effective production and use of materials by working with materials suppliers and users to assure the development and implementation of the measurements and standards infrastructure for materials. Materials science and engineering programs at NIST cover a full range of materials issues from design to processing to performance.

Bilateral Activities

Australia

J. Michael Rowe in the NIST Center for Neutron Research advised the Australian Nuclear Science and Technology Organization (ANSTO) on plans for research and reactor development. This helped to establish a relationship with ANSTO for future neutron research.

Austria

Ryan McCormack in the Ceramics Division presented the Institute for Theoretical Physics at the Technical University of Vienna with graphical user interface software written at NIST for the Vienna *ab initio* Stimulation Package (VASP). A workable user interface was established with the VASP, one of the most advanced *ab initio* simulation packages in the world, making it accessible to a wider community of users.

Belarus

Jeffrey Lynn in the NIST Center for Neutron Research collaborates with scientists at the Institute of Solid State and Semiconductor Physics, Academy of Sciences of Belarus, on inelastic neutron scattering studies of high quality single crystal samples of mutual interest.

Brazil

Albert Feldman in the Ceramics Division is collaborating with the Federal University of the Rio Grande of the South (UFGRS) on developing thermal conductivity measurement methods and on measuring the thermal conductivity of diamond and other thin film materials.

Canada

Sharon Glotzer of the Polymers Division collaborates with the University of Western Ontario on theory and modeling of glassforming materials.

China

Eric J. Amis and Charles C. Han of the Polymers Division collaborate with the Institute of Chemical Metallurgy, Academia Sinica on a database project for polymer/polymer and polymer/solvent thermodynamic properties. Charles C. Han is also collaborating with the Institute of Chemistry, Academia Sinica on reactive blending of LCP/thermoplastic polymers.

France

The Materials Reliability Division conducted an intercomparison of Charpy impact machines with the Laboratoire National d'Essais. They are investigating the possibility of performing further comparisons using the ASTM procedures.

Gregory McKenna of the Polymers Division has a joint project with the Institut Charles Sadron to re-analyze the original data of A.J. Kovacs on volume recovery of polymer glasses using "modern statistical" techniques to ascertain whether or not the data are sufficiently precise to support the reported t-effective paradox.

John Cahn of the Laboratory Office was awarded the degree Doctor Honoris Causis by the Universite d'Evry in October 1996.

Germany

Sheldon Wiederhorn of the Laboratory Office and Edwin Fuller in the Ceramics Division received a Humboldt Senior Research Award. Fuller conducted research at the Technische Universitat Dresden in September 1998.

William Luecke in the Ceramics Division collaborates with the Technical Universitat Hamburg-Harburg Arbeitsbereich Werkstoffphysik und Technologie on tensile creep of silicon nitride.

Douglas Smith in the Ceramics Division has a joint project with scientists at the Federal Institute for Materials Research and Testing (BAM) in instrumented indentation or hardness testing on NIST/BAM thin film systems under an Agreement with BAM initiated in 1994. Smith also has a three-year project with the BAM to characterize coatings by micro- and nano-indentation techniques and to develop standard reference coatings for a variety of applications. The Ceramics and Surface Technology Divisions also collaborate with the BAM on the development and characterization of standard reference coatings for optical, tribological, wear and adhesion testing.

George Quinn in the Ceramics Division is cooperating with the German Aerospace Research Institute (DLR) on characterization of structural ceramics.

Charles C. Han and Cathy Jackson from the Polymers Division are working in collaboration with the Bayreuth University on the structure and morphology of crystalline block copolymers and on crystalline polymer/thermoplastic polymer blends.

Sharon Glotzer of the Polymers Division is collaborating with the University of Mainz on two projects, simulations of polymer melts and simulations of supercooled liquids.

Sam Low in the Metallurgy Division collaborates with the Materialprüfungsamt Nordrhein-Westfalen in the field of hardness standardization.

The Center for Neutron Research has a joint research program with the Forschungszentrum Julich for joint development and use of a neutron spin echo spectrometer to study soft materials.

Greece

Alamgir Karim of the Polymers Division is collaborating with the Foundation for Research and Technology (F.O.R.T.H.) for measuring the dynamics of chemically end-grafted polystyrene brushes in good and poor solvents using dynamic light scattering.

Italy

Sharon Glotzer of the Polymers Division has a joint project with the University of Rome, Italy on simulations of supercooled o-terphenyl.

Jack Douglas from the Polymers Division is collaborating with the University of Pisa on the problem of the breakdown of the Stokes-Einstein relation in supercooled fluids. Recent modeling has explained these continuum hydrodynamics in terms of fluid heterogeneity in supercooled liquids, and a simple model calculation seems to rationalize these observations very well. Work is being done to check this model further.

Sam Low in the Metallurgy Division collaborates with scientists at Istituto di Metrologia G. Colonnetti (IMGC) in the field of hardness standardization.

Ared Cezairliyan in the Metallurgy Division was a participant in the U.S.-Italy Joint Project on Metrological Research and collaborated with the scientists at the Italian Metrology Institute on a project related to thermophysical properties of high-temperature materials.

Israel

Daniel Josell in the Metallurgy Division collaborates with the Technion on microstructure and mechanical properties of multilayer materials.

Japan

John Tesk of the Polymers Division had the honor of participating, as the only foreign member, on the first review panel for a dental school, the University of Tokushima Dental School, Japan. Tesk and his collaborator at Tokushima University were honored at the April meeting of the Japanese Society for Dental Materials and Devices with the society's annual award for the best publication in its two journals. The paper is entitled "Simulation of Transient Thermal Stress in Gypsum-Bonded Investment" and

appeared in the December issue of the *Dental Materials Journal*. Tesk was also bestowed an honorary membership in the Japan Society for Dental Materials.

Donald L. Hunston of the Polymers Division has a joint project with scientists at the National Research Laboratory of Metrology (NRLM). A scientist at NRLM will spend a year at NIST to help Hunston develop the single fiber fragmentation test method as part of an international program under VAMAS.

Charles C. Han of the Polymers Division collaborates with scientists from the Hashimoto Phasing project of ERATO/JSTA. A joint workshop was organized and several research exchanges have taken place in the past five years.

Francis W. Wang of the Polymers Division collaborates with Nihon University's School of Dentistry on cure monitoring of dentin bonding systems and surface modifications of fillers for dental restorative composites.

Hassel Ledbetter in the Materials Reliability Division collaborates with several scientists at the National Research Laboratory of Metrology (NRLM) on solid-state viscoelastic properties, thermal expansivity of SiC/Al composites, elastic constants and internal friction of low-dislocation-content silicon monocrystals and graphite-fiber epoxy-matrix composite. Ledbetter has prepared several joint manuscripts on this work. Ledbetter also collaborates with scientists at the National Institute for Research in Inorganic Materials (NIRIM) on a study of YB₆₆ monocrystal elastic constants C_{ij} . In addition, Ledbetter initiated a collaboration to study elastic-constant/hardness. At the University of Tsukuba, Ledbetter collaborates with scientists on elastic constants of (Ba-K)BiO₃ superconductors.

Andy Slifka in the Materials Reliability Division collaborates with researchers at the National Aerospace Laboratory (NAL) on measurements of thermal properties of functionally graded ceramic coatings on metal substrates intended for a wide range of industrial applications. NIST is providing measurements of absolute thermal conductivity over the temperature range of 100 to 800 degrees C. NAL is providing the specimens and measurements of highflux thermal diffusivity.

Douglas Smith in the Ceramics Division participates in a joint research and development project on the production and development of functionally graded materials (FGMs) with the Agency of Industrial Science and Technology (AIST). FGMs are produced using a plasma arc sintering process. NIST is characterizing the mechanical properties of the coatings.

Stephen Hsu in the Ceramics Division has two joint projects with the Mechanical Engineering Lab (MEL). The objective of the first project is to explore the use of carbon/carbon composites as machine elements such as spindles, bears, and axes by laser fusing of the surface. This will eliminate porosity and increase strength. Other participants in the joint project are New Energy Development Organization (NEDO) and Vacuum Metallurgical Co., Ltd. in Japan. The second project aims to develop improved materials for total joint replacement by studying the wear debris generation and formation of ultra-high molecular weight polyethylene. Joint experiments were carried out and the results were exchanged. Several measurement techniques were developed as a result of the collaboration. Other participants of this project include NEDO and Kobe Steel of Japan.

Albert Feldman in the Ceramics Division collaborates with the National Institute for Research on Inorganic Materials (NIRIM) on evaluation methods for CVD diamond films.

Jay Wallace and Edwin Fuller, Jr. in the Ceramics Division participate in a Japan-U.S. Research Collaboration in Aluminum Nitride (AlN) Substrates. The pre-competitive research on AlN substrate materials is a four-way collaboration between Dow Chemical Company in Midland, MI, which provides AlN powder to Toshiba's Research and Development Center to fabricate test specimens. NIST develops and conducts tests for characterizing the mechanical behavior and reliability of the AlN substrates, and the National Industrial Research Institute of Nagoya (NIRIN) is responsible for processing studies and microstructural characterization.

Sam Low and Dave Pitchure in the Metallurgy Division conducted an intercomparison of the Rockwell B and C hardness scales with the National Research Laboratory of Metrology (NRLM).

Leonid Bendersky in the Metallurgy Division is collaborating with NKK Corporation in the discontinuous coarsening in advanced aerospace materials.

Korea

Sam Low in the Metallurgy Division collaborates with scientists at the Korea Research Institute of Standards and Science (KRISS) in the field of hardness standardization.

Norway

Gery Stafford in the Metallurgy Division collaborates with scientists at the Norwegian University of Science and Technology on the electrodeposition of aluminum alloys from chloroaluminate molten salt electrolytes.

Poland

Francis W. Wang of the Polymers Division collaborated with the Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences in Lodz on processing of latexes for biosensors. Wang visited the Centre and gave a lecture on cure monitoring of dental resins by fluorescence spectroscopy. A joint paper entitled "Proteins at Surfaces of Poly(styrene/acrolein) Latexes and Latex Assemblies" was published.

Slovenia

Said Jahanmir in the Ceramics Division participates in a joint research project with scientists at the University of Ljubljana. The purpose of the project is to determine the influence of surface grinding on rolling contact wear and fatigue of silicon nitride ceramics.

Sweden

Adam Powell in the Metallurgy Division collaborates with the Royal Institute in Stockholm on gas-solid reactions.

Switzerland

William J. Boettinger in the Metallurgy Division has a joint project with the Swiss Federal Institute of Technology (EPFL) on solidification of multicomponent alloys.

United Kingdom

Geoffrey McFadden (891) collaborates with the University of Southampton under the auspices of a NASA grant entitled, A Phase-Field Motion Model of Solidification: Investigation of Flow Effects During Directional Solidification and Dendritic Growth.

Richard Fields in the Metallurgy Division collaborates with scientists at Cambridge University Micromechanics Center in England. The joint research is aimed at developing models for powder consolidation that can be used to accelerate the introduction of aluminum metal matrix composites into U.S. manufactured automobiles.

Ewa Drescher-Krasicka in the Metallurgy Division collaborates with the University of Cambridge in modeling associated with a new acoustic stress measurement developed at NIST.

James A. Warren and Adam C. Powell in the Metallurgy Division collaborate with the University of Greenwich on solder flow and solidification.

Multilateral Activities

Versailles Project on Advanced Materials and Standards (VAMAS) is an international cooperative program involving Canada, France, Germany, Italy, Japan, the United Kingdom, the European Union and the United States. VAMAS supports trade in high technology products through international collaborative projects aimed at providing the technical basis for drafting standards. Joseph Carpenter in the Ceramics Division attended a meeting of the VAMAS to propose a collaboration or coordination between VAMAS and Standard for the Exchange of Product data model (STEP). Stephen Hsu in the Ceramics Division is leading a VAMAS TWA1 international round robin study on wear debris generation, characterization, and representation of biomaterials.

Connected to the activity is the VAMAS TWA7 study on biocompatibility. George Quinn in the Ceramics Division is the International Leader of VAMAS Technical Working Area (TWA) #3, Ceramics. Five multinational round robins are underway in this TWA involving as many as 35 participating laboratories. Douglas Smith in the Ceramics Division is vice-chairman of a new VAMAS Technical Working Area (TWA) #22, Mechanical Property Measurement of Thin Films and Coatings. In this activity he co-organized an instrumented hardness round robin for coatings in cooperation with the National Physical Laboratory (NPL), United Kingdom. Also, Smith participated in a round robin test on recording hardness in VAMAS TWA #3.

George Onoda in the Ceramics Division is the coordinator of "The International Energy Agency (IEA) Annex II Subtask 10, an international cooperative project involving Belgium, Germany, Japan, Sweden and the United States. The objective of this project is to define standard procedures for the characterization

of secondary properties of ceramic powders and to coordinate with ASTM, CEN, and JIS in the development of ISO standards.

Albert Feldman in the Ceramics Division took part in a round-robin on thermal conductivity measurements on CVD diamond. Laboratories from Germany, France, Japan, China, and South Korea participated in the round robin.

Stanley Dapkunas in the Ceramics Division was elected a Fellow of ASM International for distinguished contributions in the field of materials science and engineering.

T. A. Siewert and C. N. McCowan in the Materials Reliability Division organized an international comparison of the energy calibration of Charpy impact test machines. The standards laboratories in Belgium, France, Japan, and the United Kingdom agreed to test specimens, while France and Belgium will contribute additional specimens. The intercomparison will evaluate a variety of procedural and specification issues such as differences between ASTM and European procedures and specimen heat treatment variables.

Sharon Glotzer of the Polymers Division is collaborating with St. Francis Xavier University, Canada, and the University of Napoli, Italy, on spatial correlations in frustrated materials.

John Bonevich in the Metallurgy Division collaborates with Bologna University (Italy) and Hitachi Advanced Research Lab (Japan) on electron holography of superconducting vortices.

International Workshops and Conferences

On June 18-20, 1997 NIST, the German Federal Institute for Materials Research and Testing and the German and American Societies for Nondestructive Testing organized an international workshop in Germany on Reliability and Validation of Non-Destructive Evaluation (NDE) Methods.

MSEL organized a lecture series to provide an information base on the economic and technological importance of the standardization system and how national and international standards infrastructures organize, work and interface. The workshop addresses U.S. measurements and standards needs for materials critical to advanced technology, global competition and international trade.

MSEL co-sponsored the Seventh International Conference on Computer Technology in Welding in San Francisco in July 1997. This conference comprised 70 presentations from 18 countries, as well as tutorials on advances in computer technology and software exhibits.

NIST Polymer Blends/ERATO POLYMER PHASING PROJECT joint workshop on Multiphase Polymers and Polyelectrolytes was held at NIST June 18-20, 1997. The Hashimoto Polymer Phasing Project of the Exploratory Research for Advanced Technology (ERATO) is sponsored by the Japan Science and Technology Agency. There has been a continuous exchange of visits and research collaborations between the Polymer Blends and Processing Group and the Hashimoto phasing project for the past five years.

The Center for Neutron Research was a co-sponsor of the International Conference on Neutron Scattering held in Canada in August 1997.

International Committee Participation

Robert Shull in the Metallurgy Division is the Vice-Chairman of the International Advisory Committee on Nanostructured Materials, which is responsible for organizing the International Conferences on Nanometer-Scale Materials.

Physics Laboratory (840)

Contact Point: Dr. Katharine B. Gebbie

The mission of the Physics Laboratory (PL) is to support United States industry by providing measurement services and research for electronic, optical and radiation technologies. The Laboratory pursues directed research in the physical sciences; develops new physical standards, measurement methods, and data; conducts an aggressive dissemination program; and collaborates with industry to commercialize inventions and discoveries. The Laboratory programs span the full range from tests of fundamental postulates of physics through generic technology to the more immediate needs of industry and commerce. Its constituency is broadly distributed throughout academia, government, and industry.

Bilateral Activities

Armenia

Garnett Bryant in the Atomic Physics Division was awarded a grant from the Civilian Research and Development Foundation to conduct joint research with scientists in Armenia on carrier scattering in quantum nanosystems.

Brazil

Scientists in the Time and Frequency Division, working with a Brazilian Guest Researcher, developed the narrowest linewidth visible laser ever reported. The laser was developed while conducting research on optical frequency standards.

Egypt

Under the auspices of the Memorandum of Understanding between NIST and the National Institute of Standards (NIS), D. Wayne Hanson in the Time and Frequency Division is working with NIS staff on how to use some resources of the communication satellite, Nilesat's, for the dissemination of time and frequency information originating at the NIS laboratories.

France

For over ten years NIST has pursued a precision gamma-ray wavelength measurement program at the Institut Laue-Langevin (ILL). This program is a unique extension of the crystal lattice spacing measurement program at NIST. Ernest Kessler and M. Scott Dewey in the Ionizing Radiation Division conducted experiments to record precision high energy gamma ray wavelengths produced in the decay of ^{36}Cl and performed routine maintenance on the NIST-ILL double flat crystal spectrometer (GAMS4).

Germany

The Ionizing Radiation Division collaborates with the Hahn Meitner Institute (HMI) on measurements of neutron coherent scattering lengths. Scientists at HMI have been working with NIST scientists to measure the scattering lengths for silicon and the isotope ^{208}Pb . The silicon scattering length is a standard whose

published accuracy has been improved by a factor of 5 by the HMI-NIST measurements at the NIST Neutron Interferometer and Optics Facility. The ^{208}Pb scattering length is a special case from which the internal electric charge distribution of the neutron can be inferred.

Christopher Soares in the Ionizing Radiation Division collaborates with the Physikalisch-Technische Bundesanstalt (PTB) on the development of beta-particle dosimetry standards. These standards are helping to improve practice in radiation protection and to bring these standards into greater international coherence. Soares also collaborates with the University of Essen on the application of scintillation counting systems to the determination of the spatial distribution of absorbed dose in water from brachytherapy sources used in radiation therapy.

Peter Mohr in the Atomic Physics Division collaborates with the Technical University in Dresden on high-Z one-electron atom data for calculation of vacuum polarization. This calculation is critical to the determination of fundamental constants.

Japan

The Time and Frequency Division has joined with the Communications Research Laboratory of Japan to build a copy of the NIST-7, the Nation's primary frequency standard. As new subsystems are developed for the new NIST-7, a replicate is made to replace subsystems of the original NIST-7. CRL has fully funded this project.

Mexico

The Time and Frequency Division and scientists at CENAM developed a workshop on "Characterization of Clocks and Oscillators" and presented the workshop, in Spanish, at CENAM in April 1998. The workshop was targeted to industrial and government electronics engineers in Mexico and Central and South American countries. In addition, the Time and Frequency Division in collaboration with scientists at CENAM have measured the phase modulation noise floor of a number of phase detectors for both homodyne and heterodyne detection. These measurements form a basis for a model for noise in commonly used phase detectors.

Russia

Standard Reference Materials are crucial to the international community monitoring nuclear waste sites in the world's oceans. The Ionizing Radiation Division, in collaboration with "Typhoon" SPA, has begun issuing a new family of low-level radionuclide natural-matrix SRMs for Ocean Studies. The first SRM was issued this year: Ocean Sediment (SRM 4357), certified for fission products and actinides. Typhoon assisted in collecting the next SRM matrix, Ocean Shellfish, which is currently being analyzed by NIST and Typhoon in a worldwide interlaboratory comparison. Typhoon is currently collecting the next SRM matrix, Seaweed.

Gerald Fraser of the Optical Technology Division was awarded a grant from the Civilian Research and Development Foundation to conduct joint research with scientists in Russia on the development of a new far-infrared molecular beam spectrometer.

Saudi Arabia

In March 1997 the General Secretariat of the King Faisal Foundation honored Eric Cornell (848) of the Quantum Physics Division and Carl Wieman of the University of Colorado with the 1997 King Faisal International Prize in Science. Cornell and Wieman were recognized for their discovery of Bose-Einstein condensation, a breakthrough in modern physics.

Sweden

William D. Phillips was selected as a co-winner of the 1997 Nobel Prize in Physics with Steven Chu of Stanford University and Claude Cohen-Tannoudji of College de France and Ecole Superieure, France. The Royal Swedish Academy selected the trio for work they did independently on the development of methods to cool and trap atoms with laser light. Phillips is the first NIST employee in the agency's history to win the Nobel Prize.

Taiwan

Jon Hougen, Senior Fellow in the Optical Technology Division, was appointed to the International Advisory Panel for the Institute of Atomic and Molecular Sciences (IAMS) for a three-year term.

In collaboration with the Institute of Nuclear Energy Research, the Ionizing Radiation Division's Radioactivity Group developed a high-temperature borate fusion to totally dissolve soil samples. This effort is a direct outgrowth of the NIST natural-matrix radionuclide SRM certification program. The borate fusion will provide NIST with a very simple and reliable sample preparation method that will easily dissolve even the most resistive minerals.

Multilateral Activities

A collaboration between staff of the Time and Frequency Division and researchers from Switzerland and the People's Republic of China produced a major improvement in the short-term stability of a rubidium-cell frequency standard. The Division also has a collaboration with Texas A&M University, the University of Germany, the Max-Planck Institute, both in Germany, and the Lebedev Institute in Russia to study optical-coherence effects in dense rubidium vapor. The Time and Frequency Division also collaborates with scientists from the United Kingdom, Brazil, Japan and Canada on laser magnetic resonance spectroscopic techniques.

The Ionizing Radiation Division, in collaboration with the Atomic Weapons Establishment (U.K.), British Nuclear Fuels (U.K.), Environmental Measurements Laboratory (U.S.), Environmental Protection Agency (U.S.), Geosciences Advisory Unit (U.K.), International Technology Corporation (Italy), Kanazawa University (Japan), Laboratory of the Government Chemist (U.K.), Laboratoire de Radioecologie Marine (France), Ministry of Agriculture, Fisheries and Food (U.K.), Nuclear Electric (U.K.), Niedersachsisches Institut fur Radiookologie (Germany), National Physical Laboratory (U.K.), National Radiological Protection Board (U.K.), Oak Ridge National Laboratory (U.S.), Oregon State University (U.S.), Radiological and Environmental Sciences Laboratory (U.S.), South of Scotland Electricity Board (U.K.), and Yankee Atomic Environmental Laboratory (U.S.), certified the radionuclide concentrations in SRM 4357 (Ocean Sediment). This material will be of critical importance to the international community

monitoring nuclear waste dumpsites in the world's oceans by providing a common measurement reference. SRM 4357 will be followed up with additional ocean matrix low-level radionuclide standards--shellfish, and seaweed.

The International Commission on Radiation Units and Measurements (ICRU) elected Stephen Seltzer in the Ionizing Radiation Division as one of its 13 Commission members, drawn from the international radiation sciences community. The ICRU develops internationally acceptable recommendations on (a) quantities and units of radiation and radioactivity, (b) procedures for the measurement and application of these quantities in clinical radiology and radiobiology, and (c) physical data needed in the application of these procedures.

International Committee Participation

Allan Carlson in the Ionizing Radiation Division was selected by the International Atomic Energy Agency (IAEA) to chair the consultants group to examine the neutron cross section database for possible new standards for data measurements and extension of existing standards.

The International Committee for Radionuclide Metrology (ICRM) elected Bert Coursey, Chief, Ionizing Radiation Division, as the next ICRM president at its annual meeting at NIST May 23, 1997. ICRM is the central international organization in radionuclide metrology that disseminates information on techniques and data related to radionuclide metrology to advance international cooperation. In conjunction with the meeting, the ICRM and NIST co-sponsored the Conference on Radionuclide Metrology and Its Applications at NIST, May 18-23, 1997.

International Workshops and Conferences

The Ionizing Radiation Division hosted the first workshop of the Council on Ionizing Radiation Measurements and Standards (CIRMS) in April 1998. More than 70 U.S. and European scientists, regulatory officials, medical professionals, medical equipment manufacturers and pharmaceutical producers participated in the workshop.

The Physics Laboratory and the Standard Reference Data Program co-sponsored the First International Conference on Atomic and Molecular Data and Their Application at NIST, September 29- October 2, 1997.

Technology Services (200)

Contact Point: Dr. Peter L.M. Heydemann

Technology Services (TS) provides U.S. industry and trade, government and the public, with measurements, standards, and information services that increase competitiveness and facilitate trade by promoting innovation, improving quality, reducing cost, promoting the use and adoption of U.S. standards, measurement practices and technology by important trading partners, and overcoming barriers to trade. Activities include: cooperating with other departments and agencies of the Federal Government, state and local governments in establishing uniform legal metrology practices, standards, codes, and specifications; developing, producing, and distributing Standard Reference Materials; providing Standard Reference Data; providing calibration and laboratory accreditation services; coordinating metric usage to the extent practical in Federal Government procurement, grants, and business-related activities; managing the Small Business Innovation Research Program (SBIR); and providing information services in support of NIST and collaborating with NIST's Laboratories in carrying out Technology Services responsibilities.

Technology Services international activities are performed within the Office of Standard Services (OSS). OSS formulates and implements standards-related policies and procedures to enhance domestic commerce and international trade. OSS provides representation to domestic and international organizations and Federal agencies concerned with standardization, product testing, certification, laboratory accreditation, and other forms of conformity assessment. Programs in OSS are dedicated to the following specific areas in standards and conformity assessment: Laboratory Accreditation, Technical Standards Activities, Global Standards, Standards Information, and Standards Conformity.

The Laboratory Accreditation Program manages the National Voluntary Laboratory Accreditation Program (NVLAP). The program responds to legislative mandates, regulatory needs, and private sector requests for third-party accreditation of testing and calibration laboratories. The program is in full conformance with the standards of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), including ISO Guide 25, General Requirements for the Competence of Calibration and Testing Laboratories, and ISO Guide 58, Calibration and Testing Laboratory Systems--General Requirements for Operation and Recognition.

The Technical Standards Activities Program (TSAP) provides technical support for public and private sector standards-related activities. TSAP manages U.S. participation in the International Organization of Legal Metrology (OIML), a treaty organization that promotes global trade for harmonizing performance requirements for measuring instruments used in legal metrology. TSAP also serves as the DOC technical contact point to investigate non-tariff trade barriers for non-agricultural products under the World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT).

The Global Standards Program (GSP) provides technical information and support to Federal agencies and industry to assist in resolving non-tariff trade-related issues on standards and conformity assessment. The program provides technical support for activities of the Commerce Department's International Trade Administration (ITA), such as the Special American Business Intern Training (SABIT) for Russian and New Independent State (NIS) technical experts, the Mutual Recognition Agreement (MRA), recently completed between the United States and the European Union, and in the ITA's Office for Asia and the Pacific for standards and conformity assessment issues related to trade. GSP works with standards and conformity assessment bodies in other countries to ensure adoption of common procedures based on

international guidelines. GSP also participates in the activities of interagency groups to establish U.S. Government positions for the North American Free Trade Agreement (NAFTA), the International Committee on Developing Country Matters (DEVCO), and the United Nations Economic Commission for Europe (UNECE). GSP administers a network of standards experts who work with U.S. businesses, other government agencies, and foreign organizations to identify and remove technical barriers to trade in the European Union, Argentina, India, Mexico, and Saudi Arabia. GSP conducts standards-related training programs for technical experts from Russia and the NIS (the SABIT program), the Americas, the Middle East, and other areas important for U.S. trade. Nine such programs were held in 1997 for delegations from Argentina, Brazil, Russia and the NIS, the Gulf Cooperation Council, and countries of the Andean Pact. When requested, GSP staff review standards-related and conformity assessment issues when other nations seek accession to the World Trade Organization (WTO) regarding areas that may be of importance to U.S. industry and exporters for trade with those nations.

The Standards Information Program (SIP) maintains the National Center for Standards and Certification Information (NCSCI). The center serves as a central depository for standards-related information in the United States, providing access to standards, technical regulations, and related documents published by the United States and foreign governments, and domestic, foreign, and international private sector standards organizations. SIP responds to domestic and foreign requests for information on U.S., foreign, regional, and international standards, technical regulations, and conformity assessment procedures. Other activities include: access to the network of information centers (ISONET) of the International Organization for Standardization; serving as the U.S. inquiry point under the Agreement on Technical Barriers to Trade (TBT) of the World Trade Organization (WTO). NCSCI operates the U.S. NAFTA inquiry point, which provides information about standards and technical regulations of the NAFTA countries. The center also operates two telephone "hotlines" that offer weekly updates on draft European standards and proposed foreign regulations.

The Standards Conformity Program (SCP) manages NIST's assigned responsibilities under the Fastener Quality Act of 1990 (PL. 101-592), which includes: issuing final implementation regulations; approving laboratory accreditation bodies to accredit fastener testing laboratories under the Act and implementing regulations; and providing technical advice and assistance to the Bureau of Export Administration (BXA), which is responsible for enforcing the Act and regulations, and to the Patent and Trademark Office, which is responsible for recording insignia under the Act and regulations. SCP carries out accreditor recognition activities under the its Accreditation Body Evaluation Program (ABEP). SCP also manages the National Voluntary Conformity Assessment Evaluation Program (NVCASE), designed to evaluate and recognize competent accreditors of laboratories, certifiers, or registrars of quality assessors.

Bilateral Activities

Australia

NVLAP participated in a reciprocal assessment activity with the National Association of Testing Authorities in Australia (NATA). An agreement with Australia was signed to recognize the technical equivalence of their testing and calibration laboratory accreditation programs.

Brazil

A Standards in Trade workshop was held for a delegation from Brazil in April 1997.

Canada

The NIST Accreditation Body Evaluation Program (ABEP) under the Fastener Quality Act (FQA) recognized the accreditation body, the Standards Council of Canada (SCC) on December 19, 1997.

European Union

NIST is identified as the designating authority in four of the six sectoral annexes of the U.S.-EU Mutual Recognition Agreement, telecommunication, EMC, electrical safety and recreational craft. NIST will be responsible for assessing the technical competence of prospective U.S. conformity assessment bodies (or their accreditors) through the National Voluntary Conformity Assessment Systems Evaluation (NVCASE) program, for listing these bodies under the MRA and for maintaining a surveillance program to assure continued competence.

NVLAP participated in a reciprocal assessment activity with the Hong Kong Laboratory Accreditation Scheme (HOKLAS).

Japan

Belinda Collins, Director, Office of Standard Services, hosted the Second U.S. - Japan Joint Information Exchange Forum on standards and conformity assessment issues January 9-10, 1997, at NIST. The Third U.S.-Japan Joint Information Exchange Forum was held at NIST September 3-4, 1997.

The NIST Accreditation Body Evaluation Program (ABEP) under the Fastener Quality Act (FQA) recognized the Japan Accreditation Board of Conformity Assessment December 19, 1997.

New Zealand

NVLAP participated in a reciprocal assessment activity with the International Accreditation of New Zealand (IANZ). An agreement with New Zealand was signed to recognize the technical equivalence of their testing and calibration laboratory accreditation programs.

Russia

John Rumble (231) was elected as a foreign member of the Metrology Academy of the Russian Federation in May 1997.

Saudi Arabia

Starting in FY 1997, TSAP is coordinating a special project, initiated with SASO, to assist Saudi Arabia in the development, adoption, and implementation of a Kingdom-wide building code program based on U.S. building codes and standards and U.S. building technology.

In collaboration with the United States Trade Representative (USTR), the International Trade Administration (ITA), and the Department of State, NIST works with Saudi Arabia on modifying the Kingdom's International Conformity Certification Program (ICCP), which may prevent Saudi Arabia's accession to the World Trade Organization (WTO). NIST was asked to review all Saudi standards and to replace obsolete ones with new standards that comply with WTO and are in agreement with U.S. and international standards. This will be done in collaboration with U.S. industry.

United Kingdom

A NIST team led by Robert Gladhill of the Standards Conformity Program visited the United Kingdom Accreditation Service (UKAS), the National Measurement Accreditation Service Branch to evaluate them for ultimate recognition by NIST to accredit laboratories in accordance with the Fastener Quality Act. The UKAS was approved by the ABEP panel as of April 23, 1997.

Vietnam

The Global Standards Program organized a seminar on U.S. standards and conformity assessment for twenty-one officials of Vietnamese companies November 17-18, 1997.

Multilateral Activities

NVLAP chairs the North American Calibration Cooperation (NACC), in which the United States, Canada, and Mexico are working toward mutual recognition of their respective calibration laboratory accreditation programs.

In Fiscal Year 1997, TSAP held nine working group meetings for OIML technical committees covering projects on industrial radiation processing, evidential breath analyzers, load cells, material testing machines, gas chromatographs for measuring pollutants, and liquid-in-glass thermometers.

SIP completed a Transparency Survey to Assess Availability and Access to Standards, Regulations and Conformity Assessment Requirements for the Sub-Committee on Standards and Conformance (SCC) of the Asia-Pacific Economic Cooperation (APEC). The survey was presented at the SCSC meeting of APEC, Victoria, British Columbia, Canada Feb. 1, 1997. NCSCI is responsible for maintaining and updating the database compiled from the survey for the APEC Secretariat.

In December 1996 Kathleen Gaaserud (203) traveled to Saudi Arabia, Qatar, Oman, the United Arab Emirates, Bahrain and Kuwait to meet with embassy officials, and standards and conformity assessment officials in the Gulf Cooperation Council (GCC) for general familiarization, to introduce Ed Wunder in his expanded role as the NIST representative to all of the GCC countries, and to discuss and plan the February 1997 Standards in Trade Workshop.

In February 1997 a Standards in Trade Workshop was held for a delegation from the Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates). The workshop familiarized GCC participants with and built confidence in U.S. technology and practices in

standardization, conformity assessment, metrology and measurement systems. U.S. participants became more familiar with GCC practices.

In June 1997 a Standards in Trade Workshop was held for a delegation of 24 standards and conformity assessment officials from both government and the private sector from the Andean Pact countries (Bolivia, Colombia, Ecuador, Peru and Venezuela).

In July 1997 Pat Cooke in the Office of Standards Services participated, with staff from the International Trade Administration, in a standards trade mission to Southeast Asia. The delegation, including representatives from trade associations, the standards industry and standards developers, conducted technical seminars on standardization and conformity assessment in the Philippines and Vietnam.

In October 1996, with help from GOSSTANDART and the Kazak State Committee, seminars were conducted in Kazakstan and Uzbekistan to translate and introduce U.S. and international standards in the Commonwealth of Independent States (CIS), and to train staff at all levels in their use. This will help U.S. industry gain access to markets in Central Asia, especially oil-rich Kazakstan.

In March 1998 the Office of Standards Services hosted a seminar on standards information for representatives from 17 Latin American countries. The seminar was part of the Standards in Trade Workshop program.

In June 1998 a Workshop on Legal Metrology for the Americas was sponsored by NIST, the National Conference on Weights and Measures, the Organization of American States (OAS), the Interamerican Metrology System and the International Organization of Legal Metrology. Thirty-one of the 34 member nations of the OAS participated.

International Committee Participation

Staff supports the incorporation of U.S. standards and practices into international standards through active cooperation in international standards developing organizations like the International Standards Organization (ISO), International Electrotechnical Commission (IEC), and International Organization of Legal Metrology (OIML).

Sam Chappell in the Office of Standards Services represents the United States on OIML and is the vice-president of OIML.

GSP is the U.S. chair of the Standards Working Group under the U.S.-Russian Business Development Committee of the Gore-Chernomyrdin Commission.

The OSS director was named vice-chair of International Laboratory Accreditation Cooperation (ILAC) at the September 1996 meeting in Amsterdam, and became chair in October 1997.

Appendix 1

International Agreements

The following table lists the current status of all NIST institute-to-institute international agreements in alphabetical order with implementing laboratory. These acronyms are used in the table: MOU = Memorandum of Understanding, MRA = Mutual Recognition Agreement, IA = Implementing Agreement, R of D = Record of Discussion.

Memoranda of Understanding

Country	Date Signed	Termination date	Comments
Argentina	June 3, 1994	June 2, 1999	MOU with the National Institute for Industrial Technology (INTI) of the Secretariat of Industry for cooperation in chemistry, physics, and engineering measurement science.
Argentina	June 3, 1994	June 2, 1999	MOU with the Secretariat of Science and Technology (SECyT) for cooperation in chemistry, physics, and measurement science.
Brazil	July 24, 1996	July 23, 2001	MOU with the National Institute of Metrology, Standardization and Industrial Quality (INMETRO) for cooperation in chemistry, physics and engineering measurement sciences.
Canada	March 23, 1992	indefinite	MOU with the Communication Security Establishment (CSE) in information security.
Canada	April 28, 1992	indefinite	MOU with the Canada Treasury Board Secretariat, Administrative Policy Branch in standardization supporting government administration.
Czech Republic	May 16, 1994	May 15, 1999	MOU with the Czech Office for Standards, Metrology, and Testing (COSMT).

Ecuador	June 9, 1994	June 8, 1999	MOU with the Ecuadorian Institute of Standardization (INEN) for cooperation in chemistry, physics, engineering measurements.
Egypt	December 16, 1996	December 15, 2001	MOU with the National Institute for Standards (NIS) for cooperation in measurement sciences in chemistry, physics, and engineering related to standards and conformity assessment.
India	August 14, 1995	August 13, 2000	Statement of Intent with the Indian National Physics Laboratory (NPL).
Indonesia	November 16, 1994	July 7, 1997	MOU between the Department of Commerce and the Ministry of State for Research and Technology. The Implementing Agencies are NIST and the National Standardization Council (DSN) for cooperation in standards, metrology, and conformity.
Japan	June 10, 1994	June 9, 1999	MOU with the Nippon Telephone and Telegraph Corporation (NTT) for cooperation in basic science and telecommunications.
Kazakstan	November 26, 1996	November 25, 2001	MOU with the Committee for Standardization, Metrology and Certification (Kazakstandart) on standards, conformity and metrology.
Korea	September 14, 1994	September 13, 1999	MOU with the Korean Research Institute of Standards and Science (KRISS) for cooperation in chemistry, physics, and engineering measurement sciences.
Korea	October 11, 1994	October 10, 1999	MOU with the Korea Telecom Research Laboratories (KTRL) for science and technology cooperation in Broadband Integrated Services Digital Network (BISDN).

Korea	September 15, 1994	September 14, 1999	MOU with the Electronics and Telecommunication Research Institute (ETRI) for science and technology cooperation in BISDN.
Mexico	December 4, 1996	December 3, 2001	MOU with the National Council for Science and Technology (CONACYT), the Secretary of Commerce and Industrial Development (SECOFI) and the National Center for Metrology (CENAM) for cooperation in chemistry, physics, engineering measurement sciences, and standards related activities.
The Netherlands	July 13, 1994	June 30, 1999	MOU with The Netherlands Measurement Institute (NMI) to demonstrate intercomparison of primary gas mixtures.
Russia	March 23, 1993	March 22, 1998	MOU with the State Committee of the Russian Federation for Standardization, Metrology and Certification (GOSSTANDARDT) for cooperation in standards, conformity and metrology.
Russia	July 16, 1996	July 15, 2001	MOU with the Russian Academy of Sciences for cooperation on chemistry, physics and engineering sciences.
Saudi Arabia	July 29, 1997	July 28, 2000	MOU with the Saudi Arabian Standards Organization (SASO) for technical cooperation in standards and related activities.
South Africa	July 23, 1996	July 22, 2001	MOU with the CSIR, a Body Corporate established in terms of the Scientific Research Council Act 1988 for cooperation in chemistry, physics and engineering measurement sciences.
Ukraine	May 28, 1994	May 27, 1999	MOU with the State Committee of Ukraine for Standardization, Metrology and Certification (SCUSMC) for cooperation in metrology, standardization and certification.

Venezuela	August 8, 1997	August 7, 2000	MOU with the National Council for Scientific and Technological Research (NCSTR) in engineering, chemistry, physics and measurement science.
Multilateral	May 15, 1990	indefinite	MOU with six countries to establish COMAR-computer access to Certified Reference Materials (CRM).
Multilateral	January 25, 1995	indefinite	MOU with the 27 countries in five regions (NORAMET, CAMET, CARIMET, ANDIMET and SURAMET) of the Interamerican Metrology System.
Multilateral	March 10, 1996	March 9, 1999	MOU with the Standardization and Metrology Organization for the Gulf Cooperation Council Countries for technical cooperation in standards activities.
Multilateral	April 4, 1995	April 3, 1999	MOU for Asia Pacific Laboratory Accreditation Cooperation (APLAC).
Regional	April 29, 1994	April 28, 1999	MOU with Canada and Mexico to establish North American Calibration Cooperation (NACC) calibrations and metrology.
Regional	April 29, 1994	April 28, 1999	MOU with Canada and Mexico to establish measurement services in North America (NORAMET).

Other Agreements

Country	Date Signed	Termination date	Comments
Australia	August 11, 1997	August 10, 1998	MRA between NVLAP and the National Association of Testing Authorities (NATA).

Canada	February 2, 1994	February 1, 1999	MRA with the Standards Council of Canada.
Canada	September 28, 1995	October 1, 1997	Letter of Agreement with the National Research Council on indoor air quality modeling and material emissions. (BFRL)
Canada	May 15, 1995	May 14, 2000	MRA with the Canadian General Standards Board. (TS)
Canada	October 15, 1997	October 14, 1999	Statement of Intent with the Institute for Research in Construction of the National Research Council.
Canada	August 9, 1995	indefinite	IA with the Communication Security Establishment (CSE) for cryptographic module validation.
Chile	May 2, 1994	indefinite	Letter of Cooperation with the Comision Chilena De Energia Nuclear (CCHEN). (CSTL)
PRC (China)	January 16, 1995	January 15, 2000	Protocol with the State Bureau of Technical Supervision (SBTS) for cooperation in standards and metrology.
Czech Republic	April 26, 1993	indefinite	IA with the Prague Institute of Chemical Technology (PICT).
Germany	June 24, 1997	December 31, 2002	Cooperative Project among Fachinformationszentrum Karlsruhe (FIZ) and Gmelin-Institute fur Anorganische Chemie der Max-Planck-Gesellschaft zur Forderung der Wissenschaften to develop a crystallographic structural database for inorganic substances.
Germany	June 25, 1998	June 24, 2000	IA with the German Aerospace Research Establishment (DLR) to compare measurement techniques that determine the thermal conductivity of ceramic coatings on metallic substrates.

Germany	March 27, 1995	indefinite	Statement of Intent on recognition of traceability of measurement standards with the Physikalisch-Technische Bundesanstalt (PTB).
Germany	June 30, 1994	June 29, 1999	Letter of Arrangement with the Bundesanstalt für Materialforschung und prüfung (BAM) for cooperative studies on advanced materials. (MSEL)
Hungary	November 22, 1984	indefinite	IA under Article II and III of the Agreement on Cooperation in Culture, Education, Science and Technology for exchange of scientists and information with the Research Institute for Technical Physics.
Hungary	October 4, 1994	October 3, 1999	Projects under umbrella U.S.-Hungary Science and Technology agreement joint fund.
Italy	October 10, 1996	October 9, 1999	IA with the Istituto Elettrotecnico Nazionale Galileo Ferraris (IEN) and Politecnico di Torino (PT) to develop a set of cesium-fountain frequency standards-atomic clocks. (PL)
Japan	March 21, 1996	indefinite	Project agreement with the Communications Research Laboratory to pursue contractual arrangement to construct and evaluate an optically pumped primary frequency standard. (PL)
Japan	November 4, 1988	indefinite	R of D with the Electrotechnical Laboratory (ETL), Agency of Industrial Science and Technology (AIST), MITI to develop measurement devices and superconductive materials. (EEEL)
Japan	November 28, 1995	November 27, 1998	R of D with the Agency of Industrial Science and Technology (AIST), MITI for cooperation on vapor deposition polymerization of thin polymer films. (CSTL)

Japan	May 5, 1995	May 4, 1997	R of D with the AIST on manufacturing techniques of fusing carbon/carbon composite materials to machine elements. (MSEL)
Japan	July 30, 1995	July 29, 1997	R of D with the AIST to develop biocompatible artificial hard tissue materials. (MSEL)
Japan	May 5, 1995	May 4, 1998	R of D with the AIST to develop high performance aluminum nitride ceramics through a low cost process. (MSEL)
Japan	March 14, 1997	March 31, 1998	Consignment Agreement with the Real World Computing Partnership of MITI for joint optoelectronics project: NIST selects, supervises and controls the U.S. Broker (facilitator between the user with a novel design and the suppliers who perform fabrication). (EEEL)
Japan	September 20, 1996	September 19, 1998	R of D with the Agency of Industrial Science and Technology (AIST), MITI for production and evaluation of functionally gradient materials (FGM). (MSEL)
Japan	February 17, 1997	February 21, 1999	Implementing Agreement with the National Aerospace Laboratory Kakuda Research Center under the U.S.-Japan Agreement for Science and Technology to compare measurement techniques to determine the thermal conductivity of ceramic coatings on metallic substrates.
Japan	October 16, 1992	October 15, 1997	Cooperative Research Project with the National Research Institute for Metals (NRIM) on a database of properties for high-temperature superconductor materials. (MSEL)
Japan	January 12, 1998	January 11, 2000	R of D with the National Institute of Materials and Chemistry to research quantitative surface analysis for catalyst by electron spectroscopy. (CSTL)

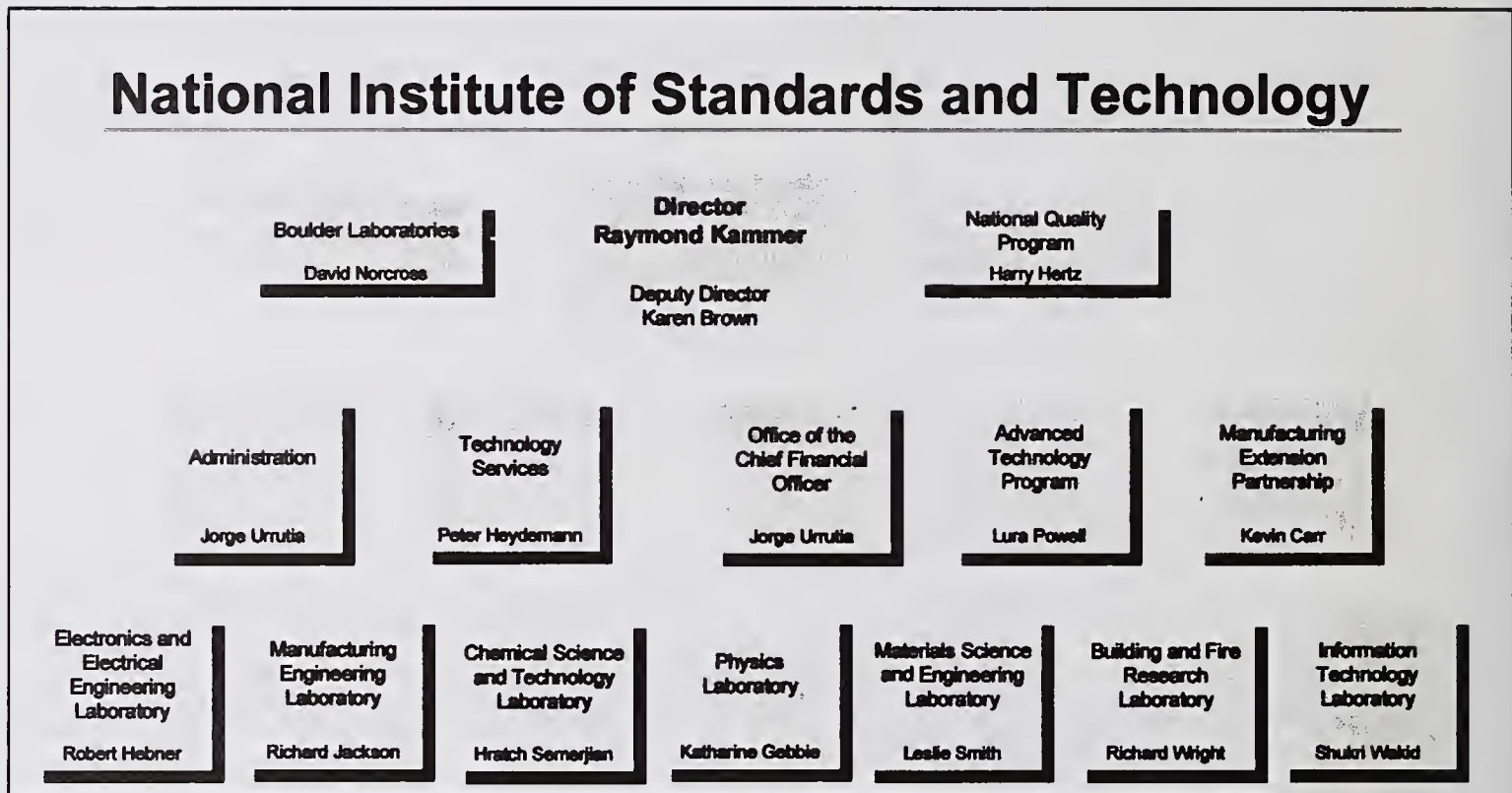
Japan	March 27, 1997	indefinite	R of D with the National Research Laboratory of Metrology on continuing intercomparisons of hardness standards. (MSEL)
Korea	August 16, 1993	August 15, 1998	Agreement with Korea Advanced Institute of Science and Technology KAIST for cooperation in materials science. (MSEL)
Korea	August 14, 1995	August 13, 1998	Project Annex to the MOU with the Korean Research Institute of Standards and Science (KRISS) for cooperation in laser spectroscopy. (CSTL)
Korea	April 9, 1997	April 30, 1998	Project Annex D to the MOU with the Korea Telecom Research and Development Group of Korea Telecommunications Authority (aka KTRL) for science and technology cooperation ATM/BISDN conformance and interoperability testing. (ITL)
Korea	September 26, 1995	September 25, 2000	Implementing Agreement under the Science and Technology umbrella agreement with the Korea Institute of Energy Research (KIER) to exchange science and technology knowledge and conduct joint research in energy technology. (BFRL)
The Netherlands	February 29, 1996	indefinite	Letter of Intent for cooperation with the Netherlands Meetinstituut Van Swinden Laboratory for cooperation on standards, and equivalencies.
New Zealand	April 7, 1983	July 17, 1998	Mutual Recognition Agreement between NVLAP and the Testing Laboratory Registration Council of New Zealand (TELARC). Renewed 7/18/97 for one year.

Russia	March 28, 1997	March 27, 2000	IA with the Institute of Crystallography of the RAS to study neutron and X-ray reflectivity properties of the structure and mechanisms of formation of Langmuir Blodgett films. (MSEL)
Russia	August 20, 1997	August 19, 1998	IA with the Russian State Metrological and Certification Analytical Center (ANTECH) a unit of the Russian Committee for Standardization, Metrology and Certification (GOSSTANDART) to update the Standard Reference Database on X-ray photoelectron spectroscopy (XPS). (TS)
Russia	November 9, 1994	November 8, 2003	Letter of Agreement with the Institute of Experimental Meteorology SPA "Typhoon" to develop ocean based reference materials. (PL)
South Africa	May 19, 1998	July 22, 2001	IA under the Agreement with CSIR. (MEP)
American Institute in Taiwan	November 2, 1994	indefinite	IA with the Telecommunications Laboratories (TL) through American Institute in Taiwan (AIT) and the Taipei Economic and Cultural Representative Office (TECRO) or (CCNAA) for telecommunications. (ITL)
AIT/TECRO	January 2, 1997	indefinite	Cooperative Program in Physical Sciences between the American Institute in Taiwan (AIT) and the Taipei Economic and Cultural Representative Office (TECRO) in the United States.
AIT/Taiwan/TECRO	September 15, 1998	September 14, 2002	IA with AIT/TECRO for cooperation in the field of nanometrology. (MEL)
United Kingdom	June 10, 1994	June 9, 1999	Letter of Arrangement with the National Physical Laboratory or cooperative studies on advanced materials. (MSEL)

Multilateral	September 2, 1998	September 1, 2000	International accord with France, United Kingdom, Italy, Canada, Japan, Germany and the EC- VAMAS- for cooperation on materials science.
Multilateral	October 1, 1996	January 1, 1999	Statement of Intent with the Danish Institute of Fundamental Metrology and Hungarian National Office of Measures on intercomparison of electrolytic conductivity solutions. (CSTL)

Appendix 2

Organizational Chart



Appendix 3

Abbreviations

Agency on Industrial Science and Technology (AIST)
American Institute in Taiwan (AIT)
Russian State Metrological and Certification Analytical Center (ANTECH)
Asian Pacific Economic Community (APEC)
American Association for Testing and Materials (ASTM)
Asynchronous Transfer Mode (ATM)
Advanced Technology Program (ATP)

Bhabha Atomic Research Center (BARC)
U.S.-Israel Binational Industrial Research and Development Foundation (BIRD)
Broadband Integrated Services Digital Network (BISDN)
Building and Fire Research Laboratory (BFRL)
International Bureau of Weights and Measures (BIPM)

Cable-Access Television (CATV)
Common Criteria (CC)
Comite Consultatif d'Electricite (CCE)
Consultative Committee du Metrologie (CCM)
Center for Cellular and Molecular Biology (CCMB)
Comite Consultatif pour la Quantite de Matiere (CCQM)
Comite Consultatif de Thermometrie (CCT)
National Center for Metrology (CENAM)
International Council for Building Research, Studies and Document (CIB)
Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas (CIEMAT)
International Committee on Weights and Measures (CIPM)
National Council for Science and Technology (CONACYT)
National Council for Scientific and Technological Research (CONICIT)
Consiglio Nazionale delle Ricerche (CNR)
Centro Radiochimica e Analisi per attivazione (CNR)
Conference on Computer Assurance (COMPASS)
Coating Research Institute (CORI)
Certified Reference Material (CRM)
Central Scientific Instruments Organization (CSIO)
Communications Security Establishment (CSE)
Centre Scientifique et Technique du Batiment (CSTB)
Chemical Science and Technology Laboratory (CSTL)

Directorate General XII (DGXII)
Deutsches Kalibrierdienst (DKD)

European Commission (EC)

erbium-doped fiber amplifier (EDFA)
Electronics and Electrical Engineering Laboratory (EEEL)
Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Roma (ENEA)
Electrotechnical Laboratory (ETL)
European Union (EU)

Federal Emergency Management Agency (FEMA)
Forschungsgesellschaft für Informationstechnik mbH (FIT)
Ministry of Development (FOMENTO)
Former Yugoslav Republic of Macedonia (FYR of Macedonia)

Gulf Cooperation Council (GCC)
Russian Committee for Standardization, Metrology and Certification (GOSSTANDART)

International Atomic Energy Agency (IAEA)
Indian Association for Cultivation of Science (IACS)
International Electrotechnical Commission (IEC)
Istituto Elettrotecnico Nazionale "Galileo Ferraris" (IEN)
Internet Engineering Task Force (IETF)
International Federation for Information Processing (IFIP)
Indira Gandhi Centre for Atomic Research (IGCAR)
Indian Institute of Science (IIS)
Indian Institute of Technology (IIT)
Institute Laue Langevin (ILL)
Istituto di Metrologia "G. Colonnetti" (IMGC)
Intelligent Manufacturing Systems (IMS)
National Metrology and Standards Institute of Brazil (INMETRO)
Immigration and Naturalization Service (INS)
National Institute for Industrial Technology (INTI)
Institute for Research in Construction (IRC)
International Standards Organizations (ISO)
Istituto Superiore di Sanita (ISS)
International Trade Administration (ITA)
Industrial Technology Research Institute (ITRI)
Information Technology Laboratory (ITL)

Korean Institute of Energy Research (KIER)
Korean Research Institute of Standard Sciences (KRISS)
Korea Telecom Research Laboratories (KTRL)

European Laboratory for Nonlinear Spectroscopy (LENS)

Manufacturing Engineering Laboratory (MEL)
Manufacturing Extension Partnership (MEP)
Ministry of International Trade and Industry (MITI)
Memorandum of Understanding (MOU)

Materials Science and Engineering Laboratory (MSEL)

National Academy of Sciences (NAS)

North Atlantic Treaty Organization (NATO)

National Security Agency's National Computer Security Center (NCSC)

National Center for Standards and Certification Information (NCSCI)

Network in Microelectronic System Integration Packaging (NETPACK)

National Institutes of Health (NIH)

National Institute of Standards (NIS)

National Institute of Standards and Technology (NIST)

Nederlands Meetinstituut (NMI)

Nederlands Meetinstituut Van Swinden Laboratory (NMI VSL)

National Metallurgical Laboratory (NML)

National Physical Laboratory (NPL)

National Research Council (NRC)

National Research Laboratory (NRL)

National Science Council (NSC)

National Science Foundation (NSF)

National Voluntary Laboratory Accreditation Program (NVLAP)

Office of Academic Affairs (OAA)

Organization of American States (OAS)

Office of International Affairs (OIA)

Office of International and Academic Affairs (OIAA)

International Organization of Legal Metrology (OIML)

Oficina Nacional de Normas y Unidades de Medida (ONNUM)

Process Industry Executive for Achieving Business Advantage Using Standards of Data Exchange
(PIEBASE)

Physics Laboratory (PL)

polar mode dispersion (PMD)

Petersburg Nuclear Physics Institute (PNPI)

Politecnico di Torino (PT)

Physikalisch-Technische Bundesanstalt (PTB)

Police Scientific Development Branch (PSDB)

Russian Academy of Science (RAS)

International Union of Testing and Research Laboratories for Materials and Structures (RILEM)

R&D Institute of Metals and Composites for Future Industries (RIMCOF)

Saudi Arabian Standards Organization (SASO)

Secretariat of Science & Technology (SECyT)

Secretary of Commerce and Industrial Development (SECOFI)

Semiconductor Equipment and Materials International (SEMI)

Structured Query Language (SQL)

Standard Reference Materials (SRM)

Science and Technology (S&T)
Japanese Science and Technology Agency (STA)
Standard for the Exchange of Product model data (STEP)

Taipei Economic and Cultural Representative Office in the United States (TECRO)
Technical Standards Activities Program (TSAP)
Telecommunications Industry Association (TIA)
Tata Institute of Fundamental Research (TIFR)
Taiwan Telecommunication Laboratories (TL)
U.S./Israel/Jordan Trilateral Industrial Development Initiative (TRIDE)

U.S.-Japan Cooperative Program in Natural Resources (UJNR)
United States Agency for International Development (USAID)
United States Information Agency (USIA)
Federal University of the Rio Grande of the South (UFGRS)
U.S.-India Fund (USIF)
U.S. Special Trade Representative's Office (USTR)

Very-Large Scale Integration (VLSI)

World Trade Organization (WTO)

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