TECHNOLOGY ADMINISTRATION

OFFICE OF THE UNDER SECRETARY/OFFICE OF TECHNOLOGY POLICY

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NATIONAL TECHNICAL INFORMATION SERVICE

FISCAL YEAR 2000

BUDGET REQUEST TO CONGRESS

Exhibit 1

Department of Commerce
National Institute of Standards and Technology

BUDGET ESTIMATES, FISCAL YEAR 2000
CONGRESSIONAL BUDGET SUBMISSION

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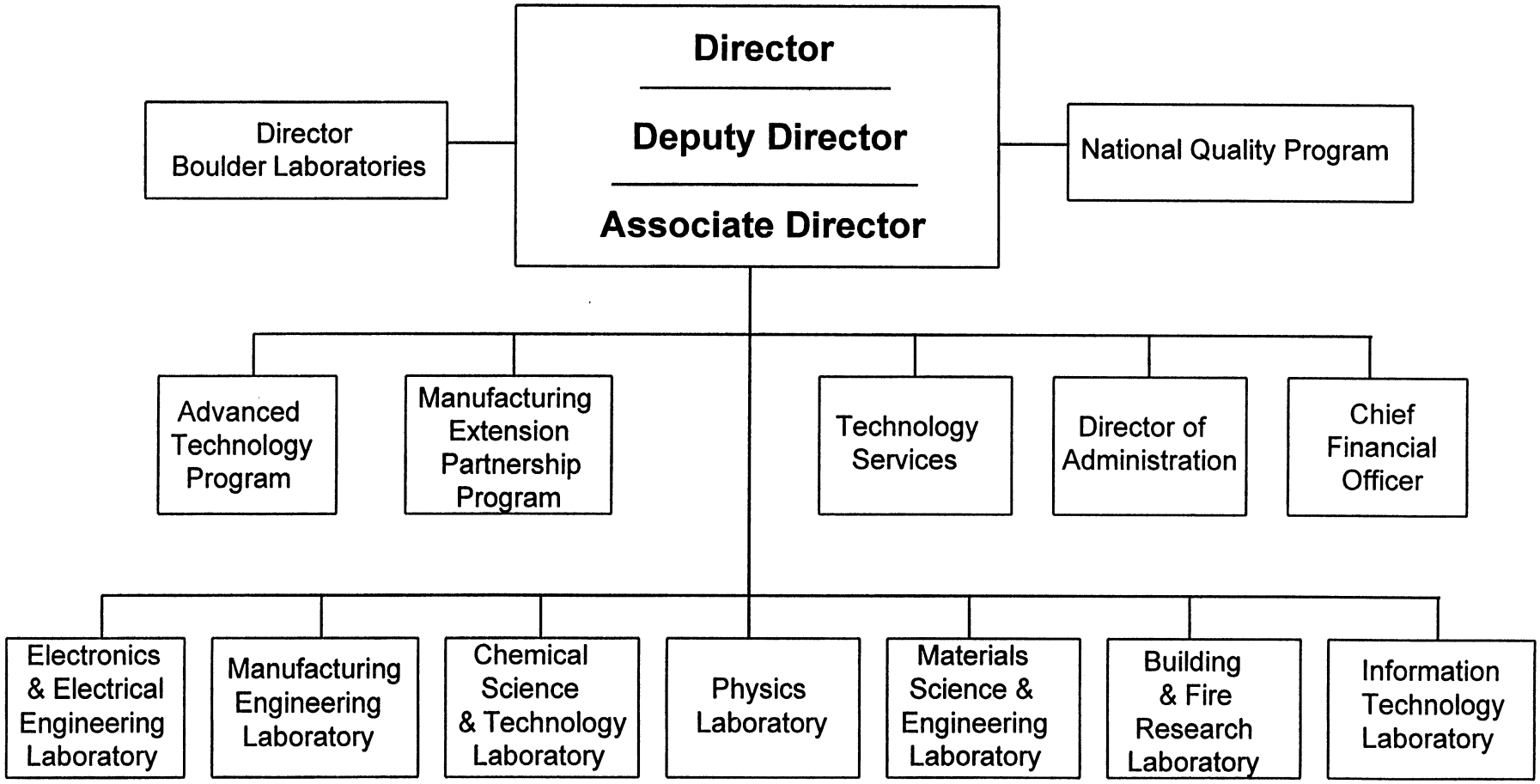
U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology



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DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Budget Estimates, Fiscal Year 2000
President's Submission

GENERAL STATEMENT

Technology is driving growth at every level of our economy. Leading economists estimate that technical change accounts for at least one half of the economic growth in advanced economies around the world. All advanced economies must rely on a technological infrastructure that both sustains economic activity and promotes technological progress. As stated by Secretary of Commerce Daley, "Companies using technologies are more productive and profitable, pay higher wages, and increase employment more rapidly than firms that do not." NIST's primary mission is to promote U.S. economic growth by working with industry to develop and apply technology, measurements, and standards -- providing the basic technical infrastructure needed by industry to transform technology into the profits and jobs that yield the true returns to American taxpayers. NIST's programs support two of the major themes of the DoC mission as stated in the Commerce Strategic Plan: (1) build for the future and promote U.S. competitiveness in the global marketplace by strengthening and safeguarding the Nation's economic infrastructure and (2) keep America competitive with cutting-edge science and technology and a world-class information base.

Goals of the Program

NIST's goal is to promote U.S. economic growth by working with industry to develop and apply technology, measurements, and standards.

Statement of Objectives

NIST carries out its goal through programs spanning four interrelated areas, described below:

- **Measurement and Standards Infrastructure**: The **Measurement and Standards Laboratories Program** is planned and implemented in cooperation with industry and focused on infrastructural technologies such as measurements, standards, evaluated data, and test methods which provide a common language for use by industry in commerce. The accuracy of transactions amounting to trillions of dollars in sales depends on NIST's maintenance and development of accurate weights and measures for the fair exchange of goods and services. Trillions of dollars in additional sales are supported by NIST-

delivered measurement techniques, equipment, calibrations, and standards. Moreover, U.S. scientists rely daily on NIST's evaluated data services and measurement expertise for a host of both basic and applied research activities. The most recent economic impact studies conducted for specific NIST measurement and standards research programs found benefit-cost ratios ranging from 4 to 1 to 10 to 1.

- **Technology Development**: The rigorously competitive **Advanced Technology Program (ATP)** invests in cost-shared research by individual companies or industry-led joint ventures. ATP has produced many technology successes, preparing the foundation for major economic gains. By enabling 431 cost-shared research projects by companies or industry-led joint ventures, ATP has fostered economically important R&D that companies would not have funded as strongly, either because the research is too risky or the benefits are too diffuse. ATP also has served a critical role in forging industry/industry and industry/university partnerships that have accelerated research progress. The most important broad-based economic impacts of ATP-supported technologies will emerge in the years ahead, reflecting the high-risk, longer-term time frame of this program.

- **Technical Assistance and Technology Diffusion**: The grassroots **Manufacturing Extension Partnership (MEP) Program** strengthens the global competitiveness of the more than 382,000 smaller U.S.-based manufacturing firms by providing a nationwide network of manufacturing extension centers integrated with Federal, state, local, and private-sector programs in support of U.S. competitiveness. The MEP centers provide access to industrial resources, services, and expertise related to modern best practices and manufacturing methodologies. Studies of companies assisted by MEP extension centers clearly show improvements in productivity in comparison to non-client companies. Now that MEP has achieved nationwide coverage with extension centers covering all 50 states, the District of Columbia, and Puerto Rico, MEP will focus on optimizing system and center performance, thereby increasing the number of small and medium-sized manufacturers that benefit from its services.

- **Business Quality and Performance Improvement**: The highly visible **Baldrige National Quality Program (BNQP)** enhances the competitiveness, quality, and productivity of U.S. organizations for the benefit of all citizens. The BNQP, which manages the Malcolm Baldrige National Quality Award, strives to make performance excellence a national priority and to disseminate best practices across the United States. Each year more than 300 experts from industry, universities, government, and non-profit organizations volunteer many hours reviewing applications for the award, conducting site visits, and providing each applicant with an extensive feedback report citing strengths and opportunities for improvement. To date, the Baldrige Award recipients have given more than 30,000 presentations reaching thousands of organizations. More than 1.7 million copies of the Baldrige Criteria for Performance Excellence have been distributed since 1988, and evidence

indicates a long-term link between use of the Baldrige Criteria and improved business performance. Health care and education are now benefitting from sector-specific criteria and new award categories.

Four fundamental principles drive NIST's work:

- NIST focuses on work that is vital to the country's technology infrastructure, but which neither industry nor the government provides separately. This is work that private companies cannot or will not take on by themselves – either because they cannot capture the broad-based benefits that will accrue to the economy at large or because the tasks are long-term and carry high risks and, therefore, fall outside the scope of what industry can do alone.

- Industry drives NIST's priorities, because follow-on investments by the private sector generate the applications that ultimately produce high economic and social benefits to the Nation.

- Rigorous, open, technically sound, and competitive processes are the hallmark of all of NIST's efforts. All of the Institute's programs are strictly merit-based, and NIST continually strives to maintain its reputation for accuracy, quality, and integrity in all of its functions.

- NIST relies heavily on evaluation of its work to ensure that industry and the taxpayers are receiving the greatest possible return on their investment.

Environmental Assumptions

Globalization is creating new policy challenges. The rapid globalization of industry heightens the need to further harmonize divergent national systems of measurement, standards, and conformity assessment. Moreover, globalization increases the need for careful coordination and strategic development of all export-related policies.

Technological change has accelerated the need for new technical infrastructure capabilities. Next-generation technologies require ever more precise measurements and supporting measurement infrastructure. For instance, rapid growth in the development and application of information technologies has generated new measurement and standards needs. Moreover, the Nation's rapid and pervasive adoption of digital technologies has elevated the need for a more reliable, secure, and accessible information infrastructure.

Industry relies increasingly on external sources of technology. Competitive pressure for faster cycle times, plus the increased breadth of scientific and technical competencies required at the forefront of technology development, encourage firms to rely upon external sources

of technology and expertise—including but not limited to infrastructure technologies. In addition, the productivity of the Nation's businesses is significantly affected by the quality, reliability, and efficiency of the Nation's physical infrastructure.

U.S. firms invest heavily in R&D, but market pressures deter investments in particular types of technology. Because private industry firms must be able to recognize returns on a time frame and at a level satisfactory to investors, they spend about half of what the Federal government does on basic research. For the same reasons, industry will continue to invest relatively less in certain types of technologies: infrastructural technologies, which require distinct competencies and are broadly applied; enabling or multi-use technologies, which benefit multiple segments of an industry or group of industries; and high potential breakthrough technologies, which typically involve risk levels and time frames that far exceed the horizons of individual firms.

Small manufacturers are critical elements in all of the multiple industrial sectors of the Nation's supply chains. They also will continue to generate large numbers of jobs and growth opportunities. However, small firms will continue to rely upon outside expertise as they struggle to overcome knowledge and resource barriers to technology adoption and productivity improvement.

Technology has the greatest positive effect on organizations when it is complemented by high performance management practices. Many U.S. manufacturing firms have demonstrated sustained performance improvements by adopting quality management practices. Many of these benefits have yet to be realized by the Nation's service industries—health care, education, and others—which account for a large and increasing share of the Nation's total output.

In an environment of rapid technological change and global competition, the Department of Commerce will continue to ensure and enhance long-term U.S. economic opportunities through policies and programs that will improve the business environment and provide the technical capabilities that industry needs to compete.

Summary of Proposed Budget Increases

Adjustments to base in all appropriations result in an increase of $11,753,000 and a decrease of 30 positions. This excludes adjustments for fiscal year 1999 rescission and Year 2000 supplemental.

To carry out its mission, goals and objectives, NIST requests program changes totaling $76,053,000 and a net decrease of 19 positions for the elements of its integrated system of industry support. Brief descriptions of each program change follow.

The Scientific and Technical Research and Services appropriation request includes program increases totaling $5,500,000 and 12 positions, and program decreases totaling $5,837,000 and 33 positions.

Export Promotion. NIST requests an increase of $2,000,000 and 2 positions to participate in a Departmental crosscut to remove barriers to expanded global trade by U.S. companies through international comparisons of measurement standards, and streamlining of the domestic standards development process.

Critical Infrastructure Protection. NIST requests an increase of $3,000,000 and 8 positions to develop and disseminate standards, measurements, and testing methodologies needed to protect the information technology elements of critical national infrastructures in support of Presidential Decision Directive (PDD) #63, announced in May 1998.

Teacher Science and Technology Enhancement Institute Program. NIST requests an increase of $500,000 and 2 positions to begin development of a program to improve the skills and foster the professional development of mathematics and science teachers in elementary, middle, and secondary schools.

Measurement and Standards Laboratory Research Program Base Reduction: NIST requests a decrease of $4,637,000 and 33 positions recognizing the program evolution of its measurement science base to reflect changing program demands and priorities.

The reduction to funding and positions in the MSL subactivities is as follows:

	$K	**Positions**
Electronics and electrical engineering	-$700	-5
Manufacturing engineering	-400	-4
Chemical science and technology	-750	-4
Physics	-500	-4
Materials science and engineering	-600	-5
Building and fire research	-500	-4
Computer science and applied mathematics	-700	5
Technology assistance	-487	-2

The Industrial Technology Services appropriation request includes an increase for the Advanced Technology Program, and a net decrease for the Manufacturing Extension Partnership.

Advanced Technology Program. NIST requests an increase of $34,500,000 to continue expansion of the ATP so that it will be a significant catalyst in bringing U.S. science and technology to the marketplace by leading industry to a sustained commitment to higher risk research, promoting higher degrees of innovation and risk-taking, and promoting much more aggressive experimentation in teaming and alliance formation.

Manufacturing Extension Partnership. NIST requests an increase of $1,000,000 and 2 positions to design, document and effectively deploy to all NIST-MEP manufacturing extension centers the highest priority best practices in areas such as employee development and service delivery. This initiative will enhance the quality and effectiveness of local centers and ensure that new services are quickly introduced to help small- and medium-sized businesses to maintain and improve their competitiveness in the global marketplace.

NIST also proposes a decrease of $9,110,000 resulting from the natural maturation of existing centers.

The Construction of Research Facilities appropriation request includes one increase and one decrease:

- **Facilities Technical Obsolescence.** NIST requests an increase of $55,000,000 to begin construction of the Advanced Measurement Laboratory (AML). This increase, along with the $40,000,000 of base funding and $108,300,000 that was appropriated in fiscal years 1998 and 1999 for construction, will allow NIST to award a contract for construction of the Advanced Measurement Laboratory (AML). An additional $15,000,000 will be needed in fiscal year 2001 for post-construction fit-up, relocation, and communications costs.

- **Safety, Capacity, Maintenance and Major Repairs.** NIST requests a one-time decrease of $5,000,000, providing a level of funding sufficient to address the highest priority safety, capacity, maintenance, and major repair projects in fiscal year 2000. While a significant backlog of projects remains, this reduction is proposed to partially offset the cost of AML construction.

Summary of Performance and Resources

Performance: Since its establishment in 1901 as the National Bureau of Standards, NIST has collaborated closely with industry to anticipate and address the Nation's measurement, standards, and technology needs. NIST's extensive and diverse interactions with industry provide an important source of information about the quality, direction, and future demand for NIST products and services.

NIST evaluates its performance and plans its work in part through direct customer feedback, but also through three distinct evaluation mechanisms: peer review and other forms of external assessment; economic impact studies; and quantitative output tracking. As described below, NIST's four programs each uses a different mix of these three mechanisms, tailored to each program's purpose and functions. In addition, NIST as a whole benefits from the agency-wide external reviews and guidance provided by the Visiting Committee on Advanced Technology, a legislatively mandated panel of 15 external advisors that meets quarterly to review NIST's general policy, organization, budget, and programs.

Measurement and Standards Laboratories

NIST has developed a comprehensive and robust performance evaluation system for the Measurement and Standards Laboratories (MSL). The system is based upon three types of performance data: 1) annual peer review of each laboratory's technical quality and direction, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. In addition, NIST uses a wide variety of contacts with its customers to continually evaluate its output relative to the Nation's measurement and standards needs.

NIST developed this diverse performance evaluation system in response to the intrinsic challenges of measuring the performance and long term impact of research programs. First, the primary output of research is scientific and technical knowledge, which itself is difficult to measure directly and comprehensively. Second, the outcomes from research often do not begin to accrue until several years after the research program has been completed, and the diffusion of benefits often affects broad segments of industry and society over long time periods. By utilizing diverse yet complementary sources of performance data, NIST can thoroughly evaluate its products, services, and processes at different stages and from different perspectives.

Peer Review and Benchmarking: Since 1959 the NIST Measurement and Standards Laboratories have been reviewed annually by the National Research Council. The current NRC Board on Assessment of NIST Programs is composed of approximately 150 scientists and engineers, organized into seven panels (one for each of the seven NIST laboratories) plus two sub-panels for specialized programs (JILA and the NIST Center for Neutron Research). Panel reviews are reported at the Division level (the major organizational unit for the Laboratories), and build upon assessments of research processes at the project and program levels.

The NRC Board on Assessment review is independent, technically sophisticated, and extensive. Each panel conducts a two- to three-day on-site review of an individual laboratory's technical quality, with particular attention to the following factors:

- The technical merit of the laboratory programs relative to the current state-of-the-art;
- The degree to which the laboratory programs conform to their mission;

- The effectiveness with which the laboratory programs are carried out and the results disseminated; and
- Insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The NRC panel reports for each laboratory become the basis for a comprehensive annual peer review report of the NIST MSL. This report not only provides an external quality assessment for GPRA purposes, but also provides each laboratory with a valuable source of information for its own performance assessment, planning, and management functions. In addition, NIST's Visiting Committee on Advanced Technology uses the NRC report and associated briefings within its evaluation of NIST as a whole. Each MSL subactivity section in the STRS budget justification includes information on NRC Board on Assessment activities.

NIST complements the NRC's assessment of technical quality with its own benchmarking data. NIST must perform world-class research to provide technical leadership for the Nation's measurement infrastructure and maintain the best measurement capabilities in the world. To track their performance and facilitate planning, the NIST laboratories conduct ongoing benchmarking assessments of their measurement capabilities relative to other national metrology institutes (NMIs) and measurement laboratories. This activity also assesses U.S. industry's evolving measurement and standards needs. To remain innovative and internationally competitive, U.S. industry must have access to the best available technology infrastructure. NIST's status as a leading NMI also provides a basis for combating technical barriers to U.S. exports, such as product acceptance testing requirements that vary from U.S. measurement standards and practices. Illustrative examples of benchmarking data for the NIST MSL are included below:

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Amount of substance	Mol – inorganics	10^{-6} – 10^{-1} mol/mol	Best in the world	Aerospace, metals, environmental monitoring
	Mol – organics	10^{-6} – 10^{-1} mol/mol	Best in the world	Environmental/health measurements, agricultural and food processing, petroleum, advanced materials
	Mol – Gases	10^{-15} – 10^{-1} mol/mol	Best in the world	Automotive, power plant emissions trading, specialty gas manufacturers
Temperature	Kelvin	0.65 – 25 K	Best in the world	Instrument manufacturing, aerospace
		13.8 – 273.16 K	Best in the world	Cryogenics, refrigeration
		83.8 – 934 K	Best in the world	Chemicals, petrochemicals
		273.16 – 1235 K	Best in the world	Medical applications, semiconductors
Pressure & vacuum	Pascal	Vacuum < 0.1 Pa	Best in the world	Vacuum processing, semiconductors
		0.1 Pa – 350 kPa	Best in the world	Aircraft altitude, health care
		10 kPa – 270 Mpa	State of the art	Valve manufacturers
Liquid density	Gram/meter^3	0.85 – 1.1 g/cm^3	State of the art	Petroleum, alcohol, natural gas
		1.1. – 3.0 g/cm^3	State of the art	Nuclear utilities
Humidity (moisture concentration in gases)	Mol of water/ Mol of carrier gas	5 nmol/mol – 10 mmol/mol	Best in the world	Semiconductors, nuclear utilities
		1 μmol/mol – 0.1 mol/mol	Best in the world	Food and chemical processing, instrument manufacturers

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Liquid flowrate	Kilogram/sec	0.1 – 150 g/s - (hydrocarbons).	Best in the world	Aerospace (aircraft engines)
		0.01 – 600 kg/s (water)	State of the art	Potable water, electric power generation
Air speed	Meter/sec.	0.15 – 10 m/s	Best in the world	Environmental monitoring
		4.0 – 67 m/s	Best in the world	Weather observations
Length (iodine stabilized laser wavelength)	Meter	Not Applicable	State of the art	Primary method to realize the unit (below are specific application areas)
SEM magnification SRMs	Meter	0.5 μm – 50 μm	Best in the world	Semiconductors, mass storage industry, instrument manufacturers
Length stds. for calibrating coordinate meas. machines	Meter	0.05m –1m	State of the art	Discrete parts, aerospace, heavy equipment, optical components, automotive
Surface finish	Meter	0 μm – 50 μm	State of the art	Discrete parts, optical components
IC photomask linewidth	Meter	0.5 μm – 30 μm	Best in the world	Semiconductors
IC photomask pitch	Meter	2 μm – 70 μm	State of the art	
Linescales	Meter	2 μm – 1 m	Best in the world	
Gage blocks (Interferometric)	Meter	1 mm – 100 mm	State of the art	Discrete parts, aerospace, heavy equipment, automotive
Mass	Kilogram	1 mg – 1 g	Best in the world	Transducer manufacturers, aerospace, automotive, buildings, nuclear utilities, weighing industry, equity-in-trade
		1 kg	State of the art	
		10 kg – 10^4 kg	Not state of the art	
Force	Newton	4.4 N – 4.5 MN	Best in the world	Transducer manufacturers, aerospace, automotive, buildings, nuclear utilities
		4.5 MN – 50 MN	State of the art	
Acceleration	Meter/sec^2	9.8 m/s^2 (5 Hz – 20 kHz)	State of the art	
Acoustic pressure	Pascal	50 Hz – 20 kHz	State of the art	
Ultrasonic power	Watts	10 mW – 1 W	Best in the world	Health care

Key: “Best in the world” = only NMI at this level of practice; “State of the art” = one or more NMIs also at this level; “Not state of the art” = below other NMIs

Microeconomic Impact Assessments: NIST augments the performance data obtained through benchmarking and peer review with formal microeconomic impact assessments of the long-term impacts of MSL R&D programs. Impact assessments of NIST's R&D in specific technical areas are conducted by external economic and technical experts contracted by NIST. These studies provide both qualitative assessments and quantitative estimates of the economic impacts resulting from the different types of technology infrastructure that NIST provides to U.S. industry. Quantitative estimates are provided as cost-benefit ratios and/or social rates of return. Due to the cost and complexity of these in-depth studies, NIST can commission only a few per year. By their nature, these studies are retrospective, and because considerable time is required to allow impacts to appear and be measured, the actual impact data and analyses are usually available only after several years have elapsed since the project began.

The impact studies conducted to date consistently show high rates of return from NIST research, relative to both private investments in technology and other public technology investments. These results are not surprising, given that NIST targets its research at specific infrastructure problems that typically are faced by a large number of firms and/or industries and which have been identified through cooperative strategic planning with industry. The results of these impact assessments not only respond to the need to measure and analyze current and past performance but also contribute to on-going project management and strategic planning needs.

Each MSL subactivity section in the STRS budget justification includes information on economic impact studies and results.

Quantitative Output Metrics: In part due to the long time frame and intermittent character of economic impact assessments, NIST also tracks MSL activities through a series of quantitative output metrics. These measures convey useful information to management regarding the generation of particular NIST products and services, such as Standard Reference Materials, databases, calibration services, etc. However, these measures do not comprehensively represent the output from NIST laboratories, nor do they provide information about the quality or impact of particular products and services. Moreover, their interpretation requires careful attention to the meaning and context of each measure. For instance, NIST generates a great deal of valuable intellectual property, but chooses to patent that knowledge only when patenting represents the best mechanism for quickly and widely disseminating the knowledge to industry. Consequently, a stable (versus an increasing) trend line for patents and licenses may represent an optimal outcome.

Specific examples of quantitative performance measures for all NIST research programs are summarized as follows:

Quantitative Performance Measures
(All Sources of Funding)

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Services Output							
- Standard Reference Data							
-- database titles available	60	62	64	66	68	70	72
- Standard Reference Materials available for sale	1,299	1,315	1,330	1,345	1,360	1,375	1,390
- National Voluntary Laboratory Accreditation							
-- total accreditations	869	900	900	900	900	900	900
- Technology Support							
-- NIST patents filed and licenses issued	41	40	40	40	40	40	40
-- standards committees involving NIST staff	1,204	1,200	1,200	1,200	1,200	1,200	1,200
-- chairmanships held by NIST staff on standards committees	135	135	135	135	135	135	135
-- NIST staff on international committees	93	90	90	90	90	90	90
-- leadership positions held on international committees	28	30	30	30	30	30	30

Quantitative Performance Measures (continued)
(All Sources of Funding)

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
- Other Information Exchange							
-- number of NIST technical publications	2,217	2,100	2,100	2,100	2,000	2,000	2,000
-- number of major NIST-sponsored conferences & workshops	125	125	125	125	125	125	125
Product and Service Sales							
- Calibration and Testing							
-- number of items calibrated[1]	3,529	3,375	3,250	3,125	3,000	2,875	2,750
- SRM							
-- number of units sold [1]	36,814	38,000	37,500	37,000	36,500	36,000	36,000
- SRD							
-- number of database units distributed	4,911	5,300	5,400	5,500	5,600	5,700	5,700

[1] NIST estimates flat or gradual decreases over time in some areas as many of its customers rely increasingly on secondary laboratories that can provide services based on NIST primary standards. The number of SRM units sold in FY 1999 is an exception, however, due to a projected surge in sales of new and restocked SRMs.

Advanced Technology Program

The ATP continuously strives to define the state-of-the-art in technology impact/outcome evaluation. Highly qualified academic and consulting economists and other experts in evaluation, in addition to in-house staff, assist ATP in planning, modeling, and developing databases, and in conducting surveys, case studies, statistical and econometric analyses, and other studies to enhance program performance and the quality and reliability of performance metrics.

The ATP has developed a multi-faceted evaluation strategy in consultation with leading economists in the field of technological change. The main components of this strategy are:

- statistical profiling of applicants, projects, participants, technologies, and target applications;
- real-time monitoring of project developments by ATP staff;
- status reports on completed projects;
- interim measures of awardee progress towards developing and commercializing funded technologies;
- microeconomic case studies that focus in detail on project developments and outcomes over defined periods;
- macroeconomic projections of long-term project and program impacts and empirical assessment of long-term outcomes.

ATP's Applicant Database and Awards Database provide important descriptive information about applicants and the portfolio of ATP projects. These databases are augmented by a unique, integrated set of databases, called the "Business Reporting System," that is used to track the evolution of projects toward achieving their business and economic goals during the projects and extending into the post-project periods. All projects funded by ATP since 1993 and their participants are included in this reporting system. Third-party surveys are conducted periodically to provide updates on projects not in this system.

The Business Reporting System and survey data enable comprehensive statistical analyses of awardee progress. For example, a recent study of over 200 ATP projects funded from 1993-1995 shows more than 1,000 potential applications that have been identified for the technologies under development. It also shows that the ATP is having a significant impact on the ATP-funded technology development areas, by increasing industry's investment, accelerating the R&D process, stimulating broader-scope and more challenging technology development, and reducing the time-to-market in highly competitive markets. Eighty-six percent of ATP-funded organizations indicate they are already ahead in their R&D cycle as a result of ATP funding. Speed-to-market is considered "critical" or "important" for 98 percent of the commercial applications, and, even though most of the projects analyzed were at an early stage of R&D, about ten percent of companies, representing 15 percent of projects, indicated they have earned early revenues. Acceleration in time-to-market by two years or more is anticipated for 62 percent of planned commercial applications. The results are documented in *Development, Commercialization, and*

Diffusion of Enabling Technologies, Progress Report for Projects Funded 1993-1995, one of a series of studies commissioned in ATP's evaluation and analysis efforts.

In a recent study, economists at the Research Triangle Institute (RTI) developed a model for predicting the long-term social benefits of ATP's investment in medical technologies and applied the model in a preliminary analysis of seven ATP-funded tissue-engineering projects. Study estimates are that ATP's investment of $15.5 million may result in societal benefits worth billions of dollars. A status report of the first 38 ATP projects completed found that more than one-third had achieved early commercialization, a significant percentage of the others had commercialization efforts underway, and patent filings and publications were extensive in many of the projects.

In addition to these case studies, the ATP is funding a number of studies by leading researchers through the National Bureau of Economic Research to increase understanding of the underlying relationships among research, innovation, and economic growth. For example, one such study nearing completion investigates the use of joint ventures by businesses to create options in emerging technologies. Another examines the role that universities are playing in ATP projects.

Manufacturing Extension Partnership

The MEP has a number of evaluation and assessment activities in place to improve program management and performance, demonstrate its benefit to the Nation, and respond to the requirements of GPRA. These activities include:

- independent assessment of MEP programs, plans, and policies by the newly-established MEP National Advisory Board;
- legislatively mandated independent panel reviews of individual MEP center operations and outcomes conducted against criteria adapted from the Malcolm Baldrige National Quality Award; and
- regular program oversight and periodic review of individual MEP center operations and outcomes by NIST staff.

These reviews and assessments utilize a variety of metrics, including:

- output tabulations, such as the number of companies served and the number of activities completed;
- interim impacts on client competitiveness, such as increased sales, cost savings, capital investment, and inventory savings which are collected via regular surveys conducted by the Census Bureau on behalf of MEP; and
- analysis of more detailed information regarding the operations and performance of individual centers.

The Census Bureau surveys of MEP clients are designed to measure improvements in client firm business performance. While most MEP centers have been providing services for only a few years, results of these surveys indicate that MEP's network of manufacturing extension

services is fostering significant improvements in manufacturing and business performance. For example, based on recent surveys of MEP client companies around the country that completed projects for FY 1998, MEP services generated approximately $329 million in new sales, $33 million in labor and material savings, $44 million in inventory savings, and leveraged approximately $256 million in additional capital investment by client firms.[2] These estimates are conservative, as they represent only a subset of the wide variety of positive impacts MEP generates and do not reflect recurring or cumulative impacts.

MEP's National Advisory Board was created to provide guidance and advice on the MEP program from the perspective of its customers and providers who have a vision of industrial extension with a national scope. The Board represents the views and needs of various stakeholders on MEP programs, plans, and policies -- reviewing the soundness of MEP strategies and assessing current performance of the program against MEP's goals. The Board is comprised of prominent leaders from industry, state and local governments, academia, and labor who were selected for their expertise in manufacturing and industrial extension as well as their work on behalf of small manufacturers. The Board met three times during FY 1998. Major topics covered were: MEP's methods for measuring program impacts; new service areas that centers are offering to small- and medium-sized manufacturers (including lean manufacturing); Y2K remediation planning; workforce, export and international services; and the criticality of smaller manufacturers to supply chains. Also discussed were efforts to support professional development of center staff who provide services directly to manufacturers.

Baldrige National Quality Program

The Baldrige National Quality Program (BNQP) has its performance evaluated by its Board of Overseers, a prestigious group of national quality and business experts, which is a Federal advisory panel to the Secretary of Commerce. An important part of the Board's responsibility is to assess how well the BNQP is serving the national interest. The Board reviews all aspects of the BNQP, including the adequacy of the Evaluation Criteria and processes for making Baldrige Awards, and reports its recommendations to the Secretary. Other annual reviews are provided to NIST by the Panel of Judges and the Foundation for the Malcolm Baldrige National Quality Award. Moreover, the House Committee on Science, Space and Technology conducts periodic oversight hearings involving winners of the award, NIST, and outside experts to review the program's effectiveness and management issues. In addition, to assure ongoing responsiveness to the needs of U.S. industry and business, the BNQP utilizes an improvement questionnaire and annual Improvement Day. The BNQP uses several metrics for assessing information dissemination and outreach, including the number of BNQP documents viewed or downloaded from the World Wide Web, the number of criteria mailed, the number of state and local quality award programs supported by BNQP, and

[2] Reflects updated data as of January 1999.

tracking the number of presentations given by award winners. Ultimately, the program's effectiveness is evaluated by its impact on the performance of company winners and other users of the criteria.

A series of four NIST stock investment studies consistently show that quality management is associated with impressive returns. In the most recent study, a hypothetical investment of $1,000 was made in the Standard and Poor's 500 and in each of the publicly traded companies that has won the Malcolm Baldrige National Quality Award from 1988-1996. For the time the investment was tracked, the 18 award-winning companies outperformed the S&P 500 by about 2.4 to 1, a 362 percent return on investment compared to a 148 percent return for the S&P 500. The six whole company winners did somewhat better, outperforming the S&P 500 by 2.7 to 1 and achieving a 394 percent return on investment compared to a 147 percent return for the S&P 500, and the 52 publicly traded site-visited companies outperformed the S&P 500 by 2 to 1. This comparison suggests that successful companies tend to be those that implement quality and performance management practices. To more rigorously assess the effect of the BNQP on corporate performance, the BNQP recently initiated a formal economic impact study.

Construction of Research Facilities

The current plan for NIST's Construction of Research Facilities program was formulated with active engagement by NIST management and with oversight by NIST's Visiting Committee. It is the culmination of a long and thorough effort to ensure NIST keeps pace with advances in science and technology and the requirements of the National for Advanced Technical Measurements and Standards. NIST's FY 2000 request includes $95 million for construction of an Advanced Measurement Laboratory (AML) and $11.8 million for safety, capacity, maintenance, and major repairs. The $95 million along with $108.3 million that was appropriated in FY 1998 and FY 1999 will allow NIST to award a contract for construction of the AML. These new laboratories will be equal to, or better than, similar laboratories overseas. This facility will provide NIST with the temperature, humidity, vibration, and air cleanliness controls required to perform cutting-edge research in the 21st century. Such conditions are vital for housing the institute's most advanced metrology, physics, chemistry, electronics, engineering, and materials science research and will enable NIST to keep pace with rapid developments in semiconductors, industrial robots, computers, pharmaceuticals, and emerging technologies requiring molecular and atomic-level precision.

The $11.8 million is for Safety, Capacity, Maintenance, and Major Repair projects (SCMMR). Projects included in this category are related to keeping NIST's current buildings in good working order, providing a safe working environment, or delivering sufficient and reliable utilities and other services to laboratories. While a significant backlog of projects remain, totaling about $400 million (at the end of FY 1997, in FY 1999 dollars), the FY 2000 reduction of $5 million is proposed to partially offset the cost of the AML construction.

Performance measures for these programs are to keep construction projects within 10 percent of budget and schedule and to keep downtime for existing facilities within 10 percent.

Resources: The following is a comparison of NIST's FY 1999 Appropriation with its FY 2000 budget request and related data on employment.

Appropriation	(Dollar amounts in thousands)					
	1999 Appropriation Available		2000 Estimate		Increase or (Decrease) from 2000 Base	
	Permanent Positions	Amount	Permanent Positions	Amount	Permanent Positions	Amount
Scientific & Technical Research & Services	2,062	$280,136	2,011	$289,622	(21)	($337)
Industrial Technology Services	377	304,300[3]	379	338,536	2	26,390
Construction of Research Facilities	32	56,714	32	106,798	0	50,000
TOTAL	2,471	647,150	2,422	734,956	(19)	76,053

Reimbursable Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state and local governments, and the private sector. They include calibrations and special tests, advisory services, and the sale of Standard Reference Materials. The unique measurements and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other-agency work based on an established set of criteria which include (1) the need for traceability of measurements to national standards; (2) the need for work which cannot or will not be addressed by the private sector; (3) work supported

[3] Does not reflect Y2K supplemental funding of $21 million.

by legislation that authorizes or mandates certain services; (4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and (5) requests by the private sector for NIST action or services. In FY 1998, NIST's reimbursable program totaled $125 million; the estimate for FY 1999 is $106 million and for FY 2000 is $103 million. Reimbursable permanent positions totaled 712 in FY 1998, with estimates of 691 in FY 1999, and 691 in FY 2000. NIST permanent positions in FY 1998 totaled 3,162 with estimates of 3,162 in FY 1999, and 3,113 in FY 2000.

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Exhibit 5

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.		Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
	Currently Available, 1999	2,062	2,113	$279,738	$286,801	$280,136
	less: Unobligated balance from prior year			0	(6,063)	0
	plus: Working Capital Fund adjustment	0	0	398	398	0
NIST- 25	plus: 2000 Adjustments to base	(30)	(25)	10,823	9,823	10,823
	less: Prior year recoveries	0	0	(1,000)	0	(1,000)
	2000 Base Request	2,032	2,088	289,959	290,959	289,959
	plus: 2000 Program changes	(21)	(25)	(619)	(619)	(337)
	2000 Estimate	2,011	2,063	289,340	290,340	289,622

			1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
	Comparison by activity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
	Measurement and engineering research and standards											
NIST- 33	Electronics and electrical engineering	Pos./Approp	268	$35,802	276	$38,427	272	$39,760	267	$39,060	(5)	($700)
		FTE/Obl.	269	35,460	282	38,509	279	39,815	274	39,115	(5)	(700)
NIST- 45	Manufacturing engineering	Pos./Approp	155	18,907	155	19,368	153	20,116	149	19,716	(4)	(400)
		FTE/Obl.	156	18,995	160	19,714	158	20,151	154	19,751	(4)	(400)
NIST- 57	Chemical science and technology	Pos./Approp	242	31,765	242	32,493	238	33,661	236	33,911	(2)	250
		FTE/Obl.	242	31,726	248	33,032	244	33,730	241	33,898	(3)	168
NIST- 77	Physics	Pos./Approp	191	27,851	191	28,434	188	29,369	184	28,869	(4)	(500)
		FTE/Obl.	191	28,718	196	28,916	193	29,461	189	28,961	(4)	(500)

	Comparison by activity:		1998 Actual Per-sonnel	1998 Actual Amount	1999 Currently Available Per-sonnel	1999 Currently Available Amount	2000 Base Per-sonnel	2000 Base Amount	2000 Estimate Per-sonnel	2000 Estimate Amount	Increase/ (Decrease) Over 2000 Base Per-sonnel	Increase/ (Decrease) Over 2000 Base Amount
NIST- 87	Materials science and engineering	Pos./Approp	362	50,876	362	51,335	358	53,093	353	52,493	(5)	(600)
		FTE/Obl.	362	50,028	370	52,393	366	53,285	361	52,685	(5)	(600)
NIST- 97	Building and fire research	Pos./Approp	107	22,192	107	14,898	105	15,417	101	13,717	(4)	(1,700)
		FTE/Obl.	108	22,607	111	15,136	109	15,464	105	13,764	(4)	(1,700)
NIST- 111	Computer science and applied mathematics	Pos./Approp	327	43,035	327	43,943	322	45,458	325	47,758	3	2,300
		FTE/Obl.	327	42,047	334	44,830	329	45,662	330	47,762	1	2,100
NIST- 133	Technology assistance	Pos./Approp	105	14,865	111	17,131	109	17,636	107	18,149	(2)	513
		FTE/Obl.	106	14,772	113	17,524	113	17,801	111	18,314	(2)	513
NIST- 143	National quality program	Pos./Approp	33	2,981	40	4,870	39	5,046	39	5,046	0	0
		FTE/Obl.	33	3,010	39	4,874	40	5,046	40	5,046	0	0
NIST- 151	Research support activities	Pos./Approp	251	28,578	251	29,237	248	30,403	250	30,903	2	500
		FTE/Obl.	253	30,029	260	31,873	257	30,544	258	31,044	1	500
	TOTALS	Pos./Approp	2,041	276,852	2,062	280,136	2,032	289,959	2,011	289,622	(21)	(337)
		FTE/Obl.	2,047	277,392	2,113	286,801	2,088	290,959	2,063	290,340	(25)	(619)
	Adjustments to obligations:											
	Prior year recoveries			(1,397)		(1,000)		(1,000)		(1,000)		0
	Unobligated balance, start of year			(5,206)		(6,063)		0		0		0
	Unobligated balance, end of year			6,063		0		0		0		0
	Financing from transfers:											
	Transfers to other accounts (+)			0		398		0		282		282
	Appropriation			276,852		280,136		289,959		289,622		(337)

Exhibit 8

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm Pos	FTE	Required Amount	Absorbed Amount	Requested Amount
Adjustments:					
Restoration of FY 1999 Deobligation Offset	…	…	$1,000	…	$1,000
Financing:					
FY 2000 Deobligation Offset	…	…	(1,000)	…	(1,000)
Other Changes:					
1999 Pay raise (annualization)……			$1,360	…	$1,360
2000 Pay raise……			5,207	…	5,207
Payment to the working capital fund……			48	(48)	…
Annualization of positions financed in FY 1999……		5	…	…	…
Within-grade step increases……			1,542	(1,542)	…
Personal Benefits:					
Civil Service Retirement System (CSRS)……..			(335)	…	(335)
Federal Employees' Retirement System (FERS)……			421	…	421
Thrift Savings Plan (TSP)…….			79	…	79
Federal Insurance Contribution Act (FICA)…….			240	…	240
Health Insurance…….			315	…	315
Employees' Compensation Fund……..			19	…	19
Travel and transportation of persons……			96	(96)	…
Transportation of things……			9	…	9
Rental payments to GSA……			2	…	2
Rental payments to others……			26	(26)	…
Communications, utilities, and miscellaneous charges……			166	(66)	100
Postage……..			26	…	26
FTS……			12	…	12
Printing and reproduction……			34	…	34
Other services……			362	(362)	…
Commerce Administrative Management System (CAMS)……			2,277	…	2,277
National Archives and Record Administration Storage Costs……			30	…	30
GA, Working Capital Fund……			2,095	(2,095)	…
Supplies and materials…….			167	(167)	…
Reactor fuel……			27	…	27
Equipment…….			218	(218)	…
Absorption……	(30)	(30)	…		
Total, Adjustments to Base……	**(30)**	**(25)**	**14,443**	**(4,620)** [1]	**9,823**

[1] It is necessary to eliminate 30 permanent positions/FTE in order to accomplish the absorption of STRS adjustments to base. NIST does not have the resources to maintain approved staffing. The staff reduction will be accomplished by eliminating 30 unfilled vacancies.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Adjustments:		
Restoration of FY 1999 Deobligation Offset	0	$1,000

In FY 1999, NIST's budget authority was reduced by $1,000,000 based on an estimated level of prior year deobligations. This ATB would restore the reduction in FY 2000.

Financing:		
FY 2000 Deobligation Offset	0	(1,000)

NIST's FY 2000 budget authority is being reduced by the estimated level of prior year deobligations.

Other Changes:		
1999 Pay raise (annualization)	0	1,360

A pay raise of 3.6 percent was effective January 1, 1999.

Total cost in FY 2000 of 1999 pay raise	$5,441,000
Less amount requested in FY 1999	3,514,000
Less amount absorbed in FY 1999	567,000
Amount requested in 2000 to provide full-year cost of 1999 pay raise	1,360,000
Payment to Working Capital Fund	0
Total, 1999 pay raise increase in FY 2000	1,360,000

2000 Pay increase and related costs	0	5,255

A general pay raise of 4.4 percent was effective January 1, 2000.

Total cost in FY 2000 of pay increase	$5,301,000
Less amount absorbed in FY 2000	94,000
Amount requested for FY 2000 pay increase	5,207,000
Payment to Working Capital Fund	48,000
Total adjustment for FY 2000 pay increase	5,255,000

Annualization of positions financed in FY 1999	5	0

STRS requires an additional 5 FTEs to staff FY 1999 enacted increases at their full operating level in FY 2000.

Within-grade step increases	0	1,542

An increase of $1,542,000 is required to cover the cost of within-grade step increases.

Personnel benefits	0	739

Civil Service Retirement System (CSRS)	(335)
Federal Employees' Retirement System (FERS)	421
Thrift Savings Plan (TSP)	79
Federal Insurance Contribution Act (FICA) - OASDI	240
Health Insurance	315
Employees' Compensation Fund	19

Civil Service Retirement System (-$335,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 42.2 percent in FY 1999 to 39.2 percent in FY 2000. Contribution rates will remain the same.

Payroll subject to retirement systems ($131,102,000)	
Cost of CSRS contributions in FY 2000 ($131,102,000 x .392 x .0851).....	$4,373,458
Cost of CSRS contributions in FY 1999 ($131,102,000 x .422 x .0851).....	4,708,161
Total adjustment-to-base	(334,703)

Federal Employees' Retirement System ($421,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 57.8 percent in FY 1999 to 60.8 percent in FY 2000. The contribution rate will remain at 10.7 percent in FY 2000.

Payroll subject to retirement systems ($131,102,000)	
Basic benefit cost in FY 2000 ($131,102,000 x .608 x .107)	$8,528,972
Basic benefit cost in FY 1999 ($131,102,000 x .578 x .107)	8,108,134
Total adjustment-to-base	420,838

Thrift Savings Plan ($79,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2000 ($131,102,000 x .608 x .02).....	$1,594,200
Thrift plan cost in FY 1999 ($131,102,000 x .578 x .02).....	1,515,539
Total adjustment-to-base	78,661

Federal Insurance Contributions Act (FICA) - OASDI ($245,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from $70,725 in FY 1999 to $73,275 in FY 2000. The OASDI tax rate will remain 6.2 percent in FY 2000.

FERS payroll subject to FICA tax in 2000 ($131,102,000 x .608 x .925 x .062).....	$4,571,369
FERS payroll subject to FICA tax in 1999 ($131,102,000 x .578 x .925 x .062).....	4,345,808
Increase (FY 1999-FY 2000).....	225,561

OTP payroll subject to FICA tax in FY 2000 ($8,551,000 x .925 x .062 x .608)	$298,163
OTP payroll subject to FICA tax in FY 1999 ($8,551,000 x .925 x .062 x .578)	283,451
Change (FY 1999-FY 2000)	14,712
Total adjustment-to-base	240,273

Health insurance ($315,000) - Effective January 1998, NIST's contribution to Federal employees' health insurance premiums increased by 6.4 percent. Applied against the FY 1999 estimate, the FY 2000 health insurance costs are projected to increase by $315,008.

Employees' Compensation Fund ($19,000) – The Employees' Compensation Fund bill for the year ending June 30, 1998 is $19,000 higher than the bill for the year ending June 30, 1997. The STRS share of this bill is an increase of $19,000. The changes will be reimbursed to the Department of Labor pursuant to 5 U.S.C. 8147. This ATB is being absorbed in FY 2000.

Travel and transportation of persons 0 96

Per Diem ($96,000) - Effective January 1998 the General Services Administration raised per diem rates. This increase results in a 3.3 percent increase to NIST. This percentage was applied to the FY 1999 estimate to arrive at an increase of $96,000.

Transportation of things 0 9

The cost of transporting such things as household goods, scientific instruments, and hazardous materials increased during the past year. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate to arrive at an increase of $9,000.

Rental payments to GSA 0 2

GSA rates are projected to increase 2.6 percent in FY 2000. This percentage was applied to the FY 1999 estimate to arrive at an increase of $2,000.

Rental payments to others 0 26

An increase of $26,000 is required to pay the increased costs of rental payments to others. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate.

Communications, utilities, and miscellaneous charges 0 166

This adjustment to base is required to pay the additional cost of communications, utilities, and miscellaneous charges. The increased utility costs are based on a proposed rate increase by Pepco of 3.7 percent.

Postage 0 26

There was a 3 percent increase for postal services to the FY 1999 estimate.

FTS 0 12

There was a 4.9 percent increase for FTS to the FY 1999 estimate.

Printing and reproduction 0 34

GPO has provided an estimated rate increase of 3.1 percent. This percentage was applied to the FY 1999 estimate to arrive at an increase of $34,000.

Other services 0 362

NIST is requesting $362,000 to cover increased costs in other services. Other services include management and professional support services, training, maintenance of equipment, ADP services, purchases of goods and services from other Federal agencies, and Research and Development contracts. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for other services (excluding payments to the GA Working Capital Fund).

Commerce Administrative Management Systems (CAMS) 0 2,277

NIST is requesting CAMS ATB's for both shared and specific costs. Shared costs are estimated to increase $1,068,000 in FY 2000. An additional $1,209,000 is required to fund contractor support for conversion programs, for interface programs, and for training, including NIST specific documentation of CAMS, curriculum development, and instructors.

National Archives and Records Administration (NARA) storage costs 0 30

In FY 2000, NARA will begin billing agencies for records storage and maintenance costs. The estimate for STRS is $30,000.

GA, Working Capital Fund 0 2,095

An increase of $2,095,000 is required to fund increases in the Departmental WCF to maintain the current level of services.

Supplies and materials 0 167

The $167,000 increase was calculated by applying the deflator of 1.0 percent to the FY 1999 estimate for supplies and materials.

Nuclear fuel for NIST research reactor 0 27

The Department of Energy (DOE) provides NIST with nuclear fuel elements through an interagency agreement. DOE has established and qualified a single manufacturer, Babcock and Wilcox, for fabrication of the elements. The major users are three national laboratories, Oak Ridge, Brookhaven, and Idaho, plus NIST, which is the smallest user of the four. The shutdown of the Brookhaven reactor and scheduled reductions at Oak Ridge will significantly increase fabrication costs. Because many of the costs such as security, licensing fees, and inspections are fixed regardless of the number of elements fabricated it is estimated that the cost of each element will be $34,900 for FY 2000 and beyond. This is an increase of $3,229 per element over the FY 1999 estimate of $31,671.

$34,900 x 28 = $977,200 needed in FY 2000
31,671 x 30 = 950,130 already in budget in FY 1999
27,070 requested

Equipment		0	218
Equipment amortization	148,000		
Office-ADP-Other equipment	70,000		

Equipment amortization ($148,000) - An increase of $148,000 is required to offset the effects of inflation. The increase was based on applying the GDP price deflator of 1.0 percent to the FY 1999 STRS estimate for equipment amortization. The additional appropriated funds will be allocated to the NIST operating units to finance amortization charges paid to the NIST Working Capital Fund.

Office-ADP-Other equipment ($70,000) - The $70,000 increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for office machines, ADP, and other special equipment.

Subtotal, ATB's	**0**	**14,443**
Less ATB's Absorbed	**(30)**	**(4,620)**
Total, ATB's	**(25)**	**9,823**

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Electronics and electrical engineering

Line Item		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Electronics and electrical engineering	Pos./Approp	268	$0	276	$38,427	272	$39,760	267	$39,060	(5)	($700)
	FTE/Obl.	269	35,460	282	38,509	279	39,815	274	39,115	(5)	(700)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Electronics and electrical engineering

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Electronics and electrical engineering										
Direct obligations		0		$380		0		0		0
Reimbursable FTE/Obl	101	$13,693	98	14,171	95	$14,021	95	$14,021	0	0
Total	101	13,693	98	14,551	95	14,021	95	14,021	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
ELECTRONICS AND ELECTRICAL ENGINEERING

Goal Statement

The goals of this subactivity are to (1) improve U.S. competitiveness by providing the U.S. electronics and electrical industries with advanced measurement technologies to facilitate the development of new, competitive products and (2) to provide the measurement and calibration services, and the quality assurance methodology which underpins U.S. and international commerce, enables technological progress, and improves product reliability and manufacturing processes. The measurement capability is provided to industry principally through (1) documented high-performance measurement methods for electronic and related quantities and (2) national reference standards and services which assure consistency and accuracy of measurements across all users nationwide. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

Through the Electronics and Electrical Engineering subactivity, NIST supports the U.S. electronics industry, its suppliers and its customers, including the Federal government, by providing the measurement technology that U.S. industry needs to improve its competitive position. NIST provides both measurement methods and the national reference standards that are the fundamental basis for all electrical measurements in the U.S. and are required to assure the accuracy of industry's measurements. This measurement technology is required for industrial research and development, improvements in the manufacturing of quality products, proof of performance, marketplace transactions, including the entry of U.S. products into international markets, and product application. The resulting measurement technologies broadly support the fundamental electronic technologies of semiconductors, magnetics, and superconductors that underlie all modern electronic systems; information and communication technologies, including fiber optics, photonics, microwaves, and video; electrical power systems; the advanced manufacturing of electronic products; and electronic instrumentation.

The measurement capability provided by this program supports entities ranging from large electric utilities and aerospace companies to specialized instrument manufacturers employing just a few individuals. NIST's electrical measurements help advance the growing $350 billion per year electronics sector. For example, NIST provides microwave antenna measurements used by every major U.S. aerospace company and supports a U.S. microwave industry which supplies about one-half of the $60 billion world microwave equipment market. NIST also provides national reference standards that support the accuracy of the electric power meters in every home and business in the U.S., thus supporting the metering of more than $200 billion per year of electricity. Through its National Semiconductor Metrology Program, NIST provides a growing range of measurement techniques and reference data identified in the *National Technology Roadmap for Semiconductors* as essential for maintaining the competitiveness of the semiconductor, and hence the electronics industries. NIST provides the measurement capabilities underlying voluntary industry standards affecting the manufacture of every new U.S.-made optical fiber communications line, thus supporting a U.S. fiber optics industry supplying a domestic market on the order of $3 billion and competing in a world market on the order of $10 billion in 1997, and projected to grow at a rate of 13 percent annually. Traditionally, the U.S. has been competitive in optical fiber cable, but in broad terms, Japan is believed to lead the rest of the world in optoelectronic components, including those used in telecommunications. NIST's measurement methodology is helping to address this inequity.

NIST's role is to remove trade barriers caused by incomplete, inaccurate, or inappropriate measurements that individual companies cannot resolve because they lack one or more of NIST's special characteristics, i.e., impartial position, recognized measurement capability, expertise in a wide range of measurement areas, direct access to national standards, or authority as the lead U.S. agency for measurements. These characteristics permit NIST to do what individual companies cannot: gain access to industry information needed to resolve industry-wide measurement problems; develop measurement solutions and national reference standards that benefit the industry as a whole across diverse product lines; and gain acceptance of those solutions by U.S. industry and its international customers so that U.S. products can be sold worldwide.

The FY 2000 base program operating objectives include the following:

- Complete modifications to ampere-balance facility to enable critical components to operate in vacuum and be better isolated from external vibration. This is expected to result in significant reductions in the overall uncertainty of the experiment now at about one part in ten million, a major step in developing an electronic system to monitor the drift in the present Measurement Reference Standard for mass with an accuracy derived from the fundamental physics of nature. NIST is competing with other nations in meeting this goal.

- Improve the accuracy of ac voltage measurements by developing an ac-voltage source having a one-volt output based on the same fundamental physics of nature used to provide the Measurement Reference Standard for dc voltage to support improved accuracies of multifunction calibrators being developed by industry.

- Validate, or improve as necessary, measurement methods and statistical sampling protocols for determining the energy efficiency of power-system distribution transformers having ratings of 35,000 volts and below and electric motors of greater than 1 horsepower (746 watts) and disseminate the methods and protocols to provide industry with the tools for assessing power system efficiency.

- Develop measurements for the flatness and thickness of wafers of 300 millimeter diameter with measurement uncertainties of 2 nanometers and establish the associated measurement service.

- Develop a water-vapor source for use in calibrating equipment that can detect water vapor in inert processing gasses at levels some 500 times lower than presently can be achieved and establish an associated calibration service to support, in part, the goals identified in the industry's *National Technology Roadmap for Semiconductors.*

- Develop laser power and energy measurements and establish an associated calibration service to support ultraviolet lasers operating at a wavelength of 193 nanometers for imaging smaller elements in optical lithography processes. The semiconductor industry is developing lithography employing these excimer lasers to fabricate devices having critical dimensions of 180 nanometers and below. The medical community is developing methods based on using excimer lasers to treat nearsightedness and needs measurements for safety and control.

- Develop, in response to specific industry requests, Standard Reference Materials to support accurate measurement of (1) dimensional properties, especially those related to compatible interconnection of optical fibers; (2) wavelength of light, with focus on the 1540-to-1560 nanometer range, to support wavelength-division multiplexing for increased information capacity; and (3) propagation characteristics that relate to specifying the information capacity of an optical fiber to support deployment of advanced high-bandwidth optical communication systems.

- Provide industry-invited technical input for developing video electronics standard on flat-panel displays and develop measurements for display parameters that better reflect the way a human eye views a display.

- Develop measurement method(s) for determining the microwave properties of thin insulating films in single, conducting lines on integrated-circuit substrates and publish method(s) and associated software to support the development of advanced products by the rapidly expanding wireless communications industry.

- Collaborate with the U.S. magnetic data storage/recording industry to develop methods for measuring the switching time of magnetic domains and key techniques for characterizing ultra-small structures through visual images, noise measurements, and determination of long-term reliability. These test methods and measurement services will help the magnetic data storage/recording industry develop new manufacturing processes, keep pace with improvements in the density of data storage, and maintain its lead in world markets.

- Support business use of electronic commerce to improve design and development processes for electronic products by developing and disseminating a software translator that will convert a company's internal dictionary of product terminology into the industry-standard Component Information Dictionary. A standard format is needed so that engineers and designers can compare products from two or more suppliers and to check the compatibility of selected products intended to work together.

- Develop pilot measurement services for, and procedures for using, reference radio-frequency emitters to (1) promote U.S. industry capability to respond to electromagnetic compatibility (EMC) requirements established by market areas such as Europe and (2) provide a technical basis for supporting U.S. interests in international EMC standards committee activity.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Electronics and Electrical Engineering Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess the overall technical quality and effectiveness of its laboratories, the NRC Assessment Panel for EEEL met on February 11-13, 1998, to focus on the following topics:

- the technical merit of the laboratory programs relative to the current state-of-the-art;
- the degree to which the laboratory programs conform to their mission;
- the effectiveness with which the laboratory programs are carried out and the results disseminated; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for EEEL will meet again on February 10-12, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

Along with peer-review evaluations, the Electronics and Electrical Engineering Laboratory, in cooperation with the NIST Office of Strategic Planning and Economic Analysis, began four economic impact studies in FY 1998. The topics are antenna near-field scanning, semiconductor power device modeling, laser and fiber-optic power measurements, and the Josephson voltage standard. Completion of these studies is scheduled for FY 1999.

Previous studies broadly representing programs in research, calibrations, standards, and test procedures have been conducted. Four programs of semiconductor research (thermal properties, wire-bonding, silicon resistivity, and electromigration) had internal rates of return that ranged from 63 to 181 percent. A study of EEEL's research and standards program for the optical fiber industry estimated an internal rate of return of 423 percent. Research and calibration programs in electromagnetic fields and power and energy measurement had internal rates of return of 266 percent and 428 percent, respectively. The median of the internal rates of return for all seven projects for EEEL was 181 percent. Examples of measurable benefits quantified by these studies were significantly increased productivity for the semiconductor industry, reduced transaction costs for the electric power and optical fiber industries, and reduced costs for research, testing, and measurement in the electronic equipment industry.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Electronics and electrical engineering	Pos./BA	272	$39,760	267	$39,060	(5)	($700)
	FTE/Obl.	279	39,815	274	39,115	(5)	(700)

Base reduction (-5 Permanent positions, -5 FTEs, BA -$700,000, Direct Obligations -$700,000) - This decrease affects compound semiconductors, microwave properties of materials, and superconductor standards and measurements, reflecting the Electronic and Electrical Engineering Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Electronics and electrical engineering
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Electronics engineer		ZP IV	(2)	$81,726	($163,452)
Physicist		ZP IV	(2)	81,726	(163,452)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(5)		(360,554)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(5)		(360,554)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(5)
Authorized Positions:	
Full-time permanent	(5)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Electronics and electrical engineering
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($361)
11.9	Total personnel compensation	(361)
12.1	Civilian personnel benefits	(74)
21	Travel and transportation of persons	(26)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(10)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(139)
25.3	Purchases of goods and services from Government accounts	(6)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(2)
26	Supplies and materials	(46)
31	Equipment	(36)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(700)

Department of Commerce

National Institute of Standards and Technology

Electronics and Electrical Engineering

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$2,185	$2,185	$2,185
Army	25	25	25
Navy	1,021	1,021	1,021
Other	569	569	569
Subtotal, Department of Defense	3,800	3,800	3,800
Department of Energy	456	456	456
Department of Justice	4,109	4,500	4,500
Department of Transportation	81	0	0
National Aeronautics & Space Administration	923	1,200	1,200
National Science Foundation	150	150	0
Nuclear Regulatory Commission	63	0	0
Other	62	62	62
Total, Other Agency	9,644	10,168	10,018
Calibrations & Testing	1,745	1,700	1,700
Standard Reference Materials	116	116	116
Technical & Advisory Services	2,188	2,187	2,187
WCF Investments/Operating Adjustments	0	380	0
Total, Other Reimbursables	4,049	4,383	4,003
Grand Total, Reimbursable Program	13,693	14,551	14,021

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Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Manufacturing engineering

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing engineering	Pos./BA	155	$18,907	155	$19,368	153	$20,116	149	$19,716	(4)	($400)
	FTE/Obl.	156	18,995	160	19,714	158	20,151	154	19,751	(4)	(400)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Manufacturing engineering

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Manufacturing engineering										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	52	$8,355	52	$7,040	52	$7,125	52	$7,125	0	0
Total	52	8,355	52	7,040	52	7,125	52	7,125	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MANUFACTURING ENGINEERING

Goal Statement

The goals of this subactivity are to (1) provide measurements, calibrations, and quality assurance techniques that underpin U.S. commerce, technological progress, product reliability, and manufacturing productivity and (2) enhance the competitiveness of U.S. industry by providing appropriate support for measurements, standards, and infrastructure technology, that are crucial to industry's success in exploiting advanced manufacturing technology. The Manufacturing Engineering subactivity achieves these goals by conducting research in the areas of high-precision dimensional measurements for precision-engineered systems; measurements and interface standards for automated production technology; standards and open-system architectures for intelligent manufacturing systems; and interoperability standards, information models, and frameworks for integrating manufacturing systems. In addition, this subactivity provides technical support for joint industry committees that are developing voluntary standards for length, force, mass, acceleration, other related physical quantities, and standards for the electronic representation and exchange of product and process information. An active program of technology transfer to industry is achieved through cooperative research, industrial research associates, publications, conferences, seminars, and workshops. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

Through this subactivity, carried out in the Manufacturing Engineering Laboratory, NIST provides measurement methods, calibration standards, and a technical research base for standards that facilitate interoperable manufacturing systems. These measurements, standards, and infrastructure technologies accelerate the insertion of advanced manufacturing technologies into manufacturing systems and improve on-line quality assurance processes that enable mechanical manufacturing industries to adopt advanced manufacturing technologies more quickly. The mechanical manufacturing industries served by this program comprise approximately one-third of the

total contribution to the GNP by the manufacturing sector and include the automotive, commercial aircraft, consumer electronics, and machine tool industries. This group of manufacturing industries accounts for almost one-half of the U.S. trade deficit.

To remain competitive in today's global manufacturing environment, manufacturers must constantly improve. NIST supplies U.S. industry with the standards and measurement methods that support process control and accurate inspection techniques that increase precision, quality, productivity, and cost efficiency. As the global market demands ever higher quality, U.S. industries depend upon NIST for calibration services that assure dimensional compatibility of items manufactured at different sites and that satisfy requirements for traceability to national standards. NIST aids the manufacturing community by providing the measurement tests, tools, and calibrations that are essential for controlling manufacturing processes accurately, with high precision, and with high quality.
NIST also provides a technical research base to support ever-tightening geometric tolerances, more sophisticated product descriptions, and advanced intelligent processes.

The FY 2000 base program operating objectives include the following:

- Provide reference measurements and standard reference materials of increased resolution and accuracy for use in the U.S. microelectronic, computer-data-storage, and related industries based on new generations of ultraviolet-light, combined scanning-tunneling and scanning-electron, and atomic-force microscopes to keep pace with those industries' projections of their critical-dimension measurement needs.

- Participate in international intercomparisons with other national measurement laboratories of the mechanical quantities associated with mass, force, vibration, and acoustics with the support of appropriate international organizations, such as Organization of American States (OAS), Bureau International des Poids et Mesures (BIPM), and Organization Internationale de Metrologie Legale (OIML). NIST will continue to improve quality control and reduce technical barriers to trade by refining SIMnet, a pilot interactive computer-based system that can be used to compare measurements performed at laboratories throughout the Americas across the internet in real time. These intercomparisons will provide a mechanism for measurement agreements to create fair and free access to markets for U.S. manufacturers of products that rely on these quantities.

- Develop, with the Institute of Electrical and Electronics Engineers and industry, interface standards for networking smart sensors and actuators. These interface standards will ensure that sensors and actuators from different manufacturers can be used together in a variety of sensor and control networks. By enabling easier integration of sensor and actuators into the manufacturing process, the interface standards will permit remote sensor monitoring and control of processes.

- Improve, in cooperation with industry, the speed and accuracy of geometric and dimensional measurements of manufactured parts through the use of vision, proximity sensors, and touch probes on coordinate measuring machines (CMMs), and develop open architecture interface standards for such multi-modal measuring machines. Benefits include higher speed and lower cost inspections. In addition, the inspection process can be driven intelligently from computer-aided design (CAD) databases with only minimal human intervention, and intelligent inspection systems can be built with components from competitive suppliers.

- Develop, with the Object Management Group and industry, standards for manufacturing execution systems and enterprise resource planning. These standards will provide a seamless flow of manufacturing information from customer order entry, to manufacturing planning and execution, to control of production equipment. These standards will help industry to improve its manufacturing responsiveness.

- Develop and implement the laboratory capabilities to provide world-class reference measurements of angle, cylindricity, complex-form, and large-scale features needed by the U.S. automotive, aircraft, defense, and related industries to satisfy the accuracy and traceability requirements of the global market.

- Establish an intelligent automated welding research testbed, characterize weld quality by its observable process parameters of current, voltage, and arc length, and use that data to provide feedback to both robotic and welding controllers using open architecture standardized interfaces that will be developed in cooperation with industry and with the American Welding Society. This testbed will develop the technical basis for improved weld quality from intelligent automated welding and will develop the interface standards for industry to use this technology effectively.

- Initiate a program that would allow U.S. companies to obtain internationally-recognized certification that their software products conform to ISO 10303 (also known as Standard for Exchange of Product Model Data (STEP)). This involves contributing to 1) the creation of an industry-led U.S. certification board, 2) the development of tools and methodologies to support conformance testing, 3) the accreditation of ISO 10303 conformance testing laboratories (with the National Voluntary Laboratory Accreditation Program (NVLAP)), and 4) the establishment of international recognition of conformance certificates (with other participants).

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability

benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Manufacturing Engineering Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess the overall technical quality and effectiveness of its laboratories, the NRC Assessment Panel for MEL met on March 3-4, 1998, to focus on the following topics:

- the technical merit of the laboratory programs relative to the current state-of-the-art;
- the degree to which the laboratory programs conform to their mission;
- the effectiveness with which the laboratory programs are carried out and the results disseminated; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for MEL will meet again on February 24-25, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The Manufacturing Engineering Laboratory currently is conducting a planning strategy to estimate the economic costs of inadequate interoperability in the automotive supply chain. Prior economic impact studies of MEL programs, "An Economic Evaluation of NIST's Research in Real-time Control System (RCS) Architecture, April, 1996" and "The Economic Impacts of NIST's Software Error Compensation (SEC) Research, June, 1996", estimated internal rates of return of 149 percent and 99 percent, respectively. The fundamental research done in real-time control system architecture in MEL was shown to have a significant impact on the mining industry with quantifiable benefits due to expedited use of automation, reduced injury rates, and increased coal mining productivity. As

a result of MEL's SEC research, the eventual cost of commercial R&D efforts was reduced, and the adoption and diffusion of SEC technology were accelerated with quantifiable benefits to manufacturers due to increased productivity.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing engineering	Pos./BA	153	$20,116	149	$19,716	(4)	($400)
	FTE/Obl.	158	20,151	154	19,751	(4)	(400)

Base reduction (-4 Permanent positions, -4 FTEs, BA -$400,000, Direct Obligations -$400,000) - This decrease affects inventory management and administrative database support, technology learning modules, and standards secretariat, reflecting the Manufacturing Engineering Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Manufacturing engineering
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Mechanical engineer		ZP IV	(1)	$81,726	($81,726)
Computer specialist		ZP IV	(2)	81,726	(163,452)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(4)		(278,828)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(4)		(278,828)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(4)
Authorized Positions:	
Full-time permanent	(4)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Manufacturing engineering
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($279)
11.9	Total personnel compensation	(279)
12.1	Civilian personnel benefits	(57)
21	Travel and transportation of persons	(21)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(4)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(1)
25.3	Purchases of goods and services from Government accounts	(3)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(1)
26	Supplies and materials	(34)
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(400)

Department of Commerce

National Institute of Standards and Technology

Manufacturing Engineering

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$431	$500	$525
Army	1,250	1,250	1,250
Navy	52	100	110
Other	3,738	2,000	2,000
Subtotal, Department of Defense	5,471	3,850	3,885
Department of Justice	0	60	60
Department of Veterans Affairs	190	200	200
General Services Administration	0	150	150
National Aeronautics & Space Administration	532	500	500
Other	30	30	30
Total, Other Agency	6,223	4,790	4,825
Calibrations & Testing	1,272	1,350	1,400
Technical & Advisory Services	860	900	900
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	2,132	2,250	2,300
Grand Total, Reimbursable Program	8,355	7,040	7,125

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Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Chemical science and technology	Pos./BA	242	$31,765	242	$32,493	238	$33,661	236	$33,911	(2)	$250
	FTE/Obl.	242	31,726	248	33,032	244	33,730	241	33,898	(3)	168

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Chemical science and technology										
Direct obligations		0		0		0		$82		$82
Reimbursable FTE/Obl	117	$13,090	115	$15,560	114	$14,448	114	14,448	0	0
Total	117	13,090	115	15,560	114	14,448	114	14,530	0	82

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
CHEMICAL SCIENCE AND TECHNOLOGY

Goal Statement

The goals of this subactivity are to (1) provide chemical measurement research, standards, data, and calibrations that underpin United States commerce, technological progress, improved product reliability, quality assurance, and manufacturing processes, and (2) enhance the competitiveness of American industry by providing appropriate infrastructural measurement support for industry's development of broad-based technologies which promise substantial commercial application and diffusing these scientific advances to users in all segments of the American economy. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

The Chemical Science and Technology subactivity achieves these goals by conducting fundamental investigations on measurement-based phenomena related to the composition, structure, properties, and behavior of chemical and biochemical systems, while developing and improving measurement capability and quantitative understanding of the underlying physical principles of measurement science. The program is built around several continuous activities which are designed to identify and address industry's most pressing needs and transfer NIST-developed science and technology to industry quickly and effectively, utilizing collaborative research programs, memberships in voluntary standards organizations, professional societies and trade associations, publications, patents, conferences, seminars, workshops, and CRADAs (Cooperative R&D Agreements).

Base Program

NIST's Chemical Science and Technology Laboratory (CSTL) serves as the Nation's primary reference laboratory for chemical, biochemical and chemical engineering measurements by providing the underlying scientific and engineering measurements, standards, data on key properties (thermophysical, thermochemical, and kinetic), predictive methods, modeling, and calibration and measurement services. NIST activities benefit many including the chemical, semiconductor, energy, clinical, automotive, biotechnology, food and nutrition, and materials-processing industries. By developing advanced measurement methods and reference materials for high accuracy chemical analyses; providing

the national standards for measurements of temperature, pressure, vacuum, leak rate, fluid flow, humidity, liquid density, volume, and air speed; and performing research on the structure and behavior of atoms and molecules in isolation, in clusters and on surfaces, NIST assists U.S. industry in introducing competitive technology in the marketplace and provides advances in chemical measurement science to address the needs of new high technology industries. The measurement methods, data, and reference materials from this program provide the basis for uniform measurements in the chemical and biochemical processing, semiconductor manufacturing, medical testing, public health and safety, instrument manufacturing, metals-producing, and emerging high technology materials industries, as well as many Federal programs, filling the basic need for national traceability and international comparability of chemical, chemical engineering and biochemical measurements used in commerce and science.

The diversity and nature of the required measurement science and technology and the scope and sizes of the industrial and public sectors involved are such that no single commercial organization has an economic incentive to produce, maintain, and interrelate the measurement methods and reference data and materials, and to support the necessary measurement and standards infrastructure. Measurement-related problems and barriers to technology development encountered by U.S. industry are addressed by NIST as the Nation's lead agency for measurement, extending both its expertise and its impartiality relative to sellers and buyers for the benefit of all.

The FY 2000 base program operating objectives include new and enhanced programs in advanced measurements, standards and data for chemical processes, the biosciences, health, and environment. These objectives include the following:

- Develop global intercomparability for chemical measurements by: 1) conducting international comparisons for the determination of clinically significant constituents in blood; 2) conducting international studies focussed on evaluating the scope, applicability, limitations, and appropriate use of various approaches/techniques used to assess the purity/stoichiometry of organic/inorganic compounds; 3) establishing a pilot effort for the development of gas mixture Certified Reference Materials through collaboration with other leading National Metrology Institutes. These activities will initiate the establishment of an international comparability structure for measurements in chemistry and are instrumental in removing trade barriers to international trade.

- Provide traceability for commercial producers of metal and metal alloy reference materials through extension of the NIST Traceable Reference Material (NTRM) Program to metals. The objectives include: 1) certifying the first NTRMs for selected low alloy steels; 2) identifying protocols for value assignment of benchmark materials, to be jointly chosen and produced with the secondary laboratory; and, 3) developing advanced spectroscopic and x-ray analytical methods to underpin the accuracy of metals Standard Reference Material (SRM) and NTRM certification. These activities will provide U.S. industry with a national traceability system that will greatly improve quality assurance.

- Upgrade ozone Standard Reference Photometers (SRP) in the Environmental Protection Agency (EPA) national network. This will bring EPA's SRPs into modern capabilities and solidify the national vertical traceability for ozone measurements. Coupled with the continued expansion of the international network that NIST supports, this will strengthen international comparability for this important measurement impacting global climate change decisions.

- Implement a Quality Systems approach for the Calibration Services provided by CSTL, that unifies scientific excellence with a well-documented, customer-responsive process to ensure clarity in key policies and procedures based on best practices, while ensuring conformance with the internationally recognized guidelines and standards (ANSI/NCSL Z540-1-1994 and ISO 9001) for calibration laboratories.

- Improve the capabilities of calibration services to U.S. industry by: 1) developing a state-of-the-art NIST primary gas flow calibration facility by constructing a gravimetric-volumetric gas flow calibrator (GFC) over a wide range with uncertainties no larger than 0.05% of reading; and 2) the establishment of the Low Frost-Point Generator as NIST's working standard for low-range humidity measurements, in response to a critical calibration need of the semiconductor industry.

- Establish a focussed Bioinformatics program to meet the data and measurement information needs of the rapidly emerging biotechnology industries. A primary activity will be the transfer of the National Science Foundation/Department of Energy/National Institutes of Health Protein Data Bank (PDB) from Brookhaven to NIST under the auspices of the Research Collaboratory for Structural Bioinformatics, a joint undertaking of NIST, Rutgers University and the University of California-San Diego. This reflects the importance of biomolecular structures in the future development of biotechnology, particularly in pharmaceutical development and biomanufacturing.

- Expand the DNA technologies program by advancing measurement tools and quality assurance standards for DNA diagnostic measurements, including: 1) developing new measurement methods to determine DNA triplet repeats to provide the clinical pathology research community with prototype standards for Fragile X Disease; and 2) conducting an extensive interlaboratory comparison among FBI supported crime labs on assay of mixed stains for Short Tandem Repeat for human identification testing.

- Develop evaluated benchmark data, data prediction methods, and models for the properties of important substances and systems by: 1) developing new tools for substructure searching as a major enhancement to the internet-accessible NIST Chemistry WebBook; 2) improving the mixture models in conjunction with projects on natural gas systems and refrigerants in support of the NIST Thermophysical Properties of Pure Fluids Database; 3) expanding the utility of the Chemical Kinetics Database by developing new calculational tools for evaluating data on pressure-dependent rate constants. These projects will assure U.S. industry access to accurate and reliable data and predictive models to determine the chemical and physical properties of materials and develop new processes.

- Develop and advance the quantitative reference spectral database to support open-path Fourier transfer infrared measurements of chemical emissions and hazardous air pollutant molecules to include all of the compounds listed in the Clean Air Act as well as additional compounds that are suspected to contribute to global warming and ozone depletion.

- Develop measurement and modeling techniques for characterizing enzymatic transformations that are important to industrial applications of biocatalysis and metabolic engineering. The biosynthetic pathway leading from glucose to chorismate, which has major industrial potential, will be used as a model system for these investigations.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Chemical Science and Technology Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess the overall technical quality and effectiveness of its laboratories, the NRC Assessment Panel for CSTL met on March 11-13, 1998, to focus on the following topics:

- the technical merit of the laboratory programs relative to the current state-of-the-art;
- the degree to which the laboratory programs conform to their mission;
- the effectiveness with which the laboratory programs are carried out and the results disseminated; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for CSTL will meet again on March 2-3, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

Economic impact studies of CSTL programs in calibrations (temperature measurement using thermocouples) and data evaluation (thermochemical and physicochemical properties of alternative refrigerants) have been conducted. Results from the study on calibrations indicate a social rate of return of 32 percent and a benefit-cost ratio of four to one. Results from the study on data evaluation indicate a social rate of return of 433 percent and a benefit-cost ratio of four to one. A study to assess the economic impacts of cholesterol standard reference materials began in FY 1997 and will be completed in FY 1999. Economic impact assessment studies of sulfur measurements in fossil fuels and of DNA diagnostic reference materials have been initiated in FY 1998.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Chemical science and technology	Pos/BA	238	$33,661	236	$33,911	(2)	$250
	FTE/Obl.	244	33,730	241	33,898	(3)	168
Export promotion	Pos/BA			2	1,000	2	1,000
	FTE/Obl.			1	918	1	918
Technology assistance	Pos/BA	109	17,636	107	18,149	(2)	513
	FTE/Obl.	113	17,801	111	18,314	(2)	513
Export promotion	Pos/BA			0	1,000	0	1,000
	FTE/Obl.			0	1,000	0	1,000

Export promotion (+2 Permanent positions, +1 FTE, BA +$2,000,000, Direct Obligations +$1,918,000, Transfer to WCF +$82,000) - To stimulate and permit U.S. industry to develop a comprehensive approach to international technical and product standards that promotes open trade by removing standards-related barriers and provides mechanisms to support U.S. exports. As the Nation's measurement and standards laboratory, NIST will work in concert with industry to expand its efforts to eliminate technical barriers to trade through international comparisons of measurement standards, and streamlining the domestic standards development process. With respect to the Department of Commerce Strategic Plan, this effort supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Problem Magnitude and Scope:

Increasing exports is an opportunity to continue economic growth while preserving the stability of the U.S. economy. The United States is in the longest period of sustained growth of any major economy in the world. One-third of that growth depends on exports. Since 1993, exports of manufactured goods, high technology products, and agricultural goods have risen more than 40 percent; in 1997, total U.S. exports amounted to $960 billion, supporting one in five U.S. manufacturing jobs and accounting for two million new jobs in the past four years. Export-related firms increase employment 20 percent faster, are nine percent less likely to fail, pay employees 15 percent more, and provide 11 percent higher employee benefits than firms involving no exports. Despite these statistics, the U.S. lags behind other nations. While world trade has been increasing by a stunning 15 percent annually, total U.S. exports have risen only nine percent, and U.S. exports to the European Union (EU) are growing at less than five percent annually. This can be attributed in part to the imposition of local or regional technical standards that are trade barriers to U.S. exports. Measurement systems for product acceptance testing that facilitate, rather than exclude, U.S. exports, must be in place or trade will not occur. To combat these problems, U.S. efforts that remove or avoid the erection of technical barriers to trade based on product testing protocols must be expanded significantly in three areas: (1) increase worldwide recognition of U.S. measurements and standards, (2) streamline the domestic standards development process, and (3) increase U.S. influence in international standards development through regional metrology networks.

Comparison of U.S. national measurement standards with those of other nations is essential to enhance worldwide recognition of U.S. measurements and standards. Participation in these comparisons is critical in assuring that other countries will not reject our products simply because they disagree on the methods used to perform a measurement or test. As new technologies emerge and world economies grow, the number, frequency, and coverage of such comparisons is rising rapidly. Given the enormous number of U.S. trading partners and the technological sophistication of U.S. products, it is essential that NIST be able to meet the increasing demand for comparisons of all types of measurement standards by nations in all regions of the world.

The EU has developed a very well-funded, proactive program to promote EU standards in the guise of international standards, especially in developing countries and in international standards organizations. For example, in a preemptive move to exclude U.S. goods while facilitating export of German goods, the Federal Republic of Germany has invested $40 million in metrology and standards projects in South America, spending more in Brazil alone than NIST spends in the entire world. Germany and other members of the EU have similar investments in India, the Middle East, the Commonwealth of Independent States, and other emerging markets. In balloting for adoption of international standards, the EU and its growing circle of partners routinely outvote U.S. interests, resulting in the adoption of EU or European national standards that are discriminatory to U.S. exports. To respond to this threat to U.S. export trade, NIST will aggressively develop and rapidly expand U.S. participation in international metrology networks in an effort to promulgate U.S. measurements and standards and forge partnerships in emerging markets before our global competitors establish an

unbreakable stronghold in those regions. NIST will also work actively with the American National Standards Institute (ANSI), the official representative of U.S. interests in the international standards arena, to increase U.S. effectiveness in this critical arena.

The U.S. standards development process is a voluntary, consensus-based, and private-sector system. Although the process promotes innovation and technical excellence, it can also be slow and fragmented. Consequently, the U.S. has difficulty mustering an effective response to the unified and concerted efforts abroad, as described above. For U.S. exports to fairly compete in both emerging and developed economies, the private sector, with support from the U.S. government, must develop a unified, proactive, and timely standards development and promulgation strategy, or U.S. companies will continue to be unfairly precluded from global competition by technical trade barriers.

Why NIST?:

NIST has the legal responsibility to develop and maintain the U.S. national standards of measurement and to make them available to industry, government agencies, and the public. NIST is the only organization that has the necessary combination of staff expertise, experience, industry contacts, industry respect, and worldwide prestige as a leading measurements and standards institution. NIST's technical capabilities are internationally recognized as being the best, or among the best, in the world. NIST plans and implements its programs in cooperation with industry, Federal agencies, and private-sector standards development organizations (SDOs) and, in executing this initiative, will also collaborate with the International Trade Administration (ITA).

In support of its legislated mission, NIST has measurement and standards activities that support international trade. For example, the Omnibus Trade & Competitiveness Act of 1988 (P.L. 100-418; 15 U.S.C. 272) instructs NIST to: "(1) assure the compatibility of U.S. national measurement standards with those of other nations; and (2) cooperate…with the governments of other nations and international organizations…in establishing standard practices, codes, specifications, and voluntary consensus standards."

NIST's international activities will be integrated with its leadership and coordinating role, as recently mandated by the National Technology Transfer and Advancement Act of 1995 (P.L. 104-113), in strengthening the U.S. domestic standards and product certification infrastructure. The Act instructs NIST to build workable systems for standards and product certification that meet the needs of U.S. industry in the global market. This coordinating role on behalf of the mostly private, voluntary, decentralized U.S. system is vital when interacting with the centralized, government-controlled systems of other countries.

Description of the Proposed NIST Technical Program:

The aim of a global measurement system is to ensure mutually-acceptable results internationally, as well as between trading alliances, countries, and within national borders. However, the global system is splintered in some cases and firmly entrenched in others. It is to the competitive advantage of the United States to participate more. The U.S. has three objectives to encourage U.S. exports through international standards: (1) increase worldwide recognition and dissemination of U.S. measurements and standards; (2) support private sector efforts to streamline its participation in international standards and increase U.S. presence abroad in international standardization activities; and (3) establish and strengthen regional metrology networks. The proposed program will address the first **two** objectives to increase international recognition of U.S. measurements and standards and streamline U.S. participation in international standards activities.

Increase Worldwide Recognition and Dissemination of U.S. Measurements and Standards:

International comparisons of measurement standards impact world trade by assuring trading partners of mutually-credible information. To keep pace with the growing number of requests by many U.S. trading partners, notably from emerging markets, for participation in such comparisons, NIST must expand its activities to implement a two-tiered comparison structure. This structure combines activities among regional metrology networks, such as the Inter-American System of Metrology (SIM) and the North American Metrology Cooperation (NORAMET) in the Americas, the European Metrology Program (EUROMET) in the EU, and the Asia-Pacific Economic Cooperation (APEC) among the Pacific Rim countries, with a number of key comparisons involving members of the CIPM (International Committee of Weights and Measures). CIPM is recognized under the 1875 Treaty of the Meter as the international body responsible for ensuring worldwide uniformity in units of measure. These efforts will expand activities in more traditional physical measurements, electrical measurements, and radiometric measurements, as well as new measurements addressing emerging technologies. In new and high technology areas, such as information technology, biotechnology, and chemical measurements, NIST will improve existing capabilities or develop new ones.

NIST currently leads the world in disseminating chemical measurement standards, primarily as Standard Reference Materials (SRMs). However, the demand for and scope of chemical measurements is increasing rapidly. NIST must expand its portfolio of SRMs, widely used as the means to transfer the most accurate measurements from the laboratory to the field, and leverage its activities with the private sector. This will be achieved by establishing international agreements assuring mutual recognition of SRMs and analogous materials produced by other countries, and through strategic privatization to achieve global acceptance and meet global demand. Topical areas will focus on important sectors of the U.S. export market, including automobiles, fuels, pharmaceuticals, medical diagnostics, and food. It is significant to note that because of the burgeoning need for chemical measurements, the research arm of the

CIPM has recently begun to establish a chemical measurement capability, allocating a significant portion of its limited budget to this purpose.

As technology development and use advance, new issues arise that are important even for established U.S. exports. Recently established requirements in the EU for electromagnetic compatibility require that products generate no harmful emissions and be immune to electromagnetic disturbances. U.S. industry is having difficulty meeting these requirements due to lack of experience with immunity testing since there are no domestic requirements and because EU immunity requirements have been revised to meet an increasingly severe electromagnetic radiation environment. Future international comparisons will be necessary. NIST must develop new capabilities to respond and to help U.S. industry in meeting these new standards.

The world market for interchangeable mechanical parts with complex shapes results not only in a need for dimensional measurements at part-per-million accuracy, but also for measurement standards and practices that allow description and verification of complex shapes. Coordinate measuring machines (CMMs) are replacing traditional dimensional measurement tools for this task. It is now common to find CMMs on manufacturing lines, both domestically and internationally, in the automotive, aerospace, heavy equipment, and marine industries. Determining CMM performance requires improved procedures and artifacts to achieve agreement on comparisons methods. Future comparisons will require NIST to develop more complex artifacts and the procedures supporting their use.

Support Private Sector Efforts to Streamline its Participation in International Standards and Increase U.S. Presence Abroad in International Standardization Activities:

NIST does not set most U.S. product or performance standards. These standards are developed by private sector SDOs representing specific commercial and technology areas. The U.S. voluntary standards system is unique in the world. The U.S. consensus process eliminates the use of product testing standards as a discriminatory practice by any single producer or group of producers to the detriment of the user community. ANSI, the official U.S. representative to the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC), is a non-governmental organization that promotes development of U.S. national standards to achieve the same level playing field internationally for U.S. exports. ANSI relies on technical experts provided by SDOs and the government for participation at the critical working group levels of ISO, IEC, and similar bodies. ANSI's ability to participate in the broad range of ISO and IEC committees is hampered by this reliance, since the limited resources of the SDOs are not sufficient to provide representation at many activities held outside the U.S. NIST will help bolster these resources with a $1 million grant to ANSI, thereby increasing U.S. representation in the development of international standards.

ISO and IEC are pivotal in establishing international product and performance standards. U.S. industry participates in ISO and IEC standards activities through ANSI. ANSI and industry must become more effective in these activities to prevent adoption of

international product standards that are technical barriers for U.S. exports. The U.S. is in danger of losing its technical edge in markets, not due to lack of merit, but because our international standards efforts do not always compete well with those of more organized economic interest groups. NIST will work with ANSI to help improve the effectiveness of SDOs' activities with ANSI and increase ANSI's presence in international standards organizations. Critical steps in strengthening the U.S. position are to:

1. Substantially improve support for and coordination of the activities of SDOs to streamline the development of U.S. standards for introduction into the international arena in a much more timely and efficient fashion; and
2. Develop broader industry and government participation in ISO and IEC standards committees to counter the entrenched interests of other countries.

These efforts will also aid ANSI in providing participation by small and medium-sized enterprises. Through this activity, future trade agreements that rest on international standards will be more representative of U.S. interests and broaden opportunities for U.S. export products in established and emerging markets.

Economic Impacts:

The export sector of the U.S. economy is critical to the continuation of U.S. economic growth. It influences the rate of growth of GDP and the rate of employment, with 12 million jobs directly related to manufacturing export products. However, U.S. export growth lags behind that of many other countries due significantly to technical barriers to trade. An expanded infrastructure of technical measurements and standards coupled with ANSI's proactive leadership and participation in the international standards arena will support the growth of U.S. exports by reducing or eliminating technical barriers to trade.

The NIST Traceable Reference Materials (NTRM) program for gas mixtures is an example of NIST efforts that have direct economic impacts on domestic standards and their acceptance internationally. NIST and the National Metrology Institute of the Netherlands have successfully compared the chemical measurement standards upon which gas mixture NTRMs are based, which has resulted in a mutual recognition agreement. Gas mixture NTRMs are now recognized by the U.S. Environmental Protection Agency and EU environmental regulatory bodies for emission testing by foreign and domestic auto and power generating equipment makers. As an added benefit, the ten U.S. gas NTRM suppliers for the new domestic and international NTRM market have boosted the quality of their products and increased their revenue by approximately $75 million over the last five years.

Costs and Benefits:

This initiative will strengthen the international measurement and standards infrastructure that is critical in combating the imposition of technical barriers to trade and will further promote U.S. exports. In FY 2000, NIST will:

- Provide U.S. industry with measurement capabilities to ensure cost-effective compliance evaluation of electronic products for electromagnetic compatibility and immunity, in addition to expanding comparison of electrical measurement standards (when the EU introduced a new Directive on Electromagnetic Compatibility with requirements that U.S. industry found difficult to meet, several U.S. manufacturers were forced out of the European market);
- Broaden the number of key CIPM comparisons in areas such as chemical composition, temperature, pressure/vacuum, and humidity, to strengthen U.S. leadership and participation in establishing global comparison of measurement standards;
- Develop optical detector suites suitable for comparisons of spectrophotometry, spectral irradiance, color and appearance, and photometry supporting multi-lateral comparisons in the near-infrared region of the spectrum; and
- Resolve and unify U.S. (ANSI) and international (ISO) standards efforts for coordinate measuring machines (CMM) used for accurate measurement of mechanical parts having complex shapes.

In the outyears, NIST will expand activities in the metrology networks of Asia and Africa to focus on areas such as:

- Expanded SRM development for chemical measurements and regional metrology activities in North Africa and the Middle East;
- Expanded regional metrology network to ensure support of global optical fiber and related instrumentation markets; and
- New comparisons in high-dose electron beam dosimetry and radio-pharmaceuticals, including CIPM key comparisons and those involving metrology networks in the Americas and the Pacific Rim.

These efforts will promote U.S. world leadership in metrology, which helps remove technical trade barriers for U.S. exports.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology
and Technology assistance
Program Change: Export promotion

Title		Grade	Number	Annual Salary	Total Salaries
Chemist		ZP V	1	$80,658	$80,658
Physical scientist		ZP V	1	80,658	80,658
Subtotal			2		161,316
Less lapse	25 %		(1)		(40,329)
Total full-time permanent (FTE)			1		120,987
2000 Pay Adjustment (4.4%)					5,323
Total					126,310

Personnel Data

Full-Time Equivalent Employment:	
Full-time permanent	1
Authorized Positions:	
Full-time permanent	2

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology
and Technology assistance
Program Change: Export promotion

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$126
11.9	Total personnel compensation	126
12.1	Civilian personnel benefits	31
21	Travel and transportation of persons	22
22	Transportation of things	10
23.3	Communications, utilities and miscellaneous charges	41
24	Printing and reproduction	13
25.1	Advisory and assistance services	0
25.2	Other services	1,064
25.3	Purchases of goods and services from Government accounts	36
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	15
26	Supplies and materials	39
31	Equipment	21
32	Land and structures	0
41	Grants, subsidies and contributions	500
99	Direct obligations	1,918
	Transfer to NIST Working Capital Fund	82
	Total increase requested	2,000

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Chemical science and technology	Pos./BA	238	$33,661	236	$33,911	(2)	$250
	FTE/Obl.	244	33,730	241	33,898	(3)	168
Base reduction	Pos./BA	238	33,661	234	32,911	(4)	(750)
	FTE/Obl.	244	33,730	240	32,980	(4)	(750)

Base reduction (-4 Permanent positions, -4 FTEs, BA -$750,000, Direct Obligations -$750,000) - This decrease affects the quality assurance for chemical measurements and theoretical chemistry, reflecting the Chemical Science and Technology Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Research chemist		ZP IV	(3)	$81,726	($245,178)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(4)		(278,828)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(4)		(278,828)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(4)
Authorized Positions:	
Full-time permanent	(4)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Chemical science and technology
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($279)
11.9	Total personnel compensation	(279)
12.1	Civilian personnel benefits	(57)
21	Travel and transportation of persons	(20)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(4)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(290)
25.3	Purchases of goods and services from Government accounts	(33)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(5)
26	Supplies and materials	(34)
31	Equipment	(28)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(750)

Department of Commerce
National Institute of Standards and Technology
Chemical Science and Technology
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$2,281	$3,605	$2,740
Army	155	200	182
Navy	215	188	180
Other	1,396	2,118	2,055
Subtotal, Department of Defense	4,047	6,111	5,157
Department of Commerce	334	258	250
Department of Energy	1,596	1,713	1,799
Department of Health & Human Services	5	70	72
Department of the Interior	32	76	57
Department of Justice	117	252	207
Environmental Protection Agency	950	840	725
National Aeronautics & Space Administration	1,257	955	983
National Science Foundation	0	530	500
Total, Other Agency	8,338	10,805	9,750
Calibrations & Testing	1,525	1,588	1,565
Standard Reference Materials	2,242	2,092	2,145
Technical & Advisory Services	985	1,075	988
WCF Investments/Operating Adjustments	0	0	82
Total, Other Reimbursables	4,752	4,755	4,780
Grand Total, Reimbursable Program	13,090	15,560	14,530

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Physics

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Physics	Pos./BA	191	$27,851	191	$28,434	188	$29,369	184	$28,869	(4)	($500)
	FTE/Obl.	191	28,718	196	28,916	193	29,461	189	28,961	(4)	(500)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Physics

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Physics										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	71	$12,622	70	$12,546	70	$12,538	70	$12,538	0	0
Total	71	12,622	70	12,546	70	12,538	70	12,538	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
PHYSICS PROGRAM

Goal Statement

The goals of this subactivity are to (1) enhance the competitiveness of American industry by providing measurement support for industry's development and commercialization of appropriate broad-based technologies and diffusing these advances to users in all segments of the American economy, and (2) provide measurements, calibrations, and quality assurance techniques that underpin U.S. commerce, technological progress, improved product reliability, and manufacturing processes. The program transfers physical standards, measurement methods, and data to the technical community through collaborations, visiting scientist programs, measurement services, workshops, training courses, participation on standards and other technical committees, publications, seminars, and Cooperative R&D Agreements (CRADAs). With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

The NIST Physics program supports U.S. industry by providing measurement services and research for optical, electronic, magnetic, and radiation technology. The program strives to meet existing and emerging physical measurement needs and to conduct underpinning research to develop new measurement science and technology. Measurement services span five major areas: measurement of optical radiation and optical properties of materials; atomic, molecular, and radiation data; time and frequency standards and dissemination; ionizing and neutron radiation measurements; and magnetic and electronic measurement techniques.

The Physics program develops and disseminates national standards for measurement of optical radiation and optical properties of materials for manufacturing process controls and for applications in the optical instrumentation, imaging, lighting, optoelectronics, aerospace, and semiconductor industries, and in other industries where product appearance, color, and visibility are important. The program maintains unique facilities to measure the performance of optical sensors, to provide standard reference materials for various

optical properties, to remotely measure temperature using optical and infrared radiation, to develop high performance optical radiation sources and measurement technology, and to conduct research to develop new measurement standards and techniques.

The Physics program generates, evaluates, compiles, and disseminates fundamental data on the properties of atoms, molecules, and radiation. Such data are critically needed in such national industries and programs as environmental monitoring and remediation, improved energy efficiency for vehicles and appliances, improved efficiency and safety in conventional and nuclear power generation, improved lighting efficiency, health-care, microelectronics, defense, and space research. The program develops new ways to efficiently disseminate the data through software packages, freely-accessible interactive databases on the Internet, and traditional publications.

The Physics program develops and disseminates national standards for time and frequency to meet critical industrial needs, including telecommunications, electric power transmission, transportation, navigation and positioning (including support of the Global Positioning System), and various defense applications. The program develops new time dissemination methods using the Internet and radio broadcasting for industrial, consumer, government, and scientific applications, which serve several million customers daily. The program conducts ground-breaking research to develop new time and frequency standards based on laser cooling and trapping of atoms and ions.

The Physics program develops and disseminates national standards and measurement techniques for ionizing and neutron radiation applications in support of the health-care industry, measurement and remediation of environmental radiation, radiation processing of food and materials, nuclear power generation, and radiographic imaging for non-destructive evaluation. The program conducts research to develop new techniques for improved radiation measurements for industry, and for health, environmental, and scientific applications.

The Physics program develops new methods for measuring electronic and magnetic properties of nanostructures on an atom by atom basis, primarily in support of the semiconductor and magnetic storage industries. The program conducts research to develop new measurement science in support of trends in the electronics and computer industries for greater efficiency in storing, retrieving, and processing information.

The Physics program balances state-of-the-art measurement services with an appropriate level of high-risk research and development of new measurement science to support continued technical innovation enabling U.S. high technology industries to thrive. The program plays a unique role in national high technology development, since industry and academic institutions are unable to provide the financial and human resources for such long-term, high-risk metrology research and development. The Physics program interacts with numerous industry advisory groups, such as the Council for Optical Radiation Measurements (CORM) and the Council on Ionizing Radiation Measurements and Standards (CIRMS), to help plan the direction of the Physics program's measurement services and research.

The FY 2000 base program operating objectives include:

- Commission nanoscale physics facility for characterization of electric, magnetic, and structural properties of quantum-electronic devices.

- Develop and apply high-resolution x-ray scattering methods to characterization of advanced optical materials, magnetic thin films, and semiconductor structures.

- Develop dosimetry and radioactivity standards for new radioactive sources for use in prostate cancer therapy, and for use in preventing restenosis following balloon angioplasty.

- Develop a system for making optical-frequency measurements relative to the cesium frequency standard in support of industrial requirements for length metrology and optical-frequency measurements.

- Develop beamlines at SURF III for characterizing radiometic sources and determining electron beam current in SURF III.

- Conduct research to explore manipulation of atomic and ionic states for new measurement science, including laser cooling and trapping of atoms and ions for new frequency standards, laser manipulation of atoms for production of nanostructures for semiconductor metrology, and production of custom quantum atomic and ionic states for research into quantum computing.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Physics program's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST’s strategy to assess the overall technical quality and effectiveness of its laboratories, the NRC Assessment Panel for the Physics program meets annually to focus on the following topics:

- The technical merit of the laboratory programs relative to the current state-of-the art;
- The degree to which the laboratory programs conform to their mission;
- The degree to which the laboratory programs are carried out and the results disseminated; and
- Insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for the Physics program will meet again on March 11-12, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The Physics program has strong impacts on U.S. industry and society. An economic impact study of the Physics program's Radiopharmaceutical Standard Reference Materials program, which provides the standards for assuring the safety and effectiveness of 6,000,000 diagnostic and 50,000 therapeutic nuclear medicine procedures annually in the U.S., found an internal rate of return of 138 percent and a benefit-to-cost ratio of 97 to 1. Additional impacts of the Physics program include:

- Providing the national standards for the 11,000 U.S. mammography facilities, assuring the safety and effectiveness of 26 million diagnostic mammograms annually;

- Providing the national standards for exposure quality for the $10 billion U.S. photographic and x-ray film industry; and

- Providing Internet time service to more than 4 million customers daily; U.S. regulatory agencies, such as the SEC, require synchronization to NIST time for many commercial activities.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Physics	Pos./BA	188	$29,369	184	$28,869	(4)	($500)
	FTE/Obl.	193	29,461	189	28,961	(4)	(500)

Base reduction (-4 Permanent positions, -4 FTEs, BA -$500,000, Direct Obligations -$500,000) - This decrease affects far UV detector physics and low level radioactivity metrology, reflecting the Physics Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Physics
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Physicist		ZP IV	(2)	$81,726	($163,452)
Research chemist		ZP IV	(1)	81,726	(81,726)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(4)		(278,828)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(4)		(278,828)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(4)
Authorized Positions:	
Full-time permanent	(4)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Physics
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($279)
11.9	Total personnel compensation	(279)
12.1	Civilian personnel benefits	(57)
21	Travel and transportation of persons	(20)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(4)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(15)
25.3	Purchases of goods and services from Government accounts	(31)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(7)
26	Supplies and materials	(34)
31	Equipment	(21)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(500)

Department of Commerce
National Institute of Standards and Technology
Physics
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$2,854	$2,650	$2,650
Army	672	675	690
Navy	1,200	1,380	1,380
Other	547	500	500
Subtotal, Department of Defense	5,273	5,205	5,220
Department of Commerce	98	31	35
Department of Energy	885	1,115	1,115
Department of Health & Human Services	12	12	12
Department of Transportation	18	0	0
Environmental Protection Agency	73	170	170
National Aeronautics & Space Administration	1,978	1,862	1,870
National Science Foundation	70	70	70
Nuclear Regulatory Commission	117	80	80
Other	66	135	100
Total, Other Agency	8,590	8,680	8,672
Calibrations & Testing	1,035	850	850
Standard Reference Materials	270	451	451
Technical & Advisory Services	2,727	2,565	2,565
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	4,032	3,866	3,866
Grand Total, Reimbursable Program	12,622	12,546	12,538

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Materials science and engineering

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Materials science and engineering	Pos./BA	362	$50,876	362	$51,335	358	$53,093	353	$52,493	(5)	($600)
	FTE/Obl.	362	50,028	370	52,393	366	53,285	361	52,685	(5)	(600)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Materials science and engineering

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Materials science and engineering										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	53	$7,876	54	$6,775	54	$6,600	54	$6,600	0	0
Total	53	7,876	54	6,775	54	6,600	54	6,600	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MATERIALS SCIENCE AND ENGINEERING

Goal Statement

The goals of this subactivity are to (1) enhance the competitiveness of American industry by providing measurement support for industry's development and commercialization of appropriate broad-based technologies and diffusing these advances to users in all segments of the American economy, and (2) provide measurements, calibrations, and quality assurance techniques which underpin U.S. commerce, technological progress, improved product reliability, and manufacturing processes. With respect to the Department of Commerce Strategic Plan, this effort supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities. The Materials Science and Engineering subactivity supports these goals by addressing the scientific, measurement infrastructure, data, and standards issues that are crucial to industry's success in exploiting the potential technological advantages of advanced materials. This subactivity also contributes to the development of in-process sensors and process technologies which control the transformation of these materials from laboratory research to commercial products and to manufacturing processes needed to consistently yield high quality products at reasonable costs. The research programs are built around a number of continuing activities designed to identify and address industry's most pressing measurement needs and transfer NIST-developed technology to industry quickly and effectively, utilizing joint research, consortia, the Guest Researcher program, access to unique NIST facilities, memberships on standards committees, publications, conferences, seminars, workshops, and CRADAs.

Base Program

Technological progress in such diverse fields as electronics, transportation, health care, energy, and aerospace, rely on the development of advanced materials with property and performance characteristics far superior to materials used today. The technological and economic goals of many countries are tied to advances in materials, resulting in intense international competition. Recent advances in the development of advanced ceramics, metals, polymers, and composites, as well as advanced processing technology for all of these materials, have revealed a few of the future technological possibilities. Examples of these technologies include the ability to microengineer materials to create structures and combinations of elements unknown in nature, with properties and phenomena that until

recently were unachievable. The challenge is to move these new materials from the laboratory into commercial products and to develop the necessary manufacturing processes for the transition.

Appropriate national and international measurement standards facilitate commerce in advanced materials and devices. These standards reduce time for material, process and product development. Standards provide a basis for consistent manufacture of high quality products at reasonable cost. The Materials Science and Engineering subactivity conducts research leading to (1) the development of standards, test methods, reference data, and reference materials; and (2) a scientific understanding of the underlying chemical and physical bases of materials processing, properties, and performance. This subactivity also operates the NIST Center for Neutron Research to provide the industrial and academic communities with unique measurement tools.

The FY 2000 base program operating objectives include the following:

- Work with other national and international organizations to standardize critical mechanical test procedures needed by the U.S. materials industry. Participation and coordination of standards activities promote the acceptance of U.S. goods and services in the global marketplace, thereby improving the balance of trade.

- Support the electronics industry in their pursuit of higher speed devices by developing experimental and computational techniques to measure the properties of polymer and ceramic thin film materials and metallic electrical interconnects. This activity assists the U.S. microelectronics industry to design a new generation of electronic products more quickly and economically than their competitors.

- Develop measurement methods for process control and quality assurance which enable U.S. manufacturers to improve the quality and reliability of materials being used in commercial products. The availability of these measurement methods enables more cost-effective manufacture of products with recognized high quality.

- Assist the U.S. automotive industry in cost-effective use of lightweight materials for the next generation of energy efficient vehicles through measurement, modeling, and standards activities. This research will enable the U.S. automotive industry to produce automobiles which are lighter and more fuel efficient without sacrificing performance.

- Enhance unique U.S. capability at NIST to provide essential support for users from industry, academia, and other government agencies to use cold neutrons to measure key properties of new chemicals, materials, and biological assemblies. These

measurements shorten the time from materials design to materials implementation in industries such as chemicals, transportation, and biotechnology.

- Assist the U.S. polymer industry to develop new, low cost, high volume polymers by developing methods that measure the performance of reinforcing fillers. These methods will allow the development and use of new low cost, high volume polymers necessary in applications such as automotive manufacturing.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Materials Science and Engineering Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess its measures, the NRC Assessment Panel for MSEL met on March 19-20, 1998 and the NRC Assessment Panel for the NIST Center for Neutron Research (NCNR) met on February 18-19, 1998. Both panels focused their attention on the following topics:

- Technical merit of the laboratory programs relative to the current state-of-the-art;
- Degree to which the laboratory programs conform to the mission;
- Effectiveness with which the laboratory programs are carried out and the results disseminated; and
- Adequacy of the laboratory's facilities, equipment, and human resources, insofar as they affect the quality of the technical programs.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for MSEL will meet again on March 4-5, 1999 and the NRC Assessment Panel for NCNR will meet on January 26-27, 1999. Both panels will focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The NIST Center for Neutron Research (NCNR) is a world-class national user facility with unique materials measurement capabilities. It is used annually by about 1,300 researchers from more than 50 U.S. companies, 90 universities, and 30 other government agencies, in addition to researchers from NIST, to address their special measurement needs. NCNR is operated with such efficiency that lost time due to unscheduled shutdowns is routinely held to less than two percent for the reactor and five percent including all instrument failures.

In FY 1998, MSEL completed a study of the economic impact of the ceramic phase diagram program. These evaluated diagrams are used throughout the materials community for materials design, processing and application. Over five years, this activity was conservatively estimated to result in a ten to one benefit to cost ratio and a 33 percent rate of return. Building on lessons learned in formulating the study of ceramic phase diagrams and evaluating the results, MSEL will select other technical activities to be similarly assessed. Such economic impact studies will provide more detailed and quantitative assessment of the outcome for selected components of MSEL's technical agenda and provide guidance in choosing MSEL's future technical activities.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Materials and science engineering	Pos./BA	358	$53,093	353	$52,493	(5)	($600)
	FTE/Obl.	366	53,285	361	52,685	(5)	(600)

Base reduction (-5 Permanent positions, -5 FTEs, BA -$600,000, Direct Obligations -$600,000) - This decrease affects research on materials processing technologies that alter the structure of surface materials, reflecting the Materials Science and Engineering Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Materials science and engineering
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Materials engineer		ZP IV	(2)	$81,726	($163,452)
Physicist		ZP IV	(1)	81,726	(81,726)
Chemist		ZP IV	(1)	81,726	(81,726)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(5)		(360,554)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(5)		(360,554)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(5)
Authorized Positions:	
Full-time permanent	(5)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Materials science and engineering
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($361)
11.9	Total personnel compensation	(361)
12.1	Civilian personnel benefits	(74)
21	Travel and transportation of persons	(27)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(10)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(5)
25.3	Purchases of goods and services from Government accounts	(46)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(2)
26	Supplies and materials	(46)
31	Equipment	(29)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(600)

Department of Commerce

National Institute of Standards and Technology

Materials Science and Engineering

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$299	$200	$200
Army	116	150	150
Navy	192	300	300
Other	554	650	650
Subtotal, Department of Defense	1,161	1,300	1,300
Department of Energy	784	800	800
Department of Health & Human Services	792	875	875
Department of Transportation	613	500	500
National Aeronautics & Space Administration	430	400	400
National Science Foundation	1,588	1,300	1,300
Nuclear Regulatory Commission	477	200	0
Other	300	100	125
Total, Other Agency	6,145	5,475	5,300
Standard Reference Materials	806	600	600
Technical & Advisory Services	925	700	700
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	1,731	1,300	1,300
Grand Total, Reimbursable Program	7,876	6,775	6,600

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Building and fire research

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Building and fire research	Pos./BA	107	$22,192	107	$14,898	105	$15,417	101	$13,717	(4)	($1,700)
	FTE/Obl.	108	22,607	111	15,136	109	15,464	105	13,764	(4)	(1,700)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Building and fire research

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Building and fire research										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	73	$8,999	72	$8,957	72	$8,470	72	$8,470	0	0
Total	73	8,999	72	8,957	72	8,470	72	8,470	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
BUILDING AND FIRE RESEARCH

Goal Statement

The goals of this subactivity are to enhance the competitiveness of U.S. industry and public safety through performance prediction, measurement technologies, and technical advances that improve the life cycle quality and economy of constructed facilities. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities. The Building and Fire Research subactivity furthers this goal by providing precompetitive and supporting/enabling technologies to the construction and fire safety industries, which typically under-invest because of inability to capture sufficient returns and for which NIST has specialized facilities and expertise. The program is built around several continuous activities which are designed to identify industry's most pressing needs and transfer NIST-developed technology to industry quickly and effectively through mechanisms including joint research, the Research Associate program, memberships on standards committees, publications, conferences, seminars, workshops, and Cooperative R&D Agreements (CRADAs).

Base Program

The Building and Fire Research Laboratory is the national laboratory dedicated to providing measurement technologies and performance prediction methods to enhance the life cycle quality and economy of constructed facilities - including residential, commercial, institutional, industrial, and infrastructural. Its customers include all those who have a stake in constructed facilities. They cover a broad range of industries, institutions, and segments of the economy, specifically: suppliers and manufacturers; architecture, engineering, contracting, and construction firms; home builders and developers, standards writers, and code officials; fire services and disaster response communities; owners, occupants, and operators; maintainers and repairers of facilities; finance and insurance industries; and government agencies at the local, state, and federal levels.

Accurate, timely, and efficient measurement technologies and performance prediction methods are essential for the competitiveness of these industries in global markets, for maintaining their leadership in domestic markets, and in meeting public needs for safety.

Performance metrics for the life cycle quality and economy of constructed facilities are needed to help industry capture the value added by improved products and services. The Building and Fire Research Laboratory conducts nationally recognized programs in major aspects of construction and fire research. The laboratory develops technologies to predict, measure, and test the performance of construction materials, components, systems, and practices. The laboratory also investigates the scientific principles that govern the phenomena of fire, provides the knowledge base for fire safety, develops the underlying technical support for new fire safety standards, and generates the engineering methodology to support the practice of fire protection engineering. NIST studies the emerging concept of green buildings to meet users' needs and exploit the most advanced thinking in design and engineering while using energy efficient and environmentally sound processes and materials. In cooperation with industry, NIST is developing measurement methods to define the performance of advanced building environmental systems for use in a wide range of structures.

NIST has specifically authorized responsibilities in the areas of fire and earthquake engineering. In fire, the Building and Fire Research Laboratory is the foremost fire research laboratory in the United States. Building on numerous NBS/NIST fire safety studies since 1904, the modern program was established by the Federal Fire Prevention and Control Act of 1974 to reduce the human and economic costs of unwanted fires by providing scientific and technical knowledge on all aspects of fire for the fire protection community. In the National Earthquake Hazards Reduction Program, established in response to the Earthquake Hazards Reduction Act of 1977, NIST is the principal agency for research and development to improve building codes and standards and practices for structures and lifelines. NIST has studied structural and fire safety systems performance in Hurricanes Andrew in August 1992 and Fran in August 1996, and in the January 17, 1994, Northridge, California and the January 17, 1995, Kobe, Japan earthquakes to identify needs and opportunities to improve the seismic performance of buildings, public works, and utilities. NIST has also conducted field studies on the performance of structures in the 1997 Jarrell, Texas and the 1998 Orlando, Florida and Birmingham, Alabama tornadoes.

In the U.S. in 1997, there were 4,050 fire deaths, 84 percent of which occurred in homes. On a per capita basis, the U.S. fire death rate of 18.8 per million is among the worst of industrialized nations. On a GDP basis, the direct cost of fires in 1997 was $8.5 billion. The total direct and indirect cost of fire loss and fire protection is increasing in real terms, burdening the economy at over $128 billion per year. A recent evaluation of the economic impacts of the use of NIST’s Fire Safety Evaluation System, to find more economical fire safety retrofits than allowed by prescriptive standards, shows savings of $1 billion in hospitals and nursing homes from a research investment of $4.5 million.

Construction is one of the Nation's largest industries. In 1997, new construction amounted to $600 billion. Constructed facilities shelter and support most human activities. Their quality affects the competitiveness of U.S. industry and the safety and quality of life of all people. When renovation, maintenance and repair are included for all construction sectors, the total value of construction work done amounts to almost a trillion dollars (i.e., $967.1 billion in 1997), or nearly 12 percent of GDP. The construction industry employed 8.3 million workers in 1997 or about 6 percent of total U.S. employment. Employment in construction increased by 17.5 percent between 1992 and 1997 (Sources: Current Construction Reports, C30 Series, Census Bureau and Labor Force Statistics from Current Population Survey).

Construction and fire safety comprise a giant but disaggregated industry with small enterprises predominating. Private sector research is limited to development of proprietary products. Shortages of capital for R&D, inadequate interfaces among diverse products and practices, liability concerns, and regulations are barriers to innovation. The NIST program removes technological market barriers and reduces burdens of unnecessary or ineffective regulations while maintaining essential levels of safety. Private sector R&D is stimulated by this program's authoritative, nonprescriptive performance measures for construction and fire safety of materials, components, systems, and practices. It is the principal source of technical information for construction and fire safety standards, which, in turn, are widely used in fire and building codes.

The FY 2000 base program operating objectives include the following:

- Complete experimental and finite element modeling to establish baseline structural performance characteristics of residential housing components and their interconnections composed of selected traditional and non-traditional construction materials. This will accelerate introduction of innovative US housing products and systems for domestic and international markets.

- Develop a measurement method and draft standard practice to evaluate damage caused by delamination of fiber-reinforced polymer composite elements used in strengthening concrete structural members. This is to insure the availability of nondestructive evaluation of both existing as well as new construction and rehabilitation.

- Develop a method, based on a flow simulation model, for optimization of concrete mixtures for workability. This will provide a tool for use in the design of high performance concrete mixtures with optimized flow properties for placement and consolidation.

- Develop the experimental protocol for validating models for predicting the service life of polymeric composite materials subjected to ultra-violet radiation, moisture, temperature, and mechanical loads. Reliable estimates of service life are needed for acceptance of composites in civil engineering applications.

- Complete the virtual Cybernetic Building Testbed (VCBT) for building shell heating, ventilation and air conditioning; and fire detection systems. The virtual testbed will insure the safety of critical building systems by allowing them to be tested prior to full scale production.

- Complete prototype standards and industrial demonstrations for real-time exchange of information to characterize the position and orientation of objects on a construction site. Industry has recognized the need to establish the real-time communication of uniform and accurate information among all participants in the "built environment".

- Complete contaminant-based design procedures and supporting software that will yield building design ventilation rates, maximum source strengths, and air cleaning efficiencies based on indoor contaminant loads and health-based concentration limits.

- Develop a prototype industrial fire simulation system with industry partners which demonstrates the electronic interchange of data and results of fire model simulations. This addresses a critical industrial need to measure and evaluate fire suppression systems for performance based standards.

- Develop a first-order method for estimating the time dependent uncertainty of large-scale fire test temperature measurements as part of the advanced fire metrology system for the large scale fire test facility.

- Complete a first phase model to predict the heat release rate of commodity polymers in the Cone Calorimeter and in a selected large-scale configuration. This link between material chemistry and fire test performance will reduce the time and cost for manufacturers to produce materials with assured fire safety.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability

benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Building and Fire Research Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess the overall technical quality and effectiveness of its laboratories, the NRC Assessment Panel for BFRL met on February 11-13, 1998, to focus on the following topics:

- the technical merit of the laboratory programs relative to the current state-of-the-art;
- the degree to which the laboratory programs conform to their mission;
- the effectiveness with which the laboratory programs are carried out and the results disseminated; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for BFRL will meet again on March 10-12, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The Building and Fire Research Laboratory will initiate a new economic impact study representative of BFRL programs to estimate the economic impact and return on research investment dollars. The new study will focus on measuring the economic impacts of the Building and Fire Research Laboratory's research on computer-integrated construction environments. This new study complements last year's study to predict the economic impact of cybernetic building systems and the three previously completed studies which assessed BFRL's research on roofing material, data for fire safety evaluation, and ASHRAE standard 90-75 on energy conservation. The studies

determined benefit-cost ratios of 11,000:1,[1] 126:1,[2] and 2,500:1,[1] respectively, with benefits including development and implementation of more cost effective building materials, lower cost building methods for Life Safety Code compliance, and energy conservation in buildings.[3]

[1] Chapman, Robert E. and Fuller, Sieglinde K., 1996. Benefits and Costs of Research: Two Case Studies in Building Technology. NISTIR 5840, Gaithersburg, MD: National Institute of Standards and Technology.

[2] Chapman, Robert E. and Weber, Stephen F., 1996. Benefits and Costs of Research: A Case Study of the Fire Safety Evaluation System. NISTIR 5863, Gaithersburg, MD: National Institute of Standards and Technology.

[3] The impact measures used in these studies incorporate different estimation techniques than those used in other MSL economic impact studies.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Building and fire research	Pos./BA	105	$15,417	101	$13,717	(4)	($1,700)
	FTE/Obl.	109	15,464	105	13,764	(4)	(1,700)
Wind research	Pos./BA	0	1,200	0	0	0	(1,200)
	FTE/Obl.	0	1,200	0	0	0	(1,200)

Wind Research (BA -$1,200,000, Direct Obligations -$1,200,000) - This decrease recognizes the conclusion of a disaster research program on the effects of windstorms on protective structures and other technologies.

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Building and fire research
Program Change: Wind research

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	(1,200)
99	Direct obligations	(1,200)

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Building and fire research	Pos./BA	105	$15,417	101	$13,717	(4)	($1,700)
	FTE/Obl.	109	15,464	105	13,764	(4)	(1,700)
Base reduction	Pos./BA	105	14,217	101	13,717	(4)	(500)
	FTE/Obl.	109	14,264	105	13,764	(4)	(500)

Base reduction (-4 Permanent positions, -4 FTEs, BA -$500,000, Direct Obligations -$500,000) - This decrease affects performance standards systems for housing, reflecting the Building and Fire Research Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Building and fire research
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Mechanical engineer		ZP IV	(2)	$81,726	($163,452)
Research structural engineer		ZP IV	(1)	81,726	(81,726)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(4)		(278,828)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(4)		(278,828)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(4)
Authorized Positions:	
Full-time permanent	(4)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Building and fire research
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($279)
11.9	Total personnel compensation	(279)
12.1	Civilian personnel benefits	(57)
21	Travel and transportation of persons	(20)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(4)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(46)
25.3	Purchases of goods and services from Government accounts	(33)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(6)
26	Supplies and materials	(34)
31	Equipment	(21)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(500)

Department of Commerce
National Institute of Standards and Technology
Building and Fire Research
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$128	$50	$55
Army	120	0	50
Navy	108	99	100
Other	532	703	650
Subtotal, Department of Defense	888	852	855
Department of Agriculture	10	0	0
Department of Energy	2,225	1,900	2,000
Department of Health & Human Services	85	375	340
Department of Housing & Urban Development	604	1,361	1,200
Department of the Interior	589	422	500
Department of Justice	0	78	100
Department of Labor	0	225	200
Department of Transportation	788	920	850
Department of the Treasury	12	0	0
Department of Veterans Affairs	25	25	25
Environmental Protection Agency	77	23	50
Federal Emergency Management Agency	553	248	250
General Services Administration	469	0	0
National Aeronautics & Space Administration	442	568	450
National Science Foundation	75	0	0
Nuclear Regulatory Commission	200	101	100
Other	46	373	200
Total, Other Agency	7,088	7,471	7,120
Standard Reference Materials	24	100	50
Technical & Advisory Services	1,887	1,386	1,300
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	1,911	1,486	1,350
Grand Total, Reimbursable Program	8,999	8,957	8,470

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Computer science and applied mathematics	Pos./BA	327	$43,035	327	$43,943	322	$45,458	325	$47,758	3	$2,300
	FTE/Obl.	327	42,047	334	44,830	329	45,662	330	47,762	1	2,100

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Computer science and applied mathematics										
Direct obligations		0		0		0		$200		$200
Reimbursable FTE/Obl	68	$11,204	68	$9,680	68	$9,680	68	9,680	0	0
Total	68	11,204	68	9,680	68	9,680	68	9,880	0	200

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
COMPUTER SCIENCE AND APPLIED MATHEMATICS

Goal Statement

The goals of this subactivity are to (1) develop and demonstrate tests, evaluation techniques, testing methods, and standards to enable usable, reliable, and interoperable computer and telecommunications systems; (2) identify, compare, and contrast interoperability models based on realistic problems in various interoperability contexts; (3) integrate and test security mechanisms in environments that pose real threats; and (4) provide leadership and collaborative research in the application of mathematics, statistics, and computers to science and engineering. The Computer Science and Applied Mathematics subactivity supports these goals by providing leadership and research in the development of tests and test methods, and other evaluation techniques for computers and telecommunications systems; by providing support to scientists and engineers in theoretical and experimental investigations of emerging technologies that require advanced mathematical, statistical, and computational methods; by conducting joint research with industry, universities, and other NIST laboratories and Federal agencies; and by promoting the development and use of interoperable, scalable, secure and reliable computer and telecommunications systems through leadership and research to accelerate the adoption of new technologies. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

Through this subactivity, NIST conducts research and provides technical support in the development and use of computer and related telecommunications systems by (1) expanding research and development programs that will accelerate the utilization of new technologies; (2) expediting test development and measurement methods and capabilities for enhancing the interoperability, security, scalability, and usability of systems; (3) developing test methods and tools that will be employed by industry and users to measure the capabilities and performance of hardware, software and communications protocols and interfaces; (4) developing critically needed methods to secure and protect information resources in computer and telecommunications systems; and (5) ensuring that the best and most appropriate techniques in mathematical modeling, statistics and numerical analysis and scientific computing are used by NIST staff

and their collaborators in industry. This program impacts both producers and users of information technology and telecommunications systems.

The U.S. information technology (IT) sector (computer, telecommunications industries and other related information industries) generates $680 billion in value added (contribution to GDP) per year and employs about 7.4 million people. NIST's contributions to the IT sector are precompetitive and generic, focus on technologies and standards that will have a large market payoff for U.S. industry, and promote U.S. industry's products in the global marketplace. NIST's programs focus on measurement science for information technology in the form of test methods and tests, computer science and engineering methodologies that underpin metrology for IT, and creation of open testbeds for industrial collaboration.

Innovations in computer hardware, software, and digital communications challenge managers to apply new technology for productivity increases throughout the U.S. economy in the coming years and will have pervasive effects on industry structure as well as on the quality of government services. The merging of computer and telecommunications technology heightens the importance of an integrated approach to the development and use of computer and communications systems. Information technology pervades almost all industries and organizations, enables new modes of conducting business and profoundly affects how companies around the world do business. With more demands to make information technology and its applications more effective and less costly, it is essential to overcome the barriers to the development of systems that are usable, scalable, interoperable, and secure. To this end, NIST is participating with NSF, DARPA, NASA, NIH and others in the President's Next Generation Internet initiative and other components of the Computing, Information, and Communications R&D Program to foster partnerships among academia, industry, and government that will keep the U.S. at the cutting-edge of information and communications technologies.

In addition, NIST conducts programs that support the President's July 1, 1997, memorandum to increase commerce and expand economic growth through the use of Internet and other computer-based communications by developing test methods and security services for infrastructure, encryption, and data sharing. NIST will also play a crucial role in developing the technical standards and test and measurement methods to ensure the interoperability of the elements of electronic commerce. It will enable the establishment of a technical framework in which these elements can operate, creating an environment in which U.S. industry can gain a competitive advantage in the global marketplace.

Programs supported in this subactivity have a substantial impact on the efficiency and productivity of all NIST laboratory-based programs and their interactions with users of NIST services in industry and other government agencies. Unique statistical methods developed in the program provide essential assurance that NIST technical projects produce accurate, well-documented results. Specialized techniques in numerical analysis, mathematical modeling, and scientific computing allow scientists and engineers to exploit theoretical and experimental developments at the forefront of science and technology. Direct involvement with the laboratory-based

programs allows NIST mathematicians, computer scientists, and statisticians to identify needs common to many application areas and to develop special tools and methods to meet these needs.

The FY 2000 base program operating objectives include the following:

- Continue research in computational tools developed for modeling the micro-magnetic properties of materials. The computer disk drive industry and other industries that rely on magnetic sensors need reference software and standardization test cases for modeling software.

- Develop new designs and prototypes for a software library of mathematical functions based on network client-server transactions for medium-scale computational problems, such as the solution of linear systems and eigenvalue problems. This will help establish consensus on an interface to kernel operations for sparse linear algebra in order to allow manufacturers to provide optimized kernels that achieve the best performance for their hardware while providing easy portability of their applications.

- Develop a unified system that supports testing and evaluation of mathematical software and dissemination of related reference data sets for linear algebra, special functions, and statistics on the Web to meet the needs of algorithm and software developers.

- Provide industry with an application level, adaptive strategy to deal with resource fluctuations and failures of adaptive networks to support development of an infrastructure for reconfigurable, flexible, fault tolerant peer-to-peer systems and a set of applications to exploit the infrastructure.

- Review conformance test suites for asynchronous transfer mode (ATM) technology to assess the need for continued research and development to meet the telecommunications industry’s need for modeling protocol standards to support network performance evaluation.

- Adopt an Advanced Encryption Standard that satisfies the need for a successor to the Data Encryption Standard, DES FIPS 46-2. This standard will provide significantly higher encryption security for use well into the next century.

- Complete a key recovery standard providing the capabilities required in federal government systems to meet the Administration's objective of providing key recovery capability in federal government systems and to support the technical advisory committee established by presidential directive.

- Provide conformity assessment methods to ensure consistency with and accurate use of the Java specification, develop a formal description of the Java Virtual Machine specification, and release a Java SmartCard simulator to support the effective use of the Java specification.

- Develop conformance tests for advanced functionality of Virtual Reality Modeling Language (VRML) browsers. Interoperability, which is enabled by conformance testing, is needed for industry to leverage its work and commercialize VRML products.

- Develop recommended practices to make VRML worlds accessible to the disabled. Virtual reality offers many opportunities for the disabled.

- Develop and disseminate standard reference data and guidelines for emerging biometric authentication techniques, including facial data. Improve the security and usability of fingerprint information by developing a standard interface between fingerprints and NIST's digital signature standard. Advanced biometrics supports the needs of law enforcement and security access designers.

- Develop multilingual versions of existing spoken language technologies benchmark tests in each domain of study, develop larger test sets, and develop metrics for assessing search results for multimedia information.

- Demonstrate the application of Bayesian statistical methods to significant NIST problems in calibration, certification of reference materials, and software conformance testing to facilitate NIST researchers work in complex problems and to better reflect the way scientists think about evidence.

Performance Measures
(All Sources of Funding)

As described in the General Statement of the NIST budget request, the Measurement and Standards Laboratories (MSL) evaluate their performance using three types of data: 1) peer review of each laboratory's technical quality, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. Data on MSL capability benchmarking and output metrics are provided in the General Statement. Information about the Information Technology Laboratory's specific peer review process and microeconomic impact assessments is presented below.

As part of NIST's strategy to assess its overall technical quality and effectiveness of its laboratories, the NRC panel for the Information Technology Laboratory met on March 17-19, 1998 to focus on the following topics:

- the technical merit of the laboratory programs relative to the current state-of-the-art;
- the degree to which the laboratory programs conform to their mission;
- the effectiveness with which the laboratory programs are carried out and the results disseminated; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The full report of the Panel's findings for FY 1998 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: http://www.nap.edu/readingroom/enter2.cgi?NI000762.html.

The NRC Assessment Panel for ITL will meet again on February 16-18, 1999, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and,
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The Information Technology Laboratory recently initiated an economic impact study of the Digital Encryption Standard, as well as an economic study of broadband services.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Computer science and applied mathematics	Pos./BA	322	$45,458	325	$47,758	3	$2,300
	FTE/Obl.	329	45,662	330	47,762	1	2,100
Critical infrastructure protection (CIP).....	Pos./BA			8	3,000	8	3,000
	FTE/Obl.			6	2,800	6	2,800

Critical infrastructure protection (CIP) (+8 Permanent Positions, +6 FTEs, BA +$3,000,000, Direct obligations +$2,800,000, Transfer to WCF +$200,000) - To develop and disseminate standards, measurements, and testing methodologies needed to protect the information technology (IT) elements of critical national infrastructures in support of Presidential Decision Directive (PDD) #63, announced in May 1998. The PDD assigned to DoC the lead agency function for the information and communications sector. The initiative will address several areas crucial to critical system protection, including increasing the assurance, confidence, and survivability of complex infrastructure support IT systems. As such, it provides the applied research critical to the goals of the PDD. With respect to the Department of Commerce Strategic Plan, this effort supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Problem Magnitude and Scope:

As stated in the PDD, the United States possesses both the world's strongest military and its largest national economy, and those two aspects of the Nation are mutually reinforcing and interdependent. Both are also increasingly reliant on certain critical infrastructures and on information technology systems. Because of our military strength, future enemies - whether nations, groups, or individuals - may

seek to harm us in non-traditional ways, including attacks within the United States. Our economy is increasingly reliant upon interdependent and IT-supported infrastructures, and non-traditional attacks on our infrastructure and information systems may be capable of significantly harming both our military power and our economy. The PDD was based on intense interagency effort and used the final report (October 1997) of the President's Commission on Critical Infrastructure Protection as input. The Commission was particularly concerned with a relatively new type of threat to the Nation -- the threat of attack or failure due to vulnerabilities in the Nation's underlying computer, network, and communications systems.

The ubiquitous and interconnected nature of IT increases the extent to which attacks or failures can affect multiple infrastructures, industries, and constituencies. Reliability, security, and quality are often sacrificed in the rush to get information technology products and systems to market. This has been due, in part, to the fact that consumers of such products and systems often do not demand high levels of assurance (security, quality, and reliability) from products or are unwilling to pay a premium for these features. However, as the Nation and its infrastructure sectors become increasingly dependent on computers and networks to operate, the reliability and security of those systems must be strengthened. Without these attributes, the viability of entire infrastructure sectors - and thereby the entire U.S. economy - is put at risk.

Vulnerabilities affecting the information and communications infrastructure have the potential to affect the entire U.S. economy, not just a single sector or industry. Consequently, there is a substantial need for significant new research into technology, measurements, and methods that can raise the level of reliability and security of the information technology-based systems and networks that comprise the backbone of every critical national infrastructure.

Why NIST?:

The PDD assigns to DoC the lead agency function for the information and communications sector. The National Telecommunications and Information Administration (NTIA) will serve as the executive agent for DoC based on their expertise in information and communications policy. NIST, NTIA, and the Bureau of Export Administration are working together to implement the PDD. However, NIST has the requisite technical base to address the research areas. In addition, NIST has a legislated mandate under the Computer Security Act of 1987 and the Clinger-Cohen Act and executive responsibilities under OMB Circular A-130, Appendix III *Security of Federal Automated Information* (1996) for standards and guidelines needed to assure the cost-effective security and privacy of sensitive information in Federal computer systems. NIST also has a strong technical working relationship with the National Security Agency.

In its deliberations, the Commission stated clearly its position that NIST should increase its leadership and research in providing technology and guidance for infrastructure protection for both the private sector and Federal agencies. NIST is uniquely qualified to establish vendor-neutral testbeds and demonstration facilities for rapidly evolving information technologies. In addition, NIST has the

facilities, technical expertise, and recognition as an unbiased technical facilitator, and NIST is in a unique position to facilitate national and international collaborations involving computing and communications technologies.

Description of the Proposed NIST Technical Program:

The security of an IT system may be compromised for two reasons: (1) intrusions by authorized (inside) users of the system or outside hackers which cause a failure or (2) flaws in software design, integration, or implementation. NIST will develop measurements, testing methodologies, and standards needed to help ensure the reliability, trustworthiness, and survivability of the IT systems supporting critical national infrastructures. The NIST program will address security technologies and methods used in a wide variety of systems (such as intrusion detection, cryptography, and access control), the processes used to build systems, and the application of these components to Federal government systems and to complex supervisory systems which are a rapidly emerging area faced with important security concerns. NIST's proposed technical program complements that proposed by NTIA. NIST and NTIA plan to conduct a joint research program intended to address the needs of Critical Infrastructure Protection involving information and communications technology. This joint program will comprise research activities conducted separately by NIST and NTIA, as well as possible joint research projects. NIST and NTIA coordinate their research in this important area through a technical working group and an executive committee. The areas in which NIST will focus its critical infrastructure protection efforts are described below.

Security technology: Security technology is an enabler for the entire IT infrastructure that is used to prevent and detect intrusions. Several basic security technologies comprise the building blocks of any secure, survivable system. Principal among these are cryptography, identification/authentication, and public key infrastructure (PKI). Research is needed in advanced algorithms, digital signature methods, and the application of cryptographic technology to protect the reliability and integrity of networks and components. While there has been considerable activity in these areas, there still exists a critical need to accelerate the convergence of standards and the deployment of products and PKI components. Focused efforts, including extensive collaboration with industry, will be undertaken to achieve this goal. In addition, the NIST PKI program will be coordinated with this initiative to produce the measurements and test methods needed to integrate high assurance computing elements into large, complex systems, including networks. High assurance in such networks will be achieved through advanced network protocols to provide optimized authentication based on PKI technology for domain name servers and other internal network problems like key management between the network elements using cryptography.

System Survivability: Even with the best security technology, the U.S. must expect failures of system security. A determined adversary will be able to penetrate critical information infrastructures. Critical systems must have mechanisms to detect, respond to, and, if necessary, recover from anomalous or threatening events or conditions. Application of several key technologies, including system assurance methods, fault tolerance technology, key management and secure domain name services, anomaly and suspicious event detection, automated response mechanisms, and activators capable of reconfiguring compromised components, can enhance the

survivability of critical systems. Methods for detecting anomalous behavior have evolved over the last decade or more, and with increased security awareness, government and private organizations are deploying off-the-shelf products incorporating this technology. Such products are able to identify known vulnerabilities, detect intrusions, initiate warning and response procedures, and "plug" security holes. This same technology must be extended for use in very large-scale, high criticality systems and networks that support critical infrastructures. Consumers striving to incorporate best business practices into their critical applications and vendors striving to meet consumer demands for these products need metrics and test methodologies to compare how well these products perform. NIST will develop these metrics and test methodologies and establish test beds which can be used to test these metrics against off-the-shelf and emerging technologies.

One such emerging technology is software mobile agents. Once an intrusion or other anomalous network behavior is identified, an appropriate response must be initiated. Mobile agents may be deployed in the near future on behalf of network administrators and network resource managers to assist in system protection and survivability. These agents utilize complex "goal-oriented" algorithms and specialized network communications protocols to alert human authorities, quarantine compromised components, re-initialize critical elements to known states, "inoculate" infected components against the intrusion, and even reconfigure critical infrastructure elements. However, there is still much work to be done to ensure that mobile agents can be used safely and with confidence in a hostile network environment. NIST will develop an appropriate security framework for protecting mobile agents, their databases and their execution environments.

High Confidence Systems: Today's software development and assurance methods are barely adequate for current consumer-grade systems and will not be sufficient for the large, complex systems currently in planning stages. Since the most important driver in the software industry is time-to-market, current tools and techniques are focused on increasing productivity. Testing and assurance are often handled by releasing preliminary versions and making corrections as users find bugs. New applications, and the increased demand on existing systems, make this assurance method unsatisfactory and potentially dangerous. For example, the steadily increasing demands on the national airspace system require complex computing systems to boost capacity by making it possible for more aircraft to share the skies. Planned automated highway systems are designed to increase throughput even as traffic loads increase. In both cases, safety margins are necessarily reduced and dependable computing resources are required to avoid accidents. New fields, such as telesurgery and unmanned aircraft, require ultra-dependable computing technology. Because of cost and availability considerations, developers often seek to incorporate commercial off-the-shelf components into these critical systems.

Unfortunately, commercial components and current techniques for achieving high confidence may be reaching their limits of scale and complexity. Increased integration and interactions between components make it difficult to use assurance methods that were developed for analyzing isolated systems. NIST will develop new methods of assurance and new techniques for combining dependable components. Assurance methods that hold promise for cost effective, high confidence systems include model-checking tools for formal

specifications, hazard analysis, and automated test generation techniques. Relatively inexpensive, high confidence building blocks, such as time-triggered architecture components, are being built in Europe and incorporated into real-world systems by companies such as Daimler-Benz and British Aerospace. U.S. industry needs high confidence assurance methods and components to maintain its market lead, as well as to make possible the "rocket science" technology visions of both government and industry researchers.

Security for Supervisory Systems: Supervisory systems are used to control processing in major industrial applications. Supervisory systems are in themselves complex systems for which reliability is a key design requirement. However, such systems increasingly are being integrated into the global Internet for reasons of economics and operational efficiencies. Current levels of security in Internet and private network transactions are known to be vulnerable. As critical control systems become part of an extended national infrastructure, they become more vulnerable to “cyber attacks.” NIST will develop measurement techniques to apply advanced security to two specific types of supervisory systems. This work will then be capitalized on to extend the techniques to all supervisory systems.

Manufacturing Supervisory Systems are widely used in process and discrete manufacturing activities. As such systems are used on a wider, distributed scale (e.g., nationwide control of power network load distribution), the reliability and security of these systems will be critical. The use of computers to control manufacturing processes began in the 1950’s. However, it is only in recent years that manufacturing control systems, which once were isolated and protected, are being connected through computer networks to other computer systems within and external to the individual company, creating in total a part of the critical infrastructure of our economy. Network-based interconnections are used to report inventory and cost data to accounting and production status and delivery information to sales and to customers; to report customer order information to manufacturing planning and warranty and field service data to sales and to engineering; to connect engineering and manufacturing more tightly for design-to-cost, design-to-order, and agile manufacturing; and to provide summaries of all of the above data to top management. Manufacturing Requirements Planning systems are being displaced by Enterprise Requirements Planning systems which link to external suppliers and distributors, and there is increasing acceptance of the idea of Extended Enterprises in which virtual companies are created through computer networking on a global scale.

Cybernetic Building Systems of the future will include multiple buildings (each of which will contain energy management, fire detection, security, and transport systems), energy providers, aggregators, numerous service providers, and electric utilities. By their very nature, such systems will involve extensive exchange of information and complex control data among many different subsystems and will include access to the nationwide power grid. Standard communication protocols have been developed and established on either side of the electrical meter, however, not for communication across the meter. On the end-user side, BACnet (Building Automation Control network), which was developed by NIST and the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), is the open system protocol standard for building management systems. Security and reliability issues exist between different building services (e.g., fire, security, energy management, and transportation), between different buildings linked together for

the purpose of coordinated control and/or load aggregation, and between building management systems and external service providers. As more and more points of access are created and external networks, such as the Internet, are employed for communication, the danger of misuse by authorized and unauthorized users rises exponentially. Intruders could shut down building complexes or use the building control system to access other computer systems. These security issues must be addressed by NIST in a coordinated effort if Cybernetic Building Systems are to be successful and if the U.S. is to obtain a significant share of the developing worldwide market for such systems.

Security for Federal Systems: One of the PDD goals is for Federal government agencies to implement "best practices" for information assurance within their individual agencies. NIST, as part of its authority under the Computer Security Act of 1987 (P.L. 100-235), has long had a government-wide program to provide standards, guidance, and assistance to agencies addressing all aspects of information technology security. To support these goals, NIST will need to expand and enhance its agency assistance program in order to provide assistance to agencies in their implementation of information assurance "best practices." This will also require working with other government and private sector entities to identify resources and cost-effective strategies for providing such assistance.

Economic Impacts:

This initiative addresses the protection of the Nation's critical infrastructure in several ways. First, it focuses on the underlying technology of the information and communications sector. Then, since most other industrial sectors are dependent on information technology, this initiative supports the protection needs of those sectors, as well. And finally, it looks at the growing use of the information infrastructure by private citizens. The following provides a picture of the economic impact of the information and communications sector itself and illustrates the degree to which the major sectors rely upon robust and reliable information and communications systems.

The IT Sector - The U.S. IT sector includes the computer, telecommunications, and other related information industries and generates estimated revenues of $680 billion per year. The IT sector's contributions to the economy have risen from between four to five percent in the mid-1970's to an estimated 8.2 percent in 1998. Moreover, IT accounted for 28 percent of the real growth in GDP between 1996 and 1997. Revenues associated with Internet-based electronic commerce are projected to exceed $300 billion by 2002. The U.S. IT sector employs about 7.4 million people. In the mid-1990's, about 230,000 new jobs were created in the IT sector per year which represents ten percent of the total created in the economy. Capital investments in IT exceeded 45 percent of the total capital investment in 15 sectors of the U.S. economy in 1994, and exceeded 80 percent in the telecommunications, insurance, security, and holding/investment sectors[1].

[1] Appendix 1, The Emerging Digital Economy, DoC Report, 1998.

Impact of Infrastructure Protection Efforts - Most information and communications systems today are vulnerable to direct attack or failure. When protection is added, it typically is costly and often of questionable effectiveness. The critical infrastructure protection initiative will enable infrastructure element managers to better assure the reliability and security of those systems by providing cost-effective technology, test methods, and analytic tools. The result will be safer, more reliable, and more cost-effective information and communications systems supporting critical national infrastructures.

Citizen Use of Information and Communications Infrastructure - Ordinary citizens are becoming increasingly dependent on that same technology. For example, by 2000, between ten and sixteen million American households will be doing their banking online. If that is combined with the additional millions of Americans who depend on automated teller machines (ATMs), the value of reliable and protected technology is clear. It is hard to overestimate the potential cost to the economy of a nationwide outage of just the consumer portion of this interconnected banking infrastructure, as the attendant loss of confidence could seriously constrain the future growth of this vital sector. Forrester Research estimates that by 2002, over $327 billion in goods and services will be sold over the Internet. For these estimates to be realized, the security, integrity, and availability of the underlying information and communications infrastructure must be assured.

Costs and Benefits:

The benefits of the efforts described in this initiative are clear and considerable. They include the following:

- Avoidance of catastrophic single-infrastructure failure or catastrophic multiple-infrastructure failure. This includes losses based on terrorism and acts of war, as well as the failures based on human error.

- Reduction of the level of ongoing loss (fraud, waste, and abuse) through lower-level attacks and failures in the information and communications infrastructure. The Computer Security Institute report, *Issues and Trends: 1998 CSI/FBI Computer Crime and Security Survey*, produced in conjunction with the Federal Bureau of Investigation, estimated that almost $137 million in losses were suffered due to various forms of "computer crime" over a 24-month period ending in early 1998. These are direct losses by individual organizations responding to the survey. Since there are thousands of other organizations making extensive use of IT and because this figure does not reflect indirect costs or costs of entire infrastructure failure, it is clear that the potential cost of losses given the current situation is enormous, and enhanced protection could avoid significant costs.

- Enhancement of overall national economic security through increased reliability, integrity, and user (citizen) confidence in the underlying information and communications infrastructure.

- Enhanced productivity, improved cost avoidance, and reduced operational and maintenance costs due to fewer failures within critical information infrastructures. Direct and indirect costs for computer incidents can be substantial, especially those associated with liability suits and direct loss of business. Given the dependence on IT by life-critical and economically-critical systems, these costs can be astronomical. Moreover, reliability and security are essential to develop the trust required to expand and augment benefits of applying IT to increase quality and productivity.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics
Program Change: Critical infrastructure protection (CIP)

Title		Grade	Number	Annual Salary	Total Salaries
Computer scientist		ZP V	1	$80,658	$80,658
Engineer		ZP V	1	80,658	80,658
Computer scientist		ZP IV	1	68,570	68,570
Computer specialist		ZP IV	1	68,570	68,570
Engineer		ZP IV	2	68,570	137,140
Computer scientist		ZP III	2	48,796	97,592
Subtotal			8		533,188
Less lapse	25 %		(2)		(133,298)
Total full-time permanent (FTE)			6		399,890
2000 Pay Adjustment (4.4%)					17,595
Total					417,485

Personnel Data

Full-Time Equivalent Employment:	
Full-time permanent	6
Authorized Positions:	
Full-time permanent	8

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics
Program Change: Critical infrastructure protection (CIP)

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$418
11.9	Total personnel compensation	418
12.1	Civilian personnel benefits	102
21	Travel and transportation of persons	60
22	Transportation of things	12
23.3	Communications, utilities and miscellaneous charges	122
24	Printing and reproduction	12
25.1	Advisory and assistance services	0
25.2	Other services	108
25.3	Purchases of goods and services from Government accounts	338
25.5	Research and development contracts	1,350
25.7	Operation and maintenance of equipment	45
26	Supplies and materials	120
31	Equipment	113
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	2,800
	Transfer to NIST Working Capital Fund	200
	Total increase requested	3,000

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Computer science and applied mathematics	Pos./BA	322	$45,458	325	$47,758	3	$2,300
	FTE/Obl.	329	45,662	330	47,762	1	2,100
Base reduction.....	Pos./BA	322	45,458	317	44,758	(5)	(700)
	FTE/Obl.	329	45,662	324	44,962	(5)	(700)

Base reduction (-5 Permanent positions, -5 FTE, BA -$700,000, Direct Obligations -$700,000) - This decrease affects image analysis and metrics, multimedia digital video tests, and geographic information systems, reflecting the Information Technology Laboratory's changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Mathematician		ZP IV	(1)	$81,726	($81,726)
Computer scientist		ZP IV	(2)	81,726	(163,452)
Computer specialist		ZP IV	(1)	81,726	(81,726)
Administrative/technical support		ZA II	(1)	33,650	(33,650)
Subtotal			(5)		(360,554)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(5)		(360,554)

Personnel Data

Full-Time Equivalent Employment:	
Full-time permanent	(5)
Authorized Positions:	
Full-time permanent	(5)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($361)
11.9	Total personnel compensation	(361)
12.1	Civilian personnel benefits	(74)
21	Travel and transportation of persons	(27)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(10)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(86)
25.3	Purchases of goods and services from Government accounts	(51)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(9)
26	Supplies and materials	(46)
31	Equipment	(36)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(700)

Department of Commerce
National Institute of Standards and Technology
Computer Science and Applied Mathematics
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Army	$3	$20	$20
Navy	313	307	307
Other	4,480	4,598	4,598
Subtotal, Department of Defense	4,796	4,925	4,925
Department of Agriculture	32	19	19
Department of Commerce	746	166	166
Department of Energy	5	146	146
Department of Health & Human Services	154	97	97
Department of the Interior	97	0	0
Department of Justice	759	1,651	1,651
Department of Transportation	4	31	31
Department of the Treasury	979	993	993
Department of Veterans Affairs	80	172	172
Environmental Protection Agency	1,363	182	182
General Services Administration	1,193	956	956
National Aeronautics & Space Administration	148	37	37
National Science Foundation	0	150	150
Nuclear Regulatory Commission	84	0	0
Other	295	43	43
Total, Other Agency	10,735	9,568	9,568
Technical & Advisory Services	469	112	112
WCF Investments/Operating Adjustments	0	0	200
Total, Other Reimbursables	469	112	312
Grand Total, Reimbursable Program	11,204	9,680	9,880

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Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Technology assistance

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Technology assistance	Pos./BA	105	$14,865	111	$17,131	109	$17,636	107	$18,149	(2)	$513
	FTE/Obl.	106	14,772	113	17,524	113	17,801	111	18,314	(2)	513

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Technology assistance

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Technology assistance										
Direct obligations		0		$8		0		0		0
Reimbursable FTE/Obl	142	$20,200	140	19,680	139	$19,913	139	$19,913	0	0
Total	142	20,200	140	19,688	139	19,913	139	19,913	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
TECHNOLOGY ASSISTANCE

Goal Statement

The goals of this subactivity are to (1) overcome technical, non-tariff barriers to trade in international markets through analysis of and assistance with normative standards; provide technical expertise for the development of normative standards; accredit testing laboratories and train standards officials; (2) assure U.S. consumers of a fair domestic market by providing uniform and accurate measurements in trade in collaboration with the states' weights and measures offices; and (3) support U.S. industry's development of competitive technologies by providing essential measurement services, standard reference materials, and standard reference data. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

The programs under this subactivity provide a central source of information and leadership for U.S. industry regarding national and international standardization activities and issues concerned with conformity assessment, including product testing and certification. These programs also offer industry central access to standard reference materials, standard reference data, and calibrations, and thereby traceability to national and international standards of measurements.

NIST cooperates closely with national and international standards developers and analyzes standards, codes, and regulations. NIST operates the National Center for Standards and Certification Information and assists industry, government, and the public with detailed information on standards-related issues that increasingly affect trade. NIST monitors the work of nearly 120 standards committees and manages U.S. participation in the International Organization of Legal Metrology (OIML), especially with respect to those committees (nearly half of the total) in which U.S. government and industry representatives participate (or chair). In addition, NIST recently initiated a program aimed at enhancing the flow of international standards information to U.S. industry and promoting overseas adoption of U.S standards technology. NIST maintains standards experts in major markets to assist U.S. exporters. NIST also acts as the lead agency in the national metric

conversion effort by coordinating the metric transition activities throughout the Federal government and serving as a home base for metric training and information dissemination for U.S. businesses and state and local governments.

NIST accredits calibration and testing laboratories by evaluating their technical qualifications and competence to perform certain types of calibrations and tests. These testing laboratories play an important role in conformity assurance for international trade and regulatory purposes. NIST is responsible for designing, implementing, and accrediting conformance testing in areas of calibration and major testing fields and subfields. Currently, about 800 laboratories are enrolled. The accreditation program is used by Federal, state, and local governments and by commercial manufacturers. This program is available to domestic and foreign laboratories to provide unbiased evaluation and recognition of testing performance.

In cooperation with the National Conference on Weights and Measures and the states' Weights and Measures Offices, NIST assures consumers fairness in the marketplace by establishing uniform and accurate measures used in trade. NIST also develops standardized test methods for measuring instruments used in trade; provides training for trade inspectors; writes manuals for weights and measures functions; and assures the technical validity of various laws and regulations governing packaged goods and measuring devices such as scales, gasoline pumps, taxi meters, and fuel oil meters.

Through this subactivity, NIST provides industry and government with access to its approximately 500 different physical and chemical calibration and measurement assurance programs; provides assistance to technical staff on physical and chemical measurement quality control and experiment design; evaluates the effectiveness of dissemination mechanisms; and provides a single point of contact for organizations outside of NIST which use these measurement services, including the National Conference of Standards Laboratories, the Calibration Coordination Group in the Department of Defense, and a broad range of commercial users.

FY 2000 base program operating objectives include the following:

- Help U.S. industry overcome or avoid technical, non-tariff barriers to trade in major developing markets by promoting the use of U.S. technology and practices in foreign and international standards, and designing and implementing mutually recognized conformance assessment programs in close cooperation with the International Trade Administration.

- Overcome non-tariff barriers to trade by expanded training of trade officials from developing countries on the proper use of normative standards in trade, conformity assurance, product certification, accreditation of test laboratories, and physical and chemical metrology.

- Provide industry, governments, and the public with accurate physical, chemical, and engineering measurements through calibration services, standard reference materials, and standard reference data.

- Establish a worldwide system of uniform and accurate measurement standards to support U.S. exports. This work is closely coordinated with the International Bureau of Weights and Measures and with standards authorities in developing markets.

- Provide U.S. industry with detailed current standards and conformity assessment information for major foreign markets, e.g., Market of the Americas, North American Free Trade Agreement (NAFTA), European Union (EU), Asia Pacific Economic Corporation Council (APEC), Commonwealth of Independent States (CIS), and others; provide U.S. businesses with advance information on planned changes in rules and regulations in all major markets.

- In cooperation with the State Weights and Measures Offices provide uniform and accurate measurements for retail and wholesale trade throughout the United States. This affects about $4 trillion of retail and wholesale trade.

- Provide state weights and measures inspectors with training and manuals to assure a fair market for U.S. consumers.

- Seek international acceptance of National Type Evaluation Program Certificates of Conformance through the International Organization of Legal Metrology Pattern Approval Plan.

Performance Measures

Technology Services administers many of the programs from which the NIST-wide quantitative performance measures are obtained. These performance measures appear in the General Statement of this budget request.

Exhibit 13

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Technology assistance	Pos./BA	109	$17,636	107	$18,149	(2)	$513
	FTE/Obl.	113	17,801	111	18,314	(2)	513
Export promotion.	Pos./BA			0	1,000	0	1,000
	FTE/Obl.			0	1,000	0	1,000
Chemical science and technology	Pos./BA	238	33,661	236	33,911	(2)	250
	FTE/Obl.	244	33,730	241	33,898	(3)	168
Export promotion.	Pos./BA			2	1,000	2	1,000
	FTE/Obl.			1	918	1	918

For the narrative description of the proposed increase see the Chemical Science and Technology section of this budget request on page NIST-64.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Technology assistance	Pos./BA	109	$17,636	107	$18,149	(2)	$513
	FTE/Obl.	113	17,801	111	18,314	(2)	513
Base reduction	Pos./BA	109	17,636	107	17,149	(2)	(487)
	FTE/Obl.	113	17,801	111	17,314	(2)	(487)

Base reduction (-2 Permanent positions, -2 FTEs, BA -$487,000, Direct Obligations -$487,000) - This decrease affecting measurement services reflects Technology Services' changing program demands and priorities.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Technology assistance
Program Change: Base reduction

Title		Grade	Number	Annual Salary	Total Salaries
Physical scientist		ZP IV	(2)	$81,726	($163,452)
Subtotal			(2)		(163,452)
Less lapse	0 %		0		0
Total full-time permanent (FTE)			(2)		(163,452)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(2)
Authorized Positions:	
Full-time permanent	(2)

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Technology assistance
Program Change: Base reduction

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($163)
11.9	Total personnel compensation	(163)
12.1	Civilian personnel benefits	(34)
21	Travel and transportation of persons	(14)
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	(10)
24	Printing and reproduction	(1)
25.1	Advisory and assistance services	0
25.2	Other services	(125)
25.3	Purchases of goods and services from Government accounts	(87)
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	(13)
26	Supplies and materials	(25)
31	Equipment	(15)
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(487)

Department of Commerce
National Institute of Standards and Technology
Technology Assistance
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$248	$248	$248
Army	362	362	362
Other	199	199	199
Subtotal, Department of Defense	809	809	809
Department of Agriculture	204	204	166
Department of Commerce	124	124	124
Department of Energy	1,685	811	811
Department of Health & Human Services	525	525	525
Department of the Interior	95	95	95
Department of Transportation	36	36	36
Department of Veterans Affairs	42	42	42
Environmental Protection Agency	52	36	36
National Aeronautics & Space Administration	561	561	561
National Science Foundation	26	26	26
Other	18	38	18
Total, Other Agency	4,177	3,307	3,249
Calibrations & Testing	2,220	2,246	2,264
Standard Reference Materials	6,852	6,532	6,675
Technical & Advisory Services	6,951	7,595	7,725
WCF Investments/Operating Adjustments	0	8	0
Total, Other Reimbursables	16,023	16,381	16,664
Grand Total, Reimbursable Program	20,200	19,688	19,913

Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: National quality program

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
National quality program	Pos./BA	33	$2,981	40	$4,870	39	$5,046	39	$5,046	0	0
	FTE/Obl.	33	3,010	39	4,874	40	5,046	40	5,046	0	0

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: National quality program

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
National quality program										
Direct obligations		0		$10		0		0		0
Reimbursable FTE/Obl	2	$4,087	2	$1,650	2	$2,000	2	$2,000	0	0
Total	2	4,087	2	1,660	2	2,000	2	2,000	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
NATIONAL QUALITY PROGRAM

Goal Statement

The goal of this subactivity is to assist U.S. businesses, health care, education, and non-profit organizations in delivering ever-improving value to customers while improving overall organizational effectiveness, utilizing the Malcolm Baldrige National Quality Award (MBNQA) framework, core values, criteria, and assessment methods. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 1 (Economic Infrastructure): to assist U.S. businesses in continuously improving their productivity and efficiency by adopting performance and quality management practices.

Base Program

The National Quality Program has as its foundation the Malcolm Baldrige National Quality Award, created by P.L. 100-107 in August 1987. In 1999, the award was expanded to include categories in health care and education as authorized by the Technology Administration Act of 1998 (P.L. 105-309). The Program has become a focal point for strengthening America's competitive position. The Baldrige Award has proven to be highly effective in stimulating interest in performance improvement, performance excellence, sharing and cooperation, and creation of new information networks within the business community and public benefit sectors.

NIST responsibilities under P.L. 100-107 and P.L. 105-309 are carried out by the Baldrige National Quality Program (BNQP). The Program continues to build key linkages with other organizations and provide limited educational outreach services. U.S. businesses and non-profit organizations throughout the country are now turning to NIST for leadership in performance improvement. The BNQP aims to improve its leadership as a focal point and educational resource for all U.S. organizations interested in improving their competitiveness and overall performance.

The program's design and operational strategy is three-fold: (1) to create a new kind of performance excellence standard that fosters communications and sharing among organizations of all types – business, health care, and education, as well as the public, will benefit; (2) to build networks and other key linkages to deliver performance and quality management, and competitiveness enhancement information

and services locally throughout the U.S.; and (3) to build on the success of the present program by sharing lessons learned in the business, health care, and education communities with other sectors of the economy thereby accelerating the process of performance improvement for those sectors.

The FY 2000 base program operating objectives for the Baldrige National Quality Program include the following:

- Implement the MBNQA competition, including examiner selection, examiner training, and application review, to provide services to applicants in business, health care, and education categories.

- Conduct the Quest for Excellence Conference at which MBNQA winners share their performance excellence strategies.

- Maintain a comprehensive database on state and local quality awards and their similarities to or differences from the MBNQA criteria.

- Facilitate information sharing among all sectors of the U.S. economy including business, health care, education, and government.

Performance Measures
(Total Program)

As described in the NIST General Statement, the Baldrige National Quality Program evaluates its performance through a combination of methods including: 1) independent expert review of all aspects of the BNQP's plans and operations by its Board of Overseers, combined with other annual reviews provided by the Panel of Judges and the Foundation for the Baldrige National Quality Award; 2) output tabulations, such as the number of state and local quality award programs supported; and 3) periodic surveys and other assessments of the program's relevance to corporate performance. This year, the BNQP also will conduct a formal economic impact assessment.

Values for key output measures are provided below:

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
• Number of business applications to MBNQA per year	36	38	40	42	44	46	48
• Number of applications to Baldrige-based state programs	1,023	1,074	1,128	1,156	1,185	1,208	1,232
• Number of applications to MBNQA from small businesses	16	17	18	19	20	21	22
• Number of Quality Program documents requested from the World Wide Web	550,000	575,000	600,000	625,000	650,000	675,000	700,000
• Number of printed MBNQA *Criteria for Performance Excellence* distributed by BNQP	143,345	175,000	175,000	175,000	175,000	175,000	175,000
• Number of printed MBNQA Criteria distributed by Baldrige-based state programs	81,400	85,500	89,800	92,000	94,300	96,200	98,100
• Number of state and local quality award programs supported	58	59	60	61	62	63	64

To illustrate the economic significance of the Baldrige criteria, the Baldrige National Quality Program compares the hypothetical value of equivalent financial investments in publicly-traded BNQA recipients and the Standard & Poor's 500 index. This year, the hypothetical "Baldrige Index"—a group of 18 companies that received the MBNQA between 1988 and 1996—outperformed the S&P 500 by approximately 2.4 to 1. The relevance of the Baldrige criteria to corporate performance was further illustrated by a survey of CEOs conducted in 1998 by Louis Harris & Associates. The survey, which was commissioned by the private-sector Foundation for the Baldrige National Quality Award, found that 79 percent of the 308 respondents believe the Baldrige criteria and awards are "extremely or very valuable" in stimulating improvements in quality in U.S. companies, while 67 percent believe that the Baldrige efforts improve the competitiveness of U.S. business.

In addition to the Harris survey and the annual "Baldrige Index" comparison, the BNQP has initiated a formal economic impact study. The study, which should be completed in 1999, will analyze how the MBNQA criteria have affected U.S. companies' performance management, competitiveness, and quality improvement strategies. Information collected will include impact data on both strategic investment decision-making and ultimate economic impacts. Data collection will focus on the manufacturing sector or a major subset, such as chemicals.

Department of Commerce

National Institute of Standards and Technology

National Quality Program

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Veterans Affairs	$40	$0	$0
Other	199	50	0
Total, Other Agency	239	50	0
Technical & Advisory Services	3,848	1,600	2,000
WCF Investments/Operating Adjustments	0	10	0
Total, Other Reimbursables	3,848	1,610	2,000
Grand Total, Reimbursable Program	4,087	1,660	2,000

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Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Research support activities

		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Technical competence program	Pos./BA	64	$9,371	64	$9,547	63	$9,846	63	$9,846	0	0
	FTE/Obl.	65	9,173	67	9,779	66	9,863	66	9,863	0	0
Postdoctoral fellowship program	Pos./BA	116	7,075	116	7,391	115	7,931	117	8,431	2	$500
	FTE/Obl.	117	7,984	120	9,409	119	7,957	120	8,457	1	500
Computer support	Pos./BA	71	12,132	71	12,299	70	12,626	70	12,626	0	0
	FTE/Obl.	71	12,872	73	12,685	72	12,724	72	12,724	0	0
Total	Pos./BA	251	28,578	251	29,237	248	30,403	250	30,903	2	500
	FTE/Obl.	253	30,029	260	31,873	257	30,544	258	31,044	1	500

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Research support activities

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Technical reimbursable services										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	1	$165	1	$655	1	$65	1	$65	0	0
Total	1	165	1	655	1	65	1	65	0	0
Non-technical support services										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	46	7,820	46	8,416	46	8,216	46	8,216	0	0
Total	46	7,820	46	8,416	46	8,216	46	8,216	0	0
Total										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	47	23,726	47	9,071	47	8,281	47	8,281	0	0
Total	47	23,726	47	9,071	47	8,281	47	8,281	0	0

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
RESEARCH SUPPORT ACTIVITIES

Goal Statement

This subactivity facilitates industry and government efforts to enhance the competitiveness of American industry by providing appropriate support for industry's development of broad-based, high-risk technologies which promise substantial commercial application and by diffusing these advances to users in all segments of the American economy. In particular, this subactivity provides for (1) programs to respond to needs for new technical competencies, (2) regular infusion of outstanding postdoctoral scientists and engineers, and (3) maintenance of adequate central scientific computing resources. With respect to the Department of Commerce Strategic Plan, these efforts support a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities.

Base Program

The three programs under this subactivity are centrally managed activities which provide support to other NIST programs. Specifically, the programs provide competence development in NIST mission-oriented areas of research, high caliber scientists and engineers for ongoing research programs, and central computing support for the research programs.

Technical Competence Program - Resources provided through this program enable NIST to respond to new scientific and technical opportunities and to new requirements assigned by the Administration and Congress or imposed by developments in industry, government, academia, or the public. The capacity to respond is based on the availability of teams of scientists and engineers, working at the forefront of research in various areas related to future advanced technologies, who have the ability to devote their efforts to specific, new problems as they arise.

The FY 2000 base program operating objectives include the following:

- Select and initiate four to six new competence projects, at the discretion of the Director and senior NIST managers. This fundamental research will create a window on emerging areas of science and technology and provide NIST scientists and engineers with the

knowledge and skills that are necessary to address state-of-the-art technical opportunities and needs. Selected projects continue to be supported by competence funds for approximately five years.

Postdoctoral Fellowship Program - Through this program, NIST supports a nationally competitive postdoctoral research fellowship program which is administered in cooperation with the National Academy of Sciences/National Research Council. The fellowship program recruits outstanding research scientists and engineers to work on NIST research projects, strengthens communication with university researchers, and provides a valuable mechanism for the transfer of research results from NIST to the scientific and engineering communities.

The FY 2000 base program operating objectives include the following:

- Select postdoctoral scientists and engineers of unusual promise and ability to perform advanced research related to the NIST mission.

- Introduce the latest university research results and techniques to NIST scientific programs and share NIST unique research facilities with the U.S. scientific and engineering community.

Computer Support -This program provides staffing, operation, and support of large memory capacity high performance computers, mass disk storage systems, high speed communication networks, scientific visualization facilities and associated systems which comprise the central component of the NIST Scientific Computer Facility (SCF). Services to NIST include: access to high performance parallel vector and scalable distributed memory computer systems and to clusters of symmetric memory processors and clusters of heterogeneous computers; assistance, training, and expertise on scientific software packages used on these systems, including mathematical and statistical subroutine libraries, advanced parallel programming, and software for generating graphical output and dynamic visualization of complex results; file backup and archival services for systems distributed throughout NIST; and distributed user access to a broad range of software for scientific workstations.

The SCF supports essential large-scale high-precision numerical computation, complex dynamic mathematical modeling, sophisticated data analysis, and scientific database management throughout the NIST scientific and engineering community. The SCF enables computational experiments and analyses to complement and support NIST laboratory experimentation and scientific analyses. It fosters new and innovative solutions to priority problems across a wide range of NIST scientific activities, including derivation and prediction of atomic and molecular properties, automated manufacturing, chemical and material processing, biochemical engineering, and high-performance electronic components. Computer scientists, applied mathematicians, and statisticians provide expert assistance to help SCF users exploit the full capabilities of the SCF resources.

The FY 2000 base program operating objectives include the following:

- Operate high-performance computing systems and associated communications, mass storage, networking, and visualization capabilities to support all NIST scientific and engineering programs.

- Broaden NIST user support to include expanded services from the centralized facility, including file migration, backup and archival storage, improved access to firewall protection, improved usability of parallel computing systems, and application software access and support.

Performance Measures
(All Sources of Funding)

The centrally managed activities included in this subactivity provide support throughout NIST's STRS programs. Performance evaluation information for the STRS programs is presented in the General Statement of this budget request. Performance evaluation information specific to each laboratory also appears in each laboratory's base narrative.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Postdoctoral fellowship program	Pos./BA	115	$7,931	117	$8,431	2	$500
	FTE/Obl.	119	7,957	120	8,457	1	500

Teacher science and technology enhancement institute program (+2 Permanent positions, +1 FTE, BA +$500,000, Direct Obligations +$500,000) - To begin development of a program to improve the skills and foster professional development of mathematics and science teachers of elementary, middle, and secondary schools. The initial stage of the program will be to identify ways in which NIST can improve science and mathematics teaching through emphasis on the relationships of measurements to understanding science and its impacts on commerce and daily life. When the program is fully developed and implemented, the program will improve students' understanding of science and technology in our economy, and thus become an important element in the training of skilled and knowledgeable workers and entrepreneurs who will contribute to the growth of the economy. With respect to the Department of Commerce Strategic Plan, this effort supports a major goal of Theme 2 (Science, Technology, and Information): to provide technical leadership for the Nation's measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities. The program supports the President's goals of providing economic opportunities to all Americans, regardless of their social circumstance, through equality and increased emphasis in technology literacy, and in making our schools the best in the world. This initiative is a component of the President's commitment to ensure that well-trained teachers are available for any state committing to higher standards of technology literacy for its students. The program fulfills a new mandate for NIST resulting from recent amendments to the NIST Authorization Act (P.L. 105-309 amending 15 USC 271 et seq).

Problem Magnitude and Scope:

For the 21st century, science and technology will play an ever-important role in the Nation's global economic competitiveness. In all realms of business, gains in productivity and leadership in markets increasingly require technical insight and scientific creativity. The economy is increasingly technology-based—in just the past four years, information technology has been responsible for more than a third of our economic expansion. Over the past 50 years, our commitment to science has strengthened this country in countless ways. Scientific research has created vast new industries, millions of jobs, the world's most bountiful food supplies, and remarkable tools for fighting disease.

However, trends in science and mathematics education are not encouraging. The latest international science and mathematics tests indicate that U.S. 12th grade students ranked 16th for science and 19th for mathematics among 21 developed nations. Fewer and fewer U.S. students choose careers in science and technology, in part because of perceived difficulty, lack of relevance, and social prejudices. For example, the American Physical Society reports that the number of undergraduate physics majors today is the lowest it has been in the last 37 years. The result is an increasing shortage of workers with sufficient knowledge and skills to meet the needs of commerce and industry.

High technology industries are the most rapid growth segments of the economy, and our ability to compete in these areas depends on the quality and skills of the high-tech work force. This, in turn, depends on the quality of the educational system. The problem is made more severe by the pace of rapid technological change. Science teachers have an extra burden to keep their skills current through in-service training, while school systems have limited resources to provide such professional opportunities. Inadequate training dampens the enthusiasm for teaching and reduces the knowledge base available to students, thus reducing the incentive for students to choose careers in these disciplines.

The problem of improving science and technology education in the Nation is an enormous and complex task. There are more than 400,000 science and mathematics teachers in over 15,000 independent school districts across the Nation. Many other Federal, state, and local agencies and activities provide teacher training and enhancement programs. NIST's teacher enhancement program will initially be a small part of the national effort required to improve science and math education. However, NIST has unique strengths and existing programs that can bring added value and a new perspective to the problem.

Why NIST?:

Recent amendments to the National Institute of Standards and Technology Act (P.L. 105-309 amending 15 USC 271 et seq.) direct NIST to form "a Teacher Science and Technology Enhancement program to provide for professional development of mathematics and

science teachers of elementary, middle, and secondary schools (as those terms are defined by the Director), including providing for the improvement of those teachers with respect to the understanding of science and the impacts of science on commerce." The amendments recognize that NIST is uniquely positioned to contribute to science and mathematics education through its emphasis on measurements and standards affecting commerce and products used by people of all ages in their daily lives, spanning the range from information technology to the quality of food and medical care to the structural integrity of homes and other buildings.

In the United States, pre-collegiate public education is administered by over 15,000 independent school systems, each with local autonomy over curriculum, teaching standards, and other matters. At the Federal level, the Department of Education and the National Science Foundation have broad missions to work with local authorities to improve science education. Nevertheless, other Federal agencies have unique resources and talents that contribute to the overall Federal response. An example is the Chicago Teacher's Academy for Math and Science (TAMS), now a private organization that began with the support of the Department of Energy, capitalizing on the unique interests and talents of Nobel Laureate Leon Lederman at Fermilab.

NIST's special contributions to science and math education will be based upon NIST's unique expertise in measurement and problem-solving, both critical to good science and practical mathematics. NIST operates in an environment that makes science relevant through its many interactions with the broad scope of industry, in its laboratories, in manufacturing partnerships, and in the development of advanced technology. NIST has long-standing experience in interacting productively with state and local governments through the Manufacturing Extension Partnership Program and the Weights and Measures Program—experience that will be applied to the education enterprise as well. NIST also has long standing experience in partnering with industry to build national programs to attack problems, such as the Baldridge National Quality Program and industrial consortia, which includes the Council on Optical Radiation Measurements. NIST's teacher enhancement initiative is a natural extension of the professional development that NIST already offers undergraduate, graduate, and post-graduate science students through fellowship programs, as well as outreach programs to K-12 students.

Description of the Proposed NIST Technical Program:

NIST's program will initially be a small portion of the national effort to improve science and mathematics teaching. NIST will develop a program that leverages a modest initial investment to complement existing programs sponsored by Federal, state, and local agencies and organizations. To insure optimal leveraging of the modest initial investment, NIST will first conduct a detailed examination of how best to develop and offer a program of instruction and enhancement for K-12 science and mathematics teachers that will focus on (1) scientific measurement, (2) tests and standards development, (3) industrial competitiveness and quality, (4) manufacturing, and (5) technology transfer.

NIST will evaluate the appropriateness and likelihood for success of multiple means of teacher enhancement, including: (1) on-site training programs, workshops, and seminars that utilize the expert staff and the unique laboratory resources of NIST, (2) community-based training programs at NIST's industrial and academic partners' sites, (3) Internet-based, on-demand references and services for teachers that utilize and extend NIST's expertise in forefront Internet capabilities and its high-bandwidth Internet connection, (4) identification and dissemination of best practices for training programs, (5) cooperative participation in the activities of educational associations, and (6) outreach activities in the school districts. NIST will evaluate the appropriateness of collaborating with universities and businesses close to school districts to gain access for teachers to higher-bandwidth (Internet and video) facilities.

NIST will collaborate with organizations to plan a program that avoids duplication of effort, creates new value, and capitalizes on experience in the production and utilization of training materials. Such organizations include the National Science Teachers Association, the National Council of Teachers of Mathematics, the National Academy of Sciences, and the National Science Foundation, among many others.

Economic Impacts:

The purpose of this initiative is to promote economic growth by increasing the number and competence of scientifically literate workers in future decades. The creativity and competence of the high-tech work force directly correlates to innovation and increases in productivity, growth in the number of high-paying jobs, and gains in the standard of living of the community. It is generally accepted that the quality and skills of teachers, particularly in the formative years of elementary and middle schooling, are significant factors in motivating and inspiring young people to do better in their studies, which in turn provides the foundations for their careers 10–20 years later. This initiative is one component of the Federal commitment to state and local school districts to cooperate with them to improve the quality and the impact of the education enterprise, particularly in areas of science and technology education, to provide opportunities for all students to reach their maximum potential, for themselves and for their communities.

Costs and Benefits:

This initiative requires a modest amount of funding to begin development of a program to improve the skills and foster professional development of teachers of science and mathematics. The short-term direct benefits of the program may be judged qualitatively by the quality of the plans for the longer-term implementation of the program. Quality of the program will be judged by the creativity of the long-term plans, leveraging of modest resources for optimal impact across the Nation, developing new methods to capitalize on the importance of measurements for teaching and learning science, and enlisting support for the program from national education organizations.

The first year will embrace the development of the program, whereas future years will build upon its initial establishment and foundation. In the outyears, NIST will implement the training program based on the results of the initial studies. A pilot program will be established in representative school districts throughout the Nation, distributed among urban, rural, and suburban communities. Measures of effectiveness of the program will be developed and applied to the program. Community and industrial partnerships will be developed to extend the reach of the program beyond the expected modest funding levels.

Over the longer term, the direct benefits of the program may be quantified by the proficiency evaluations of the teachers who take part in it, and may be judged qualitatively by the participants in (and critical observers of) the program. Secondarily, the program may be judged by the increases in the measured skills and the academic electives of the students whose teachers participated in the program. Measures of the benefits of the program in its long-term goal of sustaining economic growth will be indirect and inferential. The proposed program is only a small component of the complete Federal effort to improve technological literacy, and because it will not be the only influence on teacher competence and student achievement, the costs and benefits of this initiative must be considered together with those of the larger enterprise. NIST expects that analysis will show that this program, once fully operational, will provide good value.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Research support activities
Program Change: Teacher science and technology enhancement institute program

Title		Grade	Number	Annual Salary	Total Salaries
General physical scientist		ZP IV	1	$68,570	$68,570
Administrative specialist		ZA III	1	48,796	48,796
Subtotal			2		117,366
Less lapse	25 %		(1)		(29,342)
Total full-time permanent (FTE)			1		88,024
2000 Pay Adjustment (4.4%)					3,873
Total					91,897

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	1
Authorized Positions:	
Full-time permanent	2

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Research support activities
Program Change: Teacher science and technology enhancement institute program

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$92
11.9	Total personnel compensation	92
12.1	Civilian personnel benefits	22
21	Travel and transportation of persons	3
22	Transportation of things	1
23.3	Communications, utilities and miscellaneous charges	21
24	Printing and reproduction	1
25.1	Advisory and assistance services	0
25.2	Other services	80
25.3	Purchases of goods and services from Government accounts	69
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	5
26	Supplies and materials	7
31	Equipment	2
32	Land and structures	0
41	Grants, subsidies and contributions	197
99	Direct obligations	500

Department of Commerce

National Institute of Standards and Technology

Research Support Activities

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Commerce	$6,362	$6,951	$6,751
Other	140	630	40
Total, Other Agency	6,502	7,581	6,791
Technical & Advisory Services	1,483	1,490	1,490
WCF Investments/Operating Adjustments	15,741	0	0
Total, Other Reimbursables	17,224	1,490	1,490
Grand Total, Reimbursable Program	23,726	9,071	8,281

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Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

Exhibit 16

	Object Class	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
11	Personnel compensation					
11.1	Full-time permanent	$116,245	$124,537	$127,876	$126,150	($1,726)
11.3	Other than full-time permanent	10,295	10,576	10,998	10,998	0
11.5	Other personnel compensation	3,919	3,919	3,919	3,919	0
11.9	Total personnel compensation	130,459	139,032	142,793	141,067	(1,726)
12.1	Civilian personnel benefits	26,886	28,994	30,256	29,927	(329)
13	Benefits for former personnel	38	38	38	38	0
21	Travel and transportation of persons	6,533	6,902	6,958	6,868	(90)
22	Transportation of things	716	810	819	842	23
23.1	Rental payments to GSA	57	57	59	59	0
23.2	Rental payments to others	2,640	2,640	2,666	2,666	0
23.3	Communications, utilities, and miscellaneous charges	9,459	10,677	10,881	11,009	128
24	Printing and reproduction	575	751	785	810	25
25.1	Advisory and assistance services	1,879	1,879	1,891	1,891	0
25.2	Other services	25,174	26,246	21,378	21,891	513
25.3	Purchases of goods and services from Government accounts	7,983	8,420	11,641	11,794	153
25.5	Research and development contracts	1,856	2,106	2,120	3,470	1,350
25.7	Operation and maintenance of equipment	6,072	6,113	6,153	6,173	20
26	Supplies and materials	13,901	17,368	17,497	17,364	(133)
31	Equipment	22,336	22,005	22,261	22,211	(50)
32	Land and structures	422	422	422	422	0
41	Grants, subsidies, and contributions	20,363	12,341	12,341	11,838	(503)
42	Insurance claims and indemnities	43	0	0	0	0
99	Total Obligations	277,392	286,801	290,959	290,340	(619)

	Object Class	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
99	Total Obligations	277,392	286,801	290,959	290,340	(619)
	Less Prior Year Recoveries	(1,397)	(1,000)	(1,000)	(1,000)	0
	Less Prior Year Unobligated Balance	(5,206)	(6,063)			
	Plus Prior Year Unobligated Balance	6,063				
	Total Budget Authority	276,852	279,738	289,959	289,340	(619)
	Transfer to NIST Working Capital Fund		398	0	282	282
	Total Requirements	276,852	280,136	289,959	289,622	(337)

Personnel Data

Full-time equivalent employment:					
Full-time permanent	1,831	1,897	1,872	1,847	(25)
Other than full-time permanent	216	216	216	216	0
Total	2,047	2,113	2,088	2,063	(25)
Authorized Positions:					
Full-time permanent	1,974	1,995	1,965	1,944	(21)
Other than full-time permanent	67	67	67	67	0
Total	2,041	2,062	2,032	2,011	(21)

Exhibit 17

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level	$5	$119	$119	0
	Senior executive service	228	4,842	4,842	0
	Career path	2,391	113,864	112,138	($1,726)
	Wage board	278	6,555	6,555	0
	Scientific & professional (P.L. 80-313)	105	2,496	2,496	0
	Subtotal	3,007	127,876	126,150	(1,726)
11.3	Other than full-time permanent				
	Career path	390	10,135	10,135	0
	Wage board	14	275	275	0
	Scientific & professional (P.L. 80-313)	5	124	124	0
	Experts & consultants	13	464	464	0
	Student	0	0	0	0
	Subtotal	422	10,998	10,998	0
11.5	Other personnel compensation				
	Overtime	0	1,101	1,101	0
	SES performance awards	0	111	111	0
	Cash awards	0	2,588	2,588	0
	Other	0	119	119	0
	Subtotal	0	3,919	3,919	0
11.9	Total personnel compensation	3,429	142,793	141,067	(1,726)

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
12.1	Civilian personnel benefits				
	Civil service retirement	(234)	4,817	4,732	(85)
	Federal employees' retirement	644	8,421	8,350	(71)
	Contribution to civil service retirement & disability fund	0	0	0	0
	Thrift savings plan	95	3,199	3,160	(39)
	Federal Insurance Contribution Act	416	6,939	6,876	(63)
	Health insurance	228	5,512	5,443	(69)
	Life insurance	7	235	233	(2)
	Employees' Compensation Fund	19	656	656	0
	Other	0	477	477	0
	Subtotal	1,175	30,256	29,927	(329)
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	38	38	0
	Subtotal	0	38	38	0
21	Travel and transportation of persons				
	Common carrier	(13)	2,249	2,216	(33)
	Mileage	(1)	151	149	(2)
	Per diem/actual	77	3,389	3,348	(41)
	Other	(7)	1,169	1,155	(14)
	Subtotal	56	6,958	6,868	(90)
22	Transportation of things	9	819	842	23
23.1	Rental payments to GSA	2	59	59	0
23.2	Rental payments to others	26	2,666	2,666	0

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
23.3	Communications, utilities, and miscellaneous charges				
	Rental of ADP equipment	0	8	8	0
	Rental of office copying equipment	0	335	360	25
	Other equipment rental	0	652	671	19
	Federal telecommunications system	12	372	377	5
	Other telecommunications services	0	793	812	19
	Postal Service by USPS	26	713	716	3
	Utilities:				
	Electric	166	5,554	5,591	37
	Gas	0	1,449	1,458	9
	Water/Sewer	0	1,005	1,016	11
	Subtotal	204	10,881	11,009	128
24	Printing and reproduction				
	Publications	19	532	550	18
	Other	15	253	260	7
	Subtotal	34	785	810	25
25.1	Advisory and assistance services				
	Management & professional support services	7	1,110	1,110	0
	Studies, analyses, & evaluation	5	781	781	0
	Engineering & technical services	0	0	0	0
	Subtotal	12	1,891	1,891	0

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
25.2	Other services				
	Training	12	1,334	1,339	5
	ADP Services	1,243	5,069	5,042	(27)
	[Commerce Administrative Management System (specific)]	[1,209]	[1,424]	[1,424]	[. . .]
	Other non-government contracts	1,041	14,975	15,510	535
	Subtotal	2,296	21,378	21,891	513
25.3	Purchases of goods and services from Government accounts				
	Payments to GA, WCF	3,211	6,575	6,575	0
	[Commerce Administrative Management System (specific)]	[. . .]	[. . .]	[. . .]	[. . .]
	[Commerce Administrative Management System (shared)]	[1,068]	[1,699]	[983]	[. . .]
	Office of Personnel Management	0	23	23	0
	Other Federal agencies:				
	Dept. of Commerce	(41)	2,003	1,866	(137)
	Other	51	3,040	3,330	290
	Subtotal	3,221	11,641	11,794	153
25.5	Research and development contracts	14	2,120	3,470	1,350
25.7	Operation and maintenance of equipment	40	6,153	6,173	20
26	Supplies and materials				
	Office & laboratory supplies	42	11,525	11,392	(133)
	Scientific publications & journals	8	733	733	0
	Fuel oil	1	45	45	0
	Reactor materials	78	5,194	5,194	0
	Subtotal	129	17,497	17,364	(133)
31	Equipment				
	Office machines and other equipment	13	2,450	2,457	7
	ADP equipment	13	4,697	4,640	(57)
	Equipment depreciation	150	15,114	15,114	0
	Subtotal	176	22,261	22,211	(50)

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
32	Land and structures	0	422	422	0
41	Grants, subsidies, and contributions	0	12,341	11,838	(503)
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	10,823	290,959	290,340	(619)
	Less Prior Year Recoveries	(1,000)	(1,000)	(1,000)	0
	Total Budget Authority	9,823	289,959	289,340	(619)
	Transfer to NIST Working Capital Fund	0	0	282	282
	Total Requirements	9,823	289,959	289,622	(337)

Department of Commerce
National Institute of Standards and Technology

Scientific and Technical Research and Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the National Institute of Standards and Technology,

15 U.S.C. 272; 272 note; 273; 278b-e; 278g; 278h; 278p
15 U.S.C. 290b-f-p
15 U.S.C. 1454(d), 1454(e)
15 U.S.C. 1512
15 U.S.C. 3711(a)c
40 U.S.C. 759(f)

15 U.S.C. 272; 273; 278b-e; provide basic authority for the performance of the functions and activities of the National Institute of Standards and Technology.

15 U.S.C. 272 note provides for educationally useful federal equipment to be donated to public or private schools.

15 U.S.C. 278g establishes a teacher science and technology enhancement program for professional development of math and science teachers.

U.S.C. 278p requires NIST to notify the Committees on Science and Appropriations of the House of Representatives and the Committees on Commerce, Science and Transportation and Appropriations of the Senate before any major reorganization of any program, project, or activity.

15 U.S.C. 278h authorizes appropriations for performance and functions of the National Institute of Standards and Technology.

15 U.S.C. 290b-f directs the Secretary of Commerce to provide for the collection, compilation, critical evaluation, publication, and dissemination of standard reference data.

15 U.S.C. 1454(d), 1454(e) assign responsibilities to the Secretary of Commerce to determine when undue proliferation exists, to develop and publish voluntary product standards, and to maintain surveillance of such standards.

15 U.S.C. 1512 provides "It shall be the province and duty of said Department to foster, promote, and develop the foreign and domestic commerce... of the United States."

15 U.S.C. 3711(a)c extends the Malcolm Baldrige Award to Health Care and Education providers.

40 U.S.C. 759(f) authorizes the Secretary of Commerce to undertake research in the science and technologies of automatic data processing, computer and related systems, and to establish uniform Federal standards.

2. $289,622,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provisions."

3. of which not to exceed $282,000 may be transferred to the "Working Capital Fund."

15 U.S.C. 278b

15 U.S.C. 278b provides in part: "The National Institute of Standards and Technology is authorized to utilize in the performance of its functions the Working Capital Fund..."

Additional authorizing legislation will be proposed for FY 2000.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Management and professional support services	$1,103	$1,103	$1,110
Studies, analyses, and evaluations	776	776	781
Total	1,879	1,879	1,891

Significant Activities

Advisory and assistance services funded by the STRS appropriation include:

(1) evaluation of candidates for the NIST Postdoctoral Fellowship program.

(2) the review and evaluation of the technical functions and operations of NIST by the Board on Assessment of the National Academy of Sciences. The Evaluation Panels consider the importance and relative priority of projects, quality of staff, equipment needs, and finances, and the relation of the program to the mission of NIST.

(3) services for core support for the operations of the U.S. Committee for the Committee on Data for Science and Technology (CODATA).

(4) an analysis of the economic impacts of the NIST/EEEL contribution to the development of a more accurate voltage standard and its impacts on several U.S. industries (manufacturers of (1) Josephson array components and systems, (2) instruments whose performance is determined by comparison with the Josephson array, and (3) products whose design or performance is determined with instrumentation that is calibrated ultimately against the Josephson voltage standard).

(5) an economic analysis of NIST/EEEL developed mathematical models that have allowed software companies to produce automated design software for an increasingly important class of semiconductor devices.

(6) an economic analysis of NIST/CSTL's program to provide standard reference materials for measurement methods and validation, quality control, and instrument calibration needed by U.S. fossil fuel industries to reduce sulfur dioxide emissions.

(7) an economic analysis of NIST/ITL's program to provide U.S. communications industries with the technical basis for ensuring the security of digital data.

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the NIST role in dealing with the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in assessing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from sources outside NIST and risk having a poorer working and professional relationship with those in the business of using the products and services offered by NIST.

Internal Controls to Ensure Appropriate Use:

Requisition requests from NIST program managers for advisory and assistance services must be accompanied by written justification for the need for such services. Personal services contracts require review by the Office of Human Resources Management.

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Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.			Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
	Currently Available, 1999		377	391	325,300	358,708	304,300
	plus:	Restoration of Rescission	0	0	6,000	6,000	6,000
	less:	1999 Y2K supplemental	0	0	(21,000)	(21,000)	0
	less:	Unobligated balance from prior year	0	0	0	(33,408)	0
	plus:	Unobligated balance carried forward	0	0	0	9,000	0
	plus:	Prior Year Recoveries	0	0	0	3,800	0
	plus:	2000 Adjustments to base	0	0	2,526	2,526	2,526
	less:	2000 Adjustments to base absorbed	0	0	(680)	(680)	(680)
NIST- 179		2000 Adjustments to base	0	0	1,846	1,846	1,846
	2000 Base Request		377	391	312,146	324,946	312,146
	plus:	2000 Program changes	2	2	26,390	26,390	26,390
	2000 Estimate		379	393	338,536	351,336	338,536

			1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
	Comparison by activity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
	Extramural programs											
NIST- 187	Advanced technology program	Pos./Approp	270	$192,500	270	$197,500	270	$204,200	270	$238,700	0	$34,500
		FTE/Obl.	280	179,092	280	230,579	280	217,000	280	251,500	0	34,500
NIST- 201	Manufacturing extension partnership	Pos./Approp	107	113,500	107	106,800	107	107,946	109	99,836	2	(8,110)
		FTE/Obl.	111	114,136	111	128,129	111	107,946	113	99,836	2	(8,110)
	TOTALS	Pos./Approp	377	306,000	377	304,300	377	312,146	379	338,536	2	26,390
		FTE/Obl.	381	293,228	391	358,708	391	324,946	393	351,336	2	26,390

Comparison by activity:	1998 Actual Per-sonnel	1998 Actual Amount	1999 Currently Available Per-sonnel	1999 Currently Available Amount	2000 Base Per-sonnel	2000 Base Amount	2000 Estimate Per-sonnel	2000 Estimate Amount	Increase/ (Decrease) Over 2000 Base Per-sonnel	Increase/ (Decrease) Over 2000 Base Amount
Adjustments to obligations:										
Prior year recoveries		(5,063)		(9,000)		(3,800)		(3,800)		0
Unobligated balance, start of year		(15,823)		(33,408)		(9,000)		(9,000)		0
Unobligated balance, end of year		33,408		9,000						
Less MEP Supplemental				(21,000)						
Financing from transfers:										
Transfers to other accounts (+)		250		0		0		0		0
Appropriation		306,000		304,300		312,146		338,536		26,390

Exhibit 8

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm Pos	FTE	Required Amount	Absorbed Amount	Requested Amount
Adjustments:					
Restoration of Prior-Year Rescission			$6,000	…	$6,000
Non-recurring cost			(21,000)	…	(21,000)
Financing:					
Unobligated Balance (from FY 1999)			9,000	…	9,000
Recoveries from Prior-year Obligations			3,800	…	3,800
Other Changes:					
1999 Pay raise (annualization)			251	…	251
2000 Pay raise			941	…	941
Payment to the working capital fund			14	…	14
Within-grade step increases			277	($68)	209
Personal Benefits:					
Civil Service Retirement System (CSRS)			(61)	…	(61)
Federal Employees' Retirement System (FERS)			76	…	76
Thrift Savings Plan (TSP)			14	…	14
Federal Insurance Contribution Act (FICA)			43	…	43
Health Insurance			60	…	60
Employees' Compensation Fund			(50)	…	(50)
Travel and transportation of persons			18	…	18
Transportation of things			1	…	1
Rental payments to others			8	…	8
Communications, utilities, and miscellaneous charges			50	…	50
Postage			8	…	8
FTS			4	…	4
Printing and reproduction			8	…	8
Other services			208	…	208
GA, Working Capital Fund			612	(612)	…
Supplies and materials			20	…	20
Equipment			24	…	24
Total, Adjustments to Base			**326**	**(680)**	**(354)**

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Adjustments:		
Restoration of Prior-Year Rescission	0	$6,000
Non-recurring Cost	0	(21,000)
Pursuant to P.L. 105-277, there is a one-time transfer of $21,000,000 for Y2K funds.		
Unobligated Balance (from FY 1999)	0	9,000
Recoveries from Prior-year Obligations	0	3,800
Other Changes:		
1999 Pay raise (annualization)	0	251

A pay raise of 3.6 percent was effective January 1, 1999.

Total cost in FY 2000 of 1999 pay raise	$1,006,000
Less amount requested in FY 1999	650,000
Less amount absorbed in FY 1999	105,000
Amount requested in 2000 to provide full-year cost of 1999 pay raise	251,000
Payment to Working Capital Fund	0
Total, 1999 pay raise increase in FY 2000	251,000

2000 Pay increase and related costs		0	955

A general pay raise of 4.4 percent was effective January 1, 2000.

Total cost in FY 2000 of pay increase	$956,000
Less amount absorbed in FY 2000	15,000
Amount requested for FY 2000 pay increase	941,000
Payment to Working Capital Fund	14,000
Total adjustment for FY 2000 pay increase	955,000

Within-grade step increases		0	277

An increase of $277,000 is required to cover the cost of within-grade step increases.

Personnel benefits		0	82

Civil Service Retirement System (CSRS)	(61)
Federal Employees' Retirement System (FERS)	76
Thrift Savings Plan (TSP)	14
Federal Insurance Contribution Act (FICA) - OASDI	43
Health Insurance	60
Employees' Compensation Fund	(50)

Civil Service Retirement System (-$61,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 42.2 percent in FY 1999 to 39.2 percent in FY 2000. Contribution rates will remain the same.

Payroll subject to retirement systems ($23,776,500)	
Cost of CSRS contributions in FY 2000 ($23,776,500 x .392 x .0851)	$793,165
Cost of CSRS contributions in FY 1999 ($23,938,000 x .422 x .0851)	853,866
Total adjustment-to-base	(60,700)

Federal Employees' Retirement System ($76,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 57.8 percent in FY 1999 to 60.8 percent in FY 2000. The contribution rate will remain at 10.7 percent in FY 2000.

Payroll subject to retirement systems ($23,776,500)	
Basic benefit cost in FY 2000 ($23,776,500 x .608 x .107)	$1,546,804
Basic benefit cost in FY 1999 ($23,938,000 x .578 x .107)	1,470,481
Total adjustment-to-base	76,323

Thrift Savings Plan ($14,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2000 ($23,776,500 x .608 x .02).....	$289,122
Thrift plan cost in FY 1999 ($23,776,500 x .578 x .02).....	274,856
Total adjustment-to-base	14,266

Federal Insurance Contributions Act (FICA) - OASDI ($43,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from $70,725 in FY 1999 to $73,275 in FY 2000. The OASDI tax rate will remain 6.2 percent in FY 2000.

FERS payroll subject to FICA tax in 2000 ($23,776,500 x .608 x .925 x .062).....	$829,058
FERS payroll subject to FICA tax in 1999 ($23,776,500 x .578 x .925 x .062).....	788,151
Increase (FY 1999-FY 2000).....	40,907
OTP payroll subject to FICA tax in FY 2000 ($1,325,500 x .925 x .062 x .608)	$46,219
OTP payroll subject to FICA tax in FY 1999 ($1,325,500 x .925 x .062 x .578)	43,938
Change (FY 1999-FY 2000).....	2,281
Total adjustment-to-base	43,188

Health insurance ($60,000) - Effective January 1998, NIST's contribution to Federal employees' health insurance premiums increased by 6.4 percent. Applied against the FY 1999 estimate of $942,000, the FY 2000 health insurance costs are projected to increase by $60,000.

Employees' Compensation Fund ($50,000) – The Employees' Compensation Fund bill for the year ending June 30, 1998 is $50,000 lower than the bill for the year ending June 30, 1997. The ITS share of this bill is a decrease of $50,000. The charges will be reimbursed to the Department of Labor pursuant to 5 U.S.C. 8147.

Travel and transportation of persons..... 0 18

Per Diem ($18,000) - Effective January 1998 the General Services Administration raised per diem rates. This increase results in a 3.3 percent increase to NIST. This percentage was applied to the FY 1999 estimate to arrive at an increase of $18,000.

Transportation of things..... 0 1

The cost of transporting such things as household goods, scientific instruments, and hazardous materials increased during the past year. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate to arrive at an increase of $1,000.

Rental payments to others 0 8

An increase of $8,000 is required to pay the increased costs of rental payments to others. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate.

Communications, utilities, and miscellaneous charges 0 50

This adjustment to base is required to pay the additional cost of communications, utilities, and miscellaneous charges. The increased utility costs are based on a proposed rate increase by Pepco of 3.7 percent.

Postage 0 8

There was a 3 percent increase for postal services to the FY 1999 estimate.

FTS 0 4

There was a 4.9 percent increase for FTS to the FY 1999 estimate.

Printing and reproduction 0 8

GPO has provided an estimated rate increase of 3.1 percent. This percentage was applied to the FY 1999 estimate to arrive at an increase of $8,000.

Other services 0 208

NIST is requesting $208,000 to cover increased costs in other services. Other services include management and professional support services, training, maintenance of equipment, ADP services, purchases of goods and services from other Federal agencies, and Research and Development contracts. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for other services (excluding payments to the GA Working Capital Fund).

GA, Working Capital Fund	0	612

An increase of $612,000 is required to fund increases in the Departmental WCF to maintain the current level of services.

Supplies and materials	0	20

The $20,000 increase was calculated by applying the deflator of 1.0 percent to the FY 1999 estimate for supplies and materials.

Equipment	0	24

Equipment amortization	17,000
Office-ADP-Other equipment	7,000

Equipment amortization ($17,000) - An increase of $17,000 is required to offset the effects of inflation. The increase was based on applying the GDP price deflator of 1.0 percent to the FY 1999 ITS estimate for equipment amortization. The additional appropriated funds will be allocated to the NIST operating units to finance amortization charges paid to the NIST Working Capital Fund.

Office-ADP-Other equipment ($7,000) - The $7,000 increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for office machines, ADP, and other special equipment.

Subtotal, ATB's	**0**	**326**
Less ATB's Absorbed	**0**	**(680)**
Total, ATB's	**0**	**354**

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Exhibit 10

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs
Subactivity: Advanced technology program

Line Item		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) over 2000 Bas	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Advanced technology program	Pos./Approp	270	$192,500	270	$197,500	270	$204,200	270	$238,700	0	$34,500
	FTE/Obl.	280	179,092	280	230,579	280	217,000	280	251,500	0	34,500

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs
Subactivity: Advanced technology program

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Advanced technology program										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	0	$2	0	0	0	0	0	0	0	0
Total	0	2	0	0	0	0	0	0	0	0

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
ADVANCED TECHNOLOGY PROGRAM

Goal Statement

The goal of this subactivity is to enhance U.S. economic growth and competitiveness by partnering with industry to support the development of new technologies that have widespread applicability. With respect to the Department of Commerce Strategic Plan, this subactivity supports a major goal of Theme 2 (Science, Technology, and Information): to accelerate technological innovation and the development of new technologies that underpin future economic growth.

Base Program

The Advanced Technology Program (ATP) shares the cost with industry of developing cutting-edge enabling new technologies that lead ultimately to families of new products across a broad range of applications that in time will lead to economic growth. The ATP invests in risky, challenging technologies that have the potential for significant pay off for the Nation's economy. By creating opportunities for new, world-class products, services and industrial processes, these enabling technologies benefit not just the ATP participants, but other companies and industries -- and ultimately consumers and taxpayers. By reducing the early-stage R&D risks for individual companies and by encouraging the creation of industry partnerships, the ATP enables industry to pursue promising technologies which otherwise would be ignored or developed too slowly to compete in rapidly changing world markets.

The ATP is a cost-shared, partnership program which provides R&D funds to U.S. businesses and joint R&D ventures to assist them in improving their competitive position in the worldwide marketplace for high-technology products and services. The ATP does **not** fund companies' product development. The ATP funds R&D to develop high-risk, enabling technologies up to the point where it is feasible for companies to begin product development using private funds. And, of course, companies also bear the full responsibility for production, marketing, sales and distribution.

ATP accelerates the pace of civilian technology development. By buying down the technical risks and fostering partnerships among companies of all sizes, universities and other organizations ATP helps bridge the technology "valley of death," stimulating a smoother

transition between basic research and early-stage technology development. The potential underlying value of the ATP is to stimulate long-term industrial investment in broadly applicable technologies that will benefit the U.S. economy. Numerous reports have noted that intense world competition has led many U.S. businesses to focus more on short term R&D at the expense of high-risk, longer-term R&D. In addition, studies suggest that enabling technologies, such as infrastructural and multi-use technologies, with large spillovers, are particularly prone to under-investment. Studies have also shown that many research problems may not be solvable without an integrated, multidisciplinary R&D effort coordinated among a number of different organizations. ATP encourages companies to form industry partnerships to take on higher risk, long-range projects of a type, which have proportionally higher benefits to society as a whole. The ATP is open to all areas of advanced technology. As of December 1998, 431 projects have been announced (including 146 joint ventures). These awarded projects involve a commitment of over $1.39 billion in NIST funds and $1.40 billion in private sector funds over their lifetimes.

Examples of technology areas funded include:

- Machine Tool Technology
- Semiconductor Processing
- Superconductors
- Flat Panel Display Manufacturing
- Computer Software
- Optical and Magnetic Data Storage
- Ceramics, Composites, and Polymers
- Microelectronics Manufacturing
- Photonics
- Automated Manufacturing Robotics
- Motor Vehicle Manufacturing
- DNA Diagnostic Technology
- Genetic and Tissue Engineering
- Energy Conservation and Distribution
- Health Care Information Technology
- Digital Video
- Catalysts and Biocatalysts
- Selective Membrane Platforms

The ATP's partners include technologically advanced U.S. businesses able to carry out the further development of these new, emerging, and changing technologies once the high-risk technical challenges are overcome. They often are suppliers of technology to other research companies. Universities, Federal laboratories (excluding NIST), and independent research institutes may receive ATP funding indirectly via collaboration with a single business or as joint venture participants. Small businesses are highly successful in the ATP, both as single-company applicants and as leaders of and participants in joint ventures, which are encouraged to include small businesses.

Each year since 1990, ATP has conducted a general competition, open to proposals involving any area of technology. To have greater impact in selected areas, the ATP began in FY 1994 to hold focused program competitions in addition to general competitions. Topics for ATP focused programs were chosen based on published selection criteria, intense industry input, and a rigorous selection process to ensure that the programs ultimately selected reflected a consensus of the industry and the technical community.

In FY 1999, the ATP is using a new competition structure that combines the best features of both the general competitions and the focused program competitions. The FY 1999 competition is open to all areas of technology, like general competitions. Like focused program competitions, project proposals will be evaluated and ranked in competition with others in the same technology area. Five technology area boards are planned in areas of biotechnology, electronics, information technology, manufacturing, and chemistry/materials. The new model will encourage companies interested in focused programs to compete immediately, rather than holding back projects until focused competitions are announced.

FY 2000 base program operating objectives include the following:

- Continue multi-year cooperative agreements selected in previous years, including real-time monitoring of the accomplishments of these projects to assure that milestones are being met.

- Conduct planned solicitations for a competition open to all areas of technology.

- Continue to implement a multi-faceted economic evaluation program, involving statistical profiling, status reports for recently completed projects, microeconomic case studies, and macroeconomic projections of long-term project and program impacts.

Performance Measures
(Total Program)

As described in the NIST General Statement, ATP assesses its performance through a combination of metrics including output tabulations, assessments of interim outcome indicators, and studies of long-term economic impacts. As ATP-funded technologies become commercialized and begin to diffuse, formal ATP economic impact assessments are conducted to assess the level of R&D spillovers; the speed of R&D development and commercialization; benefits relative to costs; and the social rate of return. Assuming stable funding, ATP estimates the following performance results for key outputs and interim outcome indicators that can be tracked annually:

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
• Cumulative number of technologies under commercialization	120	160	180	220	270	340	400
• Percent of projects reporting an increase in longer-term and/or higher risk R&D	95	95	95	95	95	95	95
• Percent of projects involving R&D collaboration	90	90	90	90	90	90	90
• Percent of project participants reporting acceleration of R&D cycle time	85	85	85	85	85	85	85
• Cumulative number of publications	400	600	690	800	1,030	1,270	1,510
• Cumulative number of patents filed	600	770	900	1,050	1,240	1,430	1,580
• Cumulative number of patent licenses	50	70	80	100	120	150	180

The long time period from ATP funding to economic impacts creates substantial market and technological uncertainties at the point early impact studies are undertaken. Few projects are sufficiently mature to assess their long-term impacts ex post. Consequently, in some cases projections are used to estimate outcomes and potential economic impacts; this was the approach taken in a recent study of the potential

economic benefits associated with ATP funding of medical technologies. The ATP has additional impact studies underway, including studies of flow-control machining and automated disease surveillance, as well as additional studies to improve evaluation methods and metrics.

To complement economic assessments, ATP also generates Status Reports of completed projects relative to each project's objectives. The first set of Status Reports will be published in January 1999 and will report on all ATP projects completed as of March 1997. Findings available to date indicate that the technologies developed by 15 of the 38 completed projects had been incorporated into commercially available products or services. In addition, patents had been granted for the technologies developed by 40 percent the projects and others had applied for patents not yet granted; and nearly half of the projects had published papers. Expected benefits from this first group of completed projects appear sufficient to more than cover all costs of the ATP thus far.

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Advanced technology program	Pos./BA	270	$204,200	270	$238,700	0	$34,500
	FTE/Obl.	280	217,000	280	251,500	0	34,500

Advanced technology program (BA +$34,500,000, Direct Obligations +$34,500,000) – To support cost-shared partnerships with industry to develop high-risk, enabling technologies critical to long-term U.S. economic growth and industrial productivity. This increase, when combined with anticipated carryover and prior-year recoveries, will support ATP's existing awards and permit NIST to offer approximately $73 million in new awards for projects proposed by U.S. industry using ATP's published selection criteria which involve both technical merit and potential for economic benefits to the U.S. Companies of all sizes are encouraged to submit proposals. To date, over half of the ATP awards to single companies have gone to small firms, and over 70 percent of the awards to joint ventures have included small companies. With respect to the Department of Commerce Strategic Plan, this effort supports a major goal of Theme 2 (Science, Technology, and Information): to accelerate technological innovation and the development of new technologies that underpin future economic growth.

Problem Magnitude and Scope:

Maximum U.S. economic growth is hindered by insufficient investment from private industry in high-risk, long-term R&D in projects with high social returns. High social return R&D results in significant economic and technical advances for the Nation as a whole even though the sponsoring company may benefit only modestly. The ATP is designed to stimulate the US economy through promotion of high social return R&D.

About half of recent U.S. economic growth is attributed to advances in technology, a fraction that is expected to continue to grow. Continued economic vitality and global competitiveness depend upon investment in new technology, particularly as new advances become more complex and more expensive. The Nation supports basic research through government funding of universities and national laboratories. Private industry heavily invests in short-term R&D leading to marketable products. However, there is insufficient national investment in high social return R&D, which tends to be high-risk, long-term, and tends to diffuse technology throughout the economy (rather than giving competitive advantage to only the sponsoring company).

Total industry funding dollars for basic research has been flat since FY 1991. For example, data compiled by the Industrial Research Institute shows movement away from "directed basic research" in industry over the past decade.[1] This trend is confirmed by several case studies.[2] Related industrial research studies show that companies generally pursue high-risk, long-term research more often when government funds and other external partnerships are available to extend, expand, and accelerate the research.[3]

The ATP stimulates the Nation's economy by providing incentives for U.S. industry to invest in the types of high-risk, high social return R&D that might otherwise be ignored by industry or developed too slowly to compete in rapidly changing world markets. Through cost-sharing and encouraging the development of industry partnerships, the ATP stimulates National industry to develop new enabling technologies benefiting not just the participating companies but large sectors of the economy.

A crucial function of the ATP is to encourage collaborations among industries representing disparate technologies and skills to develop new technologies that cut across traditional areas. For example, recent ATP awards have enabled industrial partnerships to develop powerful new tools for DNA sequencing and analysis by combining genetic engineering technologies with semiconductor technologies ("DNA chips"), promising to dramatically reduce the time and cost for medical testing and treatment, new drug development, advances in agriculture, and many other fields. Conservative financial analysts expect that in the next decade, leading companies in genomics (manipulation of DNA) will each have a market value of $40 billion or more. The ATP-supported projects build partnerships among

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[1] The Industrial Research Institute publishes annual trends data late in each calendar year. The most recent data show that 37 percent of survey respondents expect to decrease their level of directed basic research in 1999, while only 14 percent expect to increase that level. See Industrial Research Institute (1998), R&D Trends Forecast for 1999 Washington, DC: Industrial Research Institute (November).

[2] For example, see Corcoran, Elizabeth (1994), "The Changing Role of U.S. Corporate Research Labs," Research-Technology Management (July-August): 14-20; Duga, Jules (1994), IRI Forecast Reflects Major Change in How U.S. Industry Will Perform R&D," Research-Technology Management (May-June): 9-11; and Geppert, Linda (1994), "Industrial R&D: The New Priorities," IEEE Spectrum (September): 30-41.

[3] In eight of the ten case studies analyzed by a Rensselaer Polytechnic Institute research team, the government was a major source of funds after the project was formalized. See Rice, M., G.C. O'Conner, L. Peters, and J. Morone (1998), "Managing Discontinuous Innovation," Research-Technology Management (May-June): 52-58.

companies with expertise in molecular biology, physics, microbiology, chemistry, engineering, instrumentation, robotics, and software to stimulate investment in such high social return R&D.

The ATP addresses the national need for more high social return R&D by funding projects where the underlying science is well-established, where there are clear technical objectives, and where the potential is high for development of technologies impacting broad segments of the economy, as in the example above. All ATP projects are co-funded (participants typically contribute half the total funds), providing strong motivation for success. In addition, the ATP encourages collaborations cutting across science and technology disciplines, and involving companies of all sizes, to leverage maximum social return for investment of government funds.

Why NIST?:

This increase addresses a principal goal of the Department of Commerce and the Administration: to stimulate U.S. economic growth by developing high-risk and enabling technologies through industry-driven cost-shared partnerships. A stronger ATP will do precisely that by partnering with industry to develop innovative technologies, which will enable novel and/or greatly improved products and services, as well as new production processes, with the potential for broad-based economic impact. NIST is the agency best equipped to pursue this mission because of the technical expertise of its staff and its long history of partnership with industry.

The ATP has achieved a reputation for being a well-managed, effective program. In its eight years of existence, the ATP has developed a rigorous selection process which industry enthusiastically supports. In addition, a rigorous evaluation process begins during the first year of the award and continues for six years beyond completion of each project.

NIST is coordinating effectively with other Federal agencies involved in technology development to ensure that the ATP does not duplicate their efforts. The ATP has close working relationships with the Defense Advanced Research Projects Agency, the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, the Department of Energy, and others. ATP program managers meet regularly with their counterparts in these and other agencies.

Description of the Proposed NIST Technical Program:

The proposed increase of $34,500,000 above the FY 2000 base level, when combined with anticipated carryover and prior-year recoveries, is necessary to continue ongoing projects while permitting the ATP to fund $73M of new awards. These awards are expected to cover all major areas of advanced technology, such as computer hardware and software, electronics, photonics, biotechnology, chemistry, and more. These partnerships accelerate the development of new technology. ATP cost sharing is limited to the research phase. Industry does subsequent product development with its own funds.

The level requested for ATP assumes exclusion from the SBIR set-aside ($5M in FY 2000). SBIR is intended to redress the "disadvantaged" status of small R&D firms, yet small firms already receive 55 percent of all ATP awards. By requiring participant cost-sharing, ATP actually increases the national level of R&D spending, while SBIR's lack of cost-sharing makes it more likely that these funds displace internal research spending. Furthermore, unlike SBIR, ATP projects do not have to conform to an agency-specific mission. Consequently, the Administration is proposing, through the appropriation process, that ATP be exempt from the SBIR set-aside in FY 2000.

Economic Impacts:

ATP assesses its performance through a combination of metrics including output tabulations, assessments of interim outcome indicators, and studies of long-term economic impacts. Significant interim impacts have been generated by ATP projects conducted to date. In 1997, analysis of data gathered through the Business Reporting System found that 1) ATP is generating high-risk, high impact technologies: 70% reported a broader project scope and/or higher level of technical risk than could be supported by industry alone, and 35% of the applications represent "new-to-the-world" solutions; 2) ATP is successfully fostering collaboration: 78% of organizations reported that collaboration has helped to achieve project goals (85% of those organizations reported that ATP was responsible to a great or moderate extent for the collaboration); and 3) ATP is accelerating the development and commercialization of advanced technologies: 86% of organizations reported they would not have undertaken the project at all without the ATP or were significantly ahead in their R&D cycles as a result of ATP funding.

With the support of a number of nationally known economists, ATP is developing and applying methods for analyzing longer-term impacts. In one case study, preliminary estimates, based on a single early application of technologies from each of seven tissue engineering projects, suggest a high social rate of return.

Costs and Benefits:

It is anticipated that with the resources requested in this program increase, ATP will be able to broaden its impact on the economy by increasing the development of additional new technologies. Examples of encouraging developments from existing projects include the following advances:

- Nanometer-sized powders, whose production has gone from 10 grams per day at a cost of $1,000 per gram to 100 tons per year at a cost of five cents per gram. These powders have a wide diversity of applications. For example, they will enable dramatically improved high-performance ceramic components, cosmetic and skin-care products with improved sunscreen

properties, and new polishing slurries for semiconductor manufacture, which will in turn enable fabrication of smaller circuits on smoother semiconductor wafer surfaces, thereby increasing yields and computing power.

- Advanced measurement techniques and process control methodologies for automated automobile assembly that substantially improved the fit of auto body parts. The ATP project provided a framework for cooperation among small and mid-sized suppliers, universities, and large auto manufacturers that led to the solution of a complex problem with multiple causes. This is estimated to save $10 to $25 per car in production costs and $50 to $100 per car over its life in maintenance costs. In addition, these quality improvements will increase market share for U.S. producers. Furthermore, the measurement techniques and process control methodologies are expected to be adaptable to other discrete manufacturing industries, such as appliances and metal furniture.

- Technologies to improve the production of printed wiring boards, a $7 billion U.S. industry. Diffusion of these technologies into U.S. companies is attributed, by industry leaders, to have caused the U.S. share of the global market in printed wiring boards to increase after a decade of precipitous decline.

- DNA chips to analyze genetic material. Too high risk and long term for private financing when development began, these tools will transform the diagnosis and treatment of disease. Initial spin-off systems can analyze genetic material up to 1,000 times faster than conventional methods and detect genetic variations related to human cancer or drug resistance in the virus that causes AIDS.

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Extramural programs
Subactivity: Advanced technology program
Program Change: Advanced technology program

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	34,500
99	Direct obligations	34,500

Department of Commerce

National Institute of Standards and Technology

Advanced Technology Program

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Technical & Advisory Services	$2	$0	$0
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	2	0	0
Grand Total, Reimbursable Program	2	0	0

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs
Subactivity: Manufacturing extension partnership

Line Item		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) over 2000 Base	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Manufacturing extension partnership	Pos./Approp	107	$113,500	107	$106,800	107	$107,946	109	$99,836	2	($8,110)
	FTE/Obl.	111	114,136	111	$128,129	111	$107,946	113	$99,836	2	(8,110)

Exhibit 11

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs
Subactivity: Manufacturing extension partnership

	1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Manufacturing extension partnership										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	0	$1,424	0	$578	0	$50	0	$50	0	0
Total	0	1,424	0	578	0	50	0	50	0	0

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MANUFACTURING EXTENSION PARTNERSHIP

Goal Statement

The goal of this subactivity is to improve the technological capability, productivity, and competitiveness of small manufacturers. To realize this goal, MEP provides small manufacturers (those with fewer than 500 employees) throughout the United States with information, decision support, and implementation assistance in adopting advanced manufacturing technologies, techniques, and business best practices. With respect to the Department of Commerce Strategic Plan, this subactivity supports Theme 1 (Economic Infrastructure): to improve the technological capability, productivity, and competitiveness of small manufacturers.

Base Program

The Manufacturing Extension Partnership (MEP) provides small- and medium-sized U.S. manufacturers with access to technologies, resources, and expertise through cost shared cooperative efforts between NIST, state and local governments, and local extension service providers. The MEP program consists of a nationwide network of regional manufacturing extension centers which are linked to diverse Federal, state, university, and private sources of technology and expertise. Each center uses the MEP network to design and provide the most appropriate and cost-effective assistance to small- and medium-sized businesses in such areas as best manufacturing and business practices, workforce development and training, access to sources of financing, and environmental services. Centers also can use tools and techniques developed throughout the MEP network to improve the quality and efficiency of their services, which enables them to serve more firms and increase their overall impact on small- and medium-sized manufacturers in the United States.

MEP has succeeded in its initial goal of placing critically needed extension services within reach of small- and medium-sized manufacturers in all 50 States and Puerto Rico. Therefore, MEP has now turned its focus to making an even more significant contribution to the health of the economy by increasing market penetration and the effectiveness of its services to small- and medium-sized manufacturers as they improve their equipment, processes, and practices to improve capabilities, performance, and prospects for growth.

Guided by MEP's strategic plan, two significant efforts have been initiated to accomplish the goal of increasing the competitiveness of small- and medium-sized manufacturers. First, the NIST Baldrige National Quality Program evaluation criteria have been adopted as a framework

for generating continuous improvement in center performance and impact. By creating high performance centers responsive to the most pressing challenges and needs confronting large numbers of small- and medium-sized manufacturers, MEP is significantly improving manufacturing competitiveness throughout the U.S. Second, an integrated knowledge management system is being developed to facilitate the sharing of best business practices among the centers, deploy proven solutions and technologies to solve industry problems faster and at a greater number of companies, and decrease the cost of service development and training for the centers.

Extending the network's reach is also critical, and the number of small manufacturers receiving services annually by MEP centers continues to grow. Estimates for FY 1998 show that established centers and field offices provided assistance to approximately 26,000 small- and medium-sized enterprises (SMEs). MEP will continue to focus on optimizing system and center performance, thereby increasing its penetration of more small- and medium-sized U.S. manufacturers.

MEP provides a shared, distributed pool of resources, tools, and techniques to integrate its more than 400 regional locations into a nationwide network designed to expand and leverage their capabilities. The integration of these 400 regional locations into a cohesive system adds value to the individual manufacturing extension centers, minimizes duplication of effort, and fosters collective learning throughout the system. These system enhancing efforts include: supporting the training and development needs of field agents and other center staff, with a broad array of technical and service courses; establishing Internet linkages between centers and value-added resource affiliates; providing tools that assist network affiliates in building their capabilities to assist small- and medium-sized manufacturers (for example, responding cost-effectively to environmental requirements or improving workforce skills. MEP also disseminates uniform evaluation metrics and designs/oversees all legislatively mandated program evaluations; and responds to inadequately addressed or future manufacturer needs, such as the current effort on the impending Y2K problem.

The FY 2000 base program operating objectives for the MEP include the following:

- Work with the manufacturing extension centers and state and local governments to further develop their industrial extension infrastructure to increase capabilities and effectiveness and enhance the integration of the nationwide network of centers, while increasing the penetration rate to reach more manufacturing customers.

- Conduct annual, tri-annual and reapplication reviews, renew agreements, and manage the nationwide network of MEP-funded manufacturing extension centers.

- Collect and evaluate performance data on the manufacturing extension centers and the impact of their services on client firms.

- Further develop the electronic networking and information capabilities of the MEP system to strengthen center-to-center and center-to-technology resource communications.

Performances Measures
(Total Program)

As described in the NIST General Statement, MEP evaluates its performance through a combination of methods including: 1) independent assessment of MEP programs, plans, and policies by the MEP National Advisory Board; 2) legislatively mandated independent panel reviews of individual MEP center operations and outcomes conducted against criteria adapted from the Malcolm Baldrige National Quality Award; 3) regular program oversight and periodic review of individual MEP center operations and outcomes by NIST staff; and 4) special studies of national program impacts. These reviews and assessments utilize a variety of metrics, including output tabulations (such as the number of companies served and the number of activities completed); interim impacts on client competitiveness (such as increased sales, capital investment, and cost savings), which are derived from regular surveys conducted by the Bureau of the Census; and analysis of more detailed information regarding the operations and performance of individual centers. Estimated values for key output and interim outcome indicators are provided below: [1]

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
• Companies served by MEP managed extension services[2]	26,000	30,000	36,250	38,000	38,000	38,000	38,000
• Client activities completed by MEP centers[2]	44,824	48,675	55,150	57,000	57,000	57,000	57,000
• Increased sales ($ in millions)[3]	329	441	591	678	693	693	693
• Labor and material savings ($ in millions)[3]	33	44	59	68	69	69	69
• Capital investment ($ in millions)[3]	256	342	459	526	538	538	538
• Inventory savings ($ in millions)[3]	44	59	80	91	93	93	93

[1] Reflects updated data as of January 1999.

[2] Anticipated increases for companies served and activities completed for FY 1998 and beyond are based on actual increases between FY 1996 and FY 1997 and MEP$ goal of increasing the system-wide utilization rate.

[3] Data represent the impacts that projects closing in each year can be expected to have within ten months, based on U.S. Census Bureau client surveys. Because it is a snapshot of actual impacts that companies attribute directly to MEP services within ten months of receiving services, this technique does not measure cumulative or recurring benefits. Actual data for 1998 are not yet available.

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing extension partnership	Pos./BA	107	$107,946	109	$99,836	2	($8,110)
	FTE/Obl.	111	107,946	113	99,836	2	(8,110)
Best practices	Pos./BA			2	1,000	2	1,000
	FTE/Obl.			2	1,000	2	1,000

Dissemination of Center Best Practices (+2 Permanent positions, +2 FTE, BA +$1,000,000**,** Direct Obligations +$1,000,000) - To contribute to the health of the U.S. economy by strengthening the global competitiveness of U.S. small- and medium-sized manufacturers by sustaining and strengthening the NIST-affiliated manufacturing extension centers. These centers are state and local community-based non-profit organizations which work directly with small- and medium-sized manufacturers to assist them with access to public and private resources, information, and other services to meet their unique needs, especially the improvement of their production and business practices. This initiative will provide the necessary resources for NIST-MEP centers to gather, promote, and deploy useful best practices. In addition, NIST-MEP will provide program management and production plans and oversight. Appropriate center and private/public sector experts will be used to teach courses, document center assessments and create management aids and templates. With respect to the Department of Commerce (DoC) Strategic Plan, this effort supports a major goal of Theme 1 (Economic Infrastructure): to improve the technological capability, productivity, and competitiveness of small manufacturers.

Problem Magnitude and Scope:

America's small- and medium-sized manufacturers are important to the economy, both in terms of direct economic and employment impact and in their strategic relationship with the larger U.S. manufacturers they supply. There are nearly 400,000 small manufacturing establishments in the U.S. These establishments contribute more than half of the total value-added in U.S. manufactured goods and provide over 65 percent of all manufacturing jobs (over 12 million jobs). However, these firms typically do not have the expertise or resources to address the challenges of cutting costs, improving quality, meeting environmental and international standards, and getting to market quickly with new and improved products. To remain competitive in what has become a global market, small- and medium-sized manufacturers need to continually assess and improve their operations.

Many MEP centers have become highly specialized in a few focused areas, while leaving room for improvement in others. This has led to an uneven ability of centers to respond to particular customer needs. The proposed initiative will address this problem by identifying and dispersing to other centers the expertise that has been developed in particular centers, thereby benefiting all centers in the MEP network and their customers.

Why NIST?:

An efficient and effective approach to center improvement is to deploy the best practices of other centers and similar service providers. Each individual center finds it very costly to identify and deploy these practices. A centralized system tied to the current NIST/MEP evaluation process can provide the framework for cost effective deployment. Such a system would involve use of the Center Performance Excellence criteria as a framework for identification of best practices. Input would come from MEP and center plans, MEP program officers, state partners, and other stakeholders. Best practices identified would be studied, documented, and disseminated using standard approaches—case studies, curriculum standards, and tool development protocols.

The NIST-MEP web-site would be augmented to readily deploy the information, and then the most suitable field mechanism would be used to reach center staff. Having useful best practices information readily available, center staff will have more time to work with clients, and will work with them more efficiently. Thus, more firms can be served. The quality and effectiveness of services will be greatly enhanced, and new services will be introduced more quickly, leading to greater impact on firms.

NIST/MEP has demonstrated its ability to transfer technologies and business practices to small- and medium-sized manufacturers through its wide network of MEP centers. MEP has also demonstrated its ability to partner with outside organizations, having successfully worked with private industry, state governments, and other Federal agencies.

Description of the Proposed NIST Technical Program:

Entering fiscal year 2000, MEP is the only nationwide service delivery system of its kind, public or private, which provides small- and medium-sized manufacturing firms ready and affordable access to the information, decision support, and implementation assistance necessary to achieve and maintain competitiveness in the global marketplace.

Currently, NIST-MEP is able to provide only a very limited set of best practice information to centers. One area being improved deals with employee development and retention in centers. These efforts are being conducted in conjunction with the NIST-MEP center evaluations. The NIST-MEP National Advisory Board (NAB), various review panels, local boards, state sponsors, and center management have called upon NIST-MEP to accelerate these efforts. Of highest priority today are requests for services and deployment in the areas of in-depth analysis of small manufacturers' needs, center performance benchmarking, employee development, and strategic planning. Since the rapid expansion of MEP in the last four years, a demand has arisen for better dissemination of best practices information in the areas of center operations, center business practices, and service delivery.

At present, the Center Directors meet quarterly, and there is a yearly national staff conference. At these meetings, center staff learn from each other through talks and networking. Additionally, to the extent that NIST-MEP staff and center volunteers can come together to create documentation, select tools have been developed and courses are being offered. However, these efforts do not sufficiently meet the demand for the dissemination of best practices information.

Under this initiative, a more systematic approach will be developed to include the following activities:

- Identify and document high priority best practices responding to MEP criteria for Center Performance Excellence. NIST-MEP, along with leaders in the field of case study methodologies, has developed a unique approach to documenting best practices using evaluation experts in the centers and universities. In addition, working groups of center experts have developed methods for documenting technical approaches. Both methods will be used.

- Train center staff in the most effective utilization of center best practices. Training courses will be used to place the best practice information in the hands of center staff. This is a more cost-effective way to reach center staff than individualized presentations to each center. One example is the current NIST-MEP Y2K effort, which teaches center staff how to work with firms on year 2000 computer "bug" remediation planning.

- Provide technical assistance to facilitate implementation of best practices at the individual center level. In special cases, centers require direct individual training to deploy best practices, or a group of centers will be needed to pilot materials. In these cases, experts in the field, such as management consultants, technical experts, or center staff, will provide the assistance or lead the pilot efforts.

- Design and disseminate best practice materials through printed and electronic means. The NIST-MEP web-site will be used to provide comprehensive access to information.

Economic Impacts:

The potential economic impact of this effort to provide the most distinctive and effective center best practices to all MEP centers is enormous. The ability of each center to provide improved service to their small- and medium-sized manufacturing customers will also improve tremendously.

Evaluations of these collective efforts resulting from the dissemination of center best practices will be made to determine the impact on the effectiveness and efficiencies of the centers. It is expected that time spent by field staff in value-added assistance to clients will increase over the next five years by as much as five to 15 percent, which will lead to an equivalent increase in clients served and impact generated.

Costs and Benefits:

Recurring surveys by the Census Bureau continue to measure improvements in the business performance and competitiveness of MEP client firms. While most MEP centers and affiliates have been providing services for only a few years, results of these surveys indicate that MEP's network of manufacturing extension services is fostering significant improvements in manufacturing and business performance. Documented impacts include jobs created and retained, capital investment, sales increases, and cost savings. For example, based on a recent sample of 2,507 MEP client companies around the country, MEP estimates that in FY 1998 alone, MEP services generated approximately $329 million in new sales, $44 million in inventory savings, and $33 million in labor and material savings. MEP also estimates that its services leveraged approximately $256 million in additional capital investment by client firms. By implementing this initiative, all centers will have access to usable best practices information and all center staff will be better able to effectively serve their small manufacturer customers.

Exhibit 14

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Manufacturing extension partnership
Subactivity: Manufacturing extension partnership
Program Change: Best practices

Title		Grade	Number	Annual Salary	Total Salaries
Information specialist		ZA IV	1	$68,570	$68,570
Social scientist		ZP IV	1	68,570	68,570
Subtotal			2		137,140
Less lapse	25 %		0		(34,285)
Total full-time permanent (FTE)			2		102,855
2000 Pay Adjustment (4.4%)					4,526
Total					107,381

Personnel Data

Full-Time Equivalent Employment:	
Full-time permanent	2
Authorized Positions:	
Full-time permanent	2

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Manufacturing extension partnership
Subactivity: Manufacturing extension partnership
Program Change: Best practices

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$107
11.9	Total personnel compensation	107
12.1	Civilian personnel benefits	26
21	Travel and transportation of persons	25
22	Transportation of things	4
23.3	Communications, utilities and miscellaneous charges	28
24	Printing and reproduction	3
25.1	Advisory and assistance services	0
25.2	Other services	158
25.3	Purchases of goods and services from Government accounts	20
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	8
26	Supplies and materials	17
31	Equipment	2
32	Land and structures	0
41	Grants, subsidies and contributions	602
99	Direct obligations	1,000

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing extension partnership	Pos./BA	107	$107,946	109	$99,836	2	($8,110)
	FTE/Obl.	111	107,946	113	99,836	2	(8,110)
Grants maturity	Pos./BA	107	$107,946	107	98,836	0	(9,110)
	FTE/Obl.	111	107,946	111	98,836	0	(9,110)

Grants maturity (BA -$9,110,000, Direct Obligations -$9,110,000,) - A decrease of -$9,110,000 is proposed to reflect a lower Federal cost share to NIST-affiliated manufacturing extension centers based on the participation rates which are part of the operating procedures of the program as published as a final rule in the Federal Register in 1990. No decrease in the number of centers will result.

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Manufacturing extension partnership
Subactivity: Manufacturing extension partnership
Program Change: Grants maturity

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	(9,110)
99	Direct obligations	(9,110)

Department of Commerce

National Institute of Standards and Technology

Manufacturing Extension Partnership

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Navy	$16	$0	$0
Other	613	0	0
Subtotal, Department of Defense	629	0	0
Department of Health & Human Services	40	0	0
Department of Labor	555	196	50
Environmental Protection Agency	200	382	0
Total, Other Agency	1,424	578	50
WCF Investments/Operating Adjustments	0	0	0
Total, Other Reimbursables	0	0	0
Grand Total, Reimbursable Program	1,424	578	50

Exhibit 16

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	1998 Actuals	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
11	Personnel compensation					
11.1	Full-time permanent	$22,095	$23,434	$24,336	$24,336	0
11.3	Other than full-time permanent	1,762	1,811	1,845	1,845	0
11.5	Other personnel compensation	529	529	529	529	0
11.9	Total personnel compensation	24,386	25,774	26,710	26,710	0
12.1	Civilian personnel benefits	5,107	5,346	5,543	5,530	(13)
13	Benefits for former personnel	11	11	11	11	0
21	Travel and transportation of persons	1,350	1,350	1,363	1,363	0
22	Transportation of things	93	93	94	94	0
23.1	Rental payments fo GSA	17	17	17	17	0
23.2	Rental payments to others	769	784	789	784	(5)
23.3	Communications,utilities, and miscellaneous charg	2,627	2,996	3,042	3,042	0
24	Printing and reproduction	180	180	186	186	0
25.1	Advisory and assistance services	2,344	2,344	2,344	2,365	21
25.2	Other services	5,804	10,596	8,174	8,172	(2)
25.3	Purchases of goods and services from Gov. accou	5,378	5,378	5,748	5,747	(1)
25.5	Research and development contracts	0	0	1	1	0
25.7	Operation and maintenance of equipment	746	746	746	746	0
26	Supplies and materials	1,625	1,625	1,640	1,640	0
31	Equipment	2,644	2,644	2,662	2,662	0
32	Land and structures	35	35	35	35	0
41	Grants, subsidies and contributions	240,099	298,789	265,841	292,231	26,390
42	Insurance claims and indemnities	13	0	0	0	0
99	Total obligations	293,228	358,708	324,946	351,336	26,390

	Object Class	1998 Actuals	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
99	Total obligations	293,228	358,708	324,946	351,336	26,390
	Less: Prior Year Unobligated Balance	(15,823)	(33,408)	0	(9,000)	0
	Less: Prior Year Recoveries	(5,063)	(9,000)	(3,800)	(3,800)	0
	MEP Supplemental	0	(21,000)	0	0	0
	Unobligated balance carried forward	33,408	9,000	(9,000)	0	0
	Transfer to NIST Working Capital Fund	250	0	0	0	0
	Total Requirements	306,000	304,300	312,146	338,536	26,390
	Personnel Data					
	Full-time equivalent employment:					
	Full-time permanent	344	354	354	356	2
	Other than full-time permanent	37	37	37	37	0
	Total	381	391	391	393	2
	Authorized Positions:					
	Full-time permanent	364	364	364	366	2
	Other than full-time permanent	13	13	13	13	0
	Total	377	377	377	379	2

Exhibit 17

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
DETAILED REQUIREMENTS by OBJECT CLASS
(Dollar amounts in thousands)

Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
11 Personnel compensation				
11.1 Full-time permanent				
Executive level	43	1,140	1,140	0
Senior executive service	1,169	23,191	23,298	107
Career path	0	0	0	0
Wage board	0	0	0	0
Scientific & professional (P.L. 80-313)	0	0	0	0
Subtotal	1,212	24,331	24,438	107
11.3 Other than full-time permanent				
Career path	34	1,845	1,845	0
Wage board	0	0	0	0
Scientific & professional (P.L. 80-313)	0	0	0	0
Experts & consultants	0	0	0	0
Student	0	0	0	0
Subtotal	34	1,845	1,845	0
11.5 Other personnel compensation				
Overtime	0	207	207	0
SES performance awards	0	28	28	0
Cash awards	0	294	294	0
Merit pay awards	0	0	0	0
Other	0	0	0	0
Subtotal	0	529	529	0
11.9 Total personnel compensation	1,246	26,705	26,812	107

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
12.1	Civilian personnel benefits				
	Civil service retirement	(20)	921	921	0
	Federal employees' retirement	112	1,519	1,531	12
	Thrift savings plan	19	580	582	2
	Contribution to civil svc. retirement/disability fund	0	0	0	0
	Federal Insurance Contribution Act	66	1,254	1,262	8
	Health insurance	44	1,012	1,016	4
	Life insurance	2	45	45	0
	Employees' Compensation Fund	(37)	172	159	(13)
	Other	12	40	40	0
	Subtotal	198	5,543	5,556	13
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	11	11	0
	Other	0	0	0	0
	Subtotal	0	11	11	0
21	Travel and transportation of persons				
	Common carrier	0	508	516	8
	Mileage	0	40	41	1
	Per diem/actual	13	564	576	12
	Other	0	251	255	4
	Subtotal	13	1,363	1,388	25
22	Transportation of things	1	94	98	4
23.1	Rental payments to GSA	0	17	17	0
23.2	Rental payments to others	5	784	800	16

Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
23.3 Communications, utilities, and miscellaneous charges				
Rental of ADP equipment	0	16	16	0
Rental of office copying equipment	2	87	88	1
Other equipment rental	2	113	115	2
Federal telecommunications system	3	113	114	1
Other telecommunications services	2	146	150	4
Postal Service by USPS	5	200	202	2
Utilities:				
Electric	27	1,662	1,673	11
Gas	0	416	420	4
Water/Sewer	0	289	292	3
Subtotal	41	3,042	3,070	28
24 Printing and reproduction				
Publications	5	166	168	2
Other	1	20	21	1
Subtotal	6	186	189	3
25.1 Advisory and assistance services				
Management & professional support services	8	775	775	0
Studies, analyses, & evaluation	13	1,590	1,590	0
Subtotal	21	2,365	2,365	0
25.2 Other services				
Training:				0
Other	6	326	333	7
ADP Services	12	991	1,033	42
Other non-government contracts	236	6,728	6,833	105
Subtotal	254	8,045	8,199	154

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
25.3	Purchases of goods and services from Gov. accounts				
	Payments to GA, WCF	0	978	978	0
	Office of Personnel Management	0	6	6	0
	Other Federal agencies:				
	Dept. of Commerce	0	661	680	19
	Other	40	4,104	4,105	1
	Subtotal	40	5,749	5,769	20
25.5	Research and development contracts	0	0	0	0
25.7	Operation and maintenance of equipment	0	746	754	8
26	Supplies and materials				
	Office & laboratory supplies	12	1,413	1,430	17
	Scientific publications & journals	0	214	214	0
	Fuel oil	0	13	13	0
	Subtotal	12	1,640	1,657	17
31	Equipment				
	Office machines and other equipment	4	195	197	2
	ADP equipment	1	478	479	1
	Equipment amortization	4	1,989	1,989	0
	Subtotal	9	2,662	2,665	3
32	Land and structures	0	35	35	0
41	Grants, subsidies and contributions	0	253,159	279,151	25,992
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	1,846	312,146	338,536	26,390
	Transfer to NIST Working Capital Fund	0	0	0	0
	Total Requirements	1,846	312,146	338,536	26,390

Department of Commerce
National Institute of Standards and Technology

Industrial Technology Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the Manufacturing Extension Partnership of the National Institute of Standards and Technology,

15 U.S.C. 278k, 278l

15 U.S.C. 278k directs the Secretary, through the Director of NIST, to provide assistance for the creation of Regional Centers for the Transfer of Manufacturing Technology.

15 U.S.C. 278k(c)(5) allows Manufacturing Extension Partnership Program Centers to receive additional financial support beyond six years with receipt of a positive evaluation.

15 U.S.C. 278l directs the Secretary, through the Director of NIST or other appropriate officials, to provide technical assistance to State technology programs.

2. $99,836,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

3. Section 15 U.S.C. 278k(c) (5) as amended by 15U.S.C. 217 note the duration of Federal financial assistance that may be awarded by the Secretary of Commerce to Regional Centers for the transfer of Manufacturing Technology (“Centers”), states “After the sixth year, a center may receive additional financial support under this section if it has received a position evaluation through an independent review, under procedures established by the Institute. Such an independent review shall be required at least every two years after the sixth year of operation shall not exceed one third of the capital and annual operating and maintenance costs of the

Center under program." Commerce that continuation of Federal funding to the Center is in the best interest of the Regional Centers for the transfer of Manufacturing Technology Program.

Provided further, that the Center's most recent performance evaluation is positive, and the center has submitted a reapplication which has successfully passed merit review.

4. In addition, for necessary expenses of the Advanced Technology Program of the National Institute of Standards and Technology,

15 U.S.C. 278n

15 U.S.C. 278n establishes in the Institute (NIST) an Advanced Technology Program.

5. $238,700,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

Additional authorizing legislation will be proposed for FY 2000.

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1998 Actual	FY 1999 Estimate	FY2000 Estimate
Management and professional support services	$767	$767	$615
Studies, analyses, and evaluations	1,577	1,577	1,750
Total	2,344	2,344	2,365

Significant Activities

ITS advisory and assistance services are concerned with a review and evaluation of grants associated with the Advanced Technology Program (ATP) and the Manufacturing Extension Program (MEP) and with evaluation of their programmatic outcomes, service delivery efficiency, and internal infrastructure requirements.

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the NIST role in dealing with the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in implementing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from sources outside NIST and risk having a poorer working and professional relationship with those in the business of using the products and services offered by NIST.

Internal Controls to Ensure Appropriate Use:

Requisition requests from NIST program managers for advisory and assistance services must be accompanied by written justification for the need for such services. Personal services contracts require review by the Office of Human Resources Management.

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Exhibit 5

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.		Positions	FTE	Budget Authority	Direct Obligations	Appro-Appropriation
	Currently Available, 1999	32	33	$56,714	$139,010	$56,714
	less: Unobligated balance from prior years	0	0	0	(82,296)	0
NIST-227	plus: 2000 Adjustments to base	0	0	84	84	84
	2000 Base Request	32	33	56,798	56,798	56,798
	plus: 2000 Program changes	0	0	50,000	50,000	50,000
	2000 Estimate	32	33	106,798	106,798	106,798

			1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) Over 2000 Base	
	Comparison by activity:		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
	Construction and major renovations											
NIST-233	Construction and major renovations	Pos/Approp	32	$95,000	32	$56,714	32	$56,798	32	$106,798	0	$50,000
		FTE/Obl.	20	21,372	33	139,010	33	56,798	33	106,798	0	$50,000
	Adjustments to obligations:											
	Prior year recoveries			(92)								
	Unobligated balance, start of year			(8,576)		(82,296)		0		0		0
	Unobligated balance, end of year			82,296		0		0		0		0
	Financing from transfers:											
	Transfer to other accounts (+)			0		0		0		0		0
	Appropriation			95,000		56,714		56,798		106,798		50,000

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Exhibit 8

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm Pos	FTE	Required Amount	Absorbed Amount	Requested Amount
Other Changes:					
1999 Pay raise (annualization)……			$16	. . .	$16
2000 Pay raise……			58	. . .	58
Within-grade step increases……			17	($17)	. . .
Personal Benefits:					
Civil Service Retirement System (CSRS)……			(4)	. . .	(4)
Federal Employees' Retirement System (FERS)……			5	. . .	5
Thrift Savings Plan (TSP)……			1	. . .	1
Federal Insurance Contribution Act (FICA)……			3	. . .	3
Health Insurance……			4	. . .	4
Travel and transportation of persons……			1	. . .	1
Other services……			189	(189)	. . .
Supplies and materials……			11	(11)	. . .
Equipment……			3	(3)	. . .
Total, Adjustments to Base……			**304**	**(220)**	**84**

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

		FTE	Amount
Other Changes:			
1999 Pay raise (annualization)		0	$16

A pay raise of 3.6 percent was effective January 1, 1999.

Total cost in FY 2000 of 1999 pay raise	$62,000
Less amount requested in FY 1999	40,000
Less amount absorbed in FY 1999	6,000
Amount requested in 2000 to provide full-year cost of 1999 pay raise	16,000
Payment to Working Capital Fund	0
Total, 1999 pay raise increase in FY 2000	16,000

2000 Pay increase and related costs		0	58

A general pay raise of 4.4 percent was effective January 1, 2000.

Total cost in FY 2000 of pay increase	$58,000
Less amount absorbed in FY 2000	0
Amount requested for FY 2000 pay increase	58,000
Payment to Working Capital Fund	0
Total adjustment for FY 2000 pay increase	58,000

Within-grade step increases	0	17

An increase of $17,000 is required to cover the cost of within-grade step increases.

Personnel benefits	0	9

Civil Service Retirement System (CSRS)	(4)
Federal Employees' Retirement System (FERS)	5
Thrift Savings Plan (TSP)	1
Federal Insurance Contribution Act (FICA) - OASDI	3
Health Insurance	4

Civil Service Retirement System (-$4,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 42.2 percent in FY 1999 to 39.2 percent in FY 2000. Contribution rates will remain the same.

Payroll subject to retirement systems ($1,475,000)	
Cost of CSRS contributions in FY 2000 ($1,475,000 x .392 x .0851)	$49,205
Cost of CSRS contributions in FY 1999 ($1,475,000 x .422 x .0851)	52,970
Total adjustment-to-base	(3,765)

Federal Employees' Retirement System ($5,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 57.8 percent in FY 1999 to 60.8 percent in FY 2000. The contribution rate will remain at 10.7 percent in FY 2000.

Payroll subject to retirement systems ($1,475,000)	
Basic benefit cost in FY 2000 ($1,475,000 x .608 x .107)	$95,958
Basic benefit cost in FY 1999 ($1,475,000 x .578 x .107)	91,223
Total adjustment-to-base	4,735

Thrift Savings Plan ($1,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2000 ($1,475,000 x .608 x .02).....	$17,936
Thrift plan cost in FY 1999 ($1,475,000 x .578 x .02).....	17,051
Total adjustment-to-base	885

Federal Insurance Contributions Act (FICA) - OASDI ($3,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from $70,725 in FY 1999 to $73,275 in FY 2000. The OASDI tax rate will remain 6.2 percent in FY 2000.

FERS payroll subject to FICA tax in 2000 ($1,475,000 x .608 x .925 x .062)	$51,431
FERS payroll subject to FICA tax in 1999 ($1,475,000 x .578 x .925 x .062)	48,894
Increase (FY 1999-FY 2000).....	2,537
OTP payroll subject to FICA tax in FY 2000 ($51,000 x .925 x .062).....	$1,778
OTP payroll subject to FICA tax in FY 1999 ($51,000 x .925 x .062).....	1,691
Change (FY 1999-FY 2000).....	87
Total adjustment-to-base	2,624

Health insurance ($4,000) - Effective January 1998, NIST's contribution to Federal employees' health insurance premiums increased by 6.4 percent. Applied against the FY 1999 estimate, the FY 2000 health insurance costs are projected to increase by $4,000.

Travel and transportation of persons..... 0 1

Per Diem ($1,000) - Effective January 1998 the General Services Administration raised per diem rates. This increase results in a 3.3 percent increase to NIST. This percentage was applied to the FY 1999 estimate to arrive at an increase of $1,000.

Other services	0	189

NIST is requesting $189,000 to cover increased costs in other services. For Construction of Research Facilities, other services include non-governmental contracts, training, maintenance of equipment, and purchases of goods and services from other Federal agencies. The increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for other services.

Supplies and materials	0	11

The $11,000 increase was calculated by applying the deflator of 1.0 percent to the FY 1999 estimate for supplies and materials.

Equipment	0	3

Office-ADP-Other equipment ($3,000) - The $3,000 increase was calculated by applying the 1.0 percent deflator to the FY 1999 estimate for office machines, ADP, and other special equipment.

Subtotal, ATB's	**0**	**304**
Less ATB's Absorbed	**0**	**(220)**
Total, ATB's	**0**	**84**

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Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Exhibit 10

Activity: Construction and major renovations
Subactivity: Construction and major renovations

Line Item		1998 Actual		1999 Currently Available		2000 Base		2000 Estimate		Increase/ (Decrease) over 2000 Bas	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Construction and major renovations	Pos/Approp	12	$68,308	12	$40,000	12	$40,000	12	$95,000	0	$55,000
	FTE/Obl.	1	5,216	12	111,413	12	40,000	12	95,000	0	55,000
Modifications and improvements	Pos/Approp	20	26,692	20	16,714	20	16,798	20	11,798	0	(5,000)
	FTE/Obl.	19	16,156	21	27,597	21	16,798	21	11,798	0	(5,000)
Totals	Pos/Approp	32	95,000	32	56,714	32	56,798	32	106,798	0	50,000
	FTE/Obl.	20	21,372	33	139,010	33	56,798	33	106,798	0	50,000

Of the $95 million appropriated for 1998, $78,308,000 was withheld pending submission of a facilities plan. The current plan submitted to Congress with the 2000 budget reflects $68,308,000 applied to the Advanced Measurement Laboratory and $10,000,000 applied to Safety, Capacity, Maintenance, Major Repair projects.

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF PROGRAM AND PERFORMANCE
CONSTRUCTION AND MAJOR RENOVATIONS

Goal Statement

This program supports all NIST activities by providing the staff with the facilities to support two of the major themes of the DoC Mission as stated in the Commerce Strategic Plan: build for the future and promote U.S. competitiveness in the global marketplace by strengthening and safeguarding the Nation's economic infrastructure and keep America competitive with cutting-edge science and technology and an unrivaled information base.

Base Program

The base program includes funding for construction and repair of NIST facilities to meet the metrology and research needs of the 21st Century. NIST will begin construction during FY 2000 of an Advanced Measurement Laboratory (AML) in Gaithersburg, Maryland. The Laboratory will provide stringent controls for particulate matter, temperature, vibration, and humidity that are unattainable in current NIST buildings, and equal or better than similar laboratories overseas. Such conditions are vital for housing NIST's most advanced metrology, physics, chemistry, electronics, engineering and materials science research projects. These programs must keep pace with rapid developments in semiconductors, precision instruments, industrial robots, computers, chemicals, pharmaceuticals, building materials, and emerging technologies requiring molecular and atomic-level precision.

The total project cost of $218.3 million is based on construction over four years from existing designs, which have been updated to take advantage of the most recent developments in building design. In FY 1999 $108.3 million was carried over to be combined with the $95 million that is provided in FY 2000, for a total of $203.3 million which will be used to start the construction of the AML. An additional $15 million will be needed in FY 2001 for fitup, relocation, and communications.

The remaining $11.8 million under this subactivity will be used to address the highest priority safety, capacity, maintenance and major repair projects. This will ensure compliance with various health and safety regulations, improve access for the handicapped, and safeguard the utility infrastructure of existing buildings. The one-time decrease of $5 million provides a sufficient level of funding to address the highest

priority safety, capacity, maintenance, and major repair projects in FY 2000. While a significant backlog of projects remains, this reduction is proposed to partially offset the cost of the AML construction.

The FY 2000 base program operating objectives include the following:

- Begin construction of the AML.
- Continue abatement of hazardous materials from NIST sites and buildings.
- Continue to modify the sites to comply with the Access to Federal Buildings Act and the Americans with Disabilities Act.
- Continuous repairs/replacements of the following sitewide systems: Utility Systems, Exhaust and Air Filtration Systems, Mechanical-electrical Systems, and Site Alarm and Fire Safety Systems.
- Continuous architectural, structural, and conservation repairs as needed.

Although a plan is developed for the use of the base funds, it is important to note that the planned use of funds is subject to change if and when emergency situations arise. Also, in many cases, final cost estimates resulting from contract negotiations may affect the number of projects that can be funded.

Performance Measures

The focus of this program is to keep the laboratory and office space safe and as conducive to scientific work as possible within the funding available. The following measures will track how well NIST achieves this goal.

- Keep AML construction on schedule and within budget by not exceeding 110 percent of estimates.
- For existing NIST buildings, keep the operating time lost due to unscheduled downtime to less than 10 percent of total scheduled possible operating time, on average.

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
INCREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Construction and major renovations	Pos./BA	12	$40,000	12	$95,000	0	$55,000
	FTE/Obl.	12	40,000	12	95,000	0	55,000

Facilities technical obsolescence (BA +$55,000,000, Direct Obligations +$55,000,000) - NIST requests $55 million to begin construction of the Advanced Measurement Laboratory (AML). This, along with the $40 million base and the $108.3 million which was appropriated in 1998 and 1999 for construction, will allow NIST to award a contract for construction of the AML.

Problem Magnitude and Scope:

The majority of the current 30 to 45 year old laboratory facilities of NIST are failing to adequately support the Institute's mission of providing U.S. industry and science with the best possible measurement system. If technical program needs continue to escalate and the buildings continue to deteriorate at the current pace, more than 80 percent of NIST's laboratory facilities will fail to adequately support the needs of U.S. industry and science. Annual transactions involving more than $4 trillion in U.S. products depend upon NIST's maintenance of accurate weights and measures. Trillions of dollars in additional sales are supported by the availability of reference materials, measurement techniques, calibrations, and standards provided by NIST researchers.

The current plan for NIST's Construction of Research Facilities program was formulated with active engagement by NIST management and with oversight by NIST's Visiting Committee. It is the culmination of a long and thorough effort to ensure that NIST keeps pace with advances in science and technology and the requirements of the Nation for advanced technical measurements and standards. NIST's proposed five-year plan for fiscal years 2000 through 2004 is drawn from a 17-year master schedule of needed facilities improvements.

NIST's revised five-year plan addresses only its most urgent, highest priority facilities needs that must be addressed to allow NIST to continue to fulfill its mission. The plan assumes no growth in NIST staffing levels. NIST used new information provided by several new studies to re-evaluate and reprioritize its facilities needs. These include a recently drafted thorough technical needs assessment by Smith, Hinchman, & Grylls Associates (SH&G) Incorporated which validates and updates the extensive study conducted in 1991; an economic analysis by Booz-Allen & Hamilton of several alternatives to address the identified needs, currently in draft; and a comparison of NIST facilities and resources with counterpart organizations in Germany, Japan, and Brazil, which is being done in-house. SH&G, Incorporated in their draft report "confirms that the most significant problems are still prevalent today, in some cases remarkably worse.... Continued neglect of NIST's facilities has dramatically affected the ability of laboratory and technical space users to conduct measurement research." Booz-Allen & Hamilton concludes "without intervention, the performance deterioration caused by the facilities inadequacies will impede, if not invalidate, NIST's ability to maintain standards in weights and measures, and to facilitate the development and application of new technology."

Technical Highlights of the AML:

Some U.S. industrial and other government laboratories have higher-performance air quality, temperature control, vibration isolation, power stability, or humidity control than are currently available in NIST's facilities. However, few have strict control in all of these areas simultaneously as NIST needs and plans through construction of the AML. NIST researchers have made regular use of special facilities at other institutions in the United States and around the world whenever feasible to conduct experiments not possible in their own laboratories. However, there are no other U.S. laboratories that provide the capability required by NIST and reflected in the design of the AML.

The AML is designed to be a shared resource for the entire Gaithersburg campus, in support of the private-sector industrial and scientific community that works closely with NIST. Research groups from any of the NIST laboratories may be assigned space in the AML if they have a technical need for tight environmental controls. Currently, the programs with the greatest need for AML space are precision engineering; atomic-scale physics; microchemical analysis; microelectronics processing and materials analysis; acoustics, mass, and vibration measurements; pressure and temperature measurements; chemical kinetics; and photonic materials. With the evolution of technology to smaller and faster products, however, the demand for the limited AML space will continue to increase.

The AML will include five different sections joined by a central corridor that will connect them to the current Metrology Building. There are two different metrology sections in the proposed AML. The "Quiet Metrology" section includes those areas of atomic physics, mass measurements or other research that require excellent isolation from vibration sources as well as good air quality and temperature and humidity control. The "Dynamic Metrology" section will include NIST research and calibrations using coordinate measuring machines and

other metrology instruments that need good vibration isolation and temperature control but that also create some vibration due to the fact that parts of the machines must move while measuring artifacts.

The AML will also include two sections of Instrument Laboratories. These will include one floor of laboratory space, above ground, on well-isolated concrete slabs on grade for research using, for example, electron microscopes and laser/optic equipment with stringent requirements for control of vibration, temperature, humidity, and air quality. Finally, the AML will also include a Clean Room section that offers one floor of aboveground laboratory space. It will be similar to those certified as class 100 (less than 3.5 particles per liter) and has been designed to be upgradable to class 10 or better as needed.

The exacting requirements that this proposed facility presents include:

- Extremely low levels of vibration (a velocity amplitude of 3 micrometers per second or less).
- Large volumes of air changes to produce the necessary temperature control of +/- 0.25 degree Celsius or better.
- Extremely good cleanliness (1000 particles per cubic foot in most areas, 100 in the Clean Room) that can be upgraded as needs arise.
- Excellent humidity control (to +/- 1 percent in advanced metrology areas).

It is not economically feasible to retrofit existing space to meet these requirements. Structural limitations of the existing general purpose laboratories effectively prevent achieving the necessary headroom, flexibility and overall performance levels of an AML-grade laboratory. For example, while some improvement in vibration levels is possible through isolation of mechanical equipment in a retrofitted building, the exceptionally low levels required for NIST's atomic-based measurements require a building specifically designed to achieve this goal.

Cost and Benefits:

Total cost of the AML is $235.3 million. This includes $17 million already spent in FY 1996 for the building design, $108.3 million currently in hand, $95 million requested in FY 2000, and an additional $15 million needed in FY 2001 for post-construction fit-up, relocation, and communications costs related to occupying the building.

The beneficial impact of NIST's AML on the U.S. economy will be long-term and significant. NIST researchers seek to measure reliably everything from length, to time, to mass, to electric current – before industry or science hits a roadblock in its pursuit of a better product or new understanding of the way the world works. In this way, NIST research helps foster technological innovation, the driving force for about 50 percent of U.S. economic growth. NIST must be the best at measuring a whole range of quantities because industry needs high

accuracy. NIST's job is to provide U.S. manufacturers and scientists with "gold standard" templates that are indispensable to enable new generations of science, technology, and competitive products..

These new laboratories will be equal to, or better than, similar laboratories overseas. Such conditions are vital for housing the institute's most advanced metrology, physics, chemistry, electronics, engineering, and materials science research and will enable NIST to keep pace with rapid developments in semiconductors, industrial robots, computers, pharmaceuticals, and emerging technologies requiring molecular and atomic-level precision.

A representative list of the many ways in which NIST's inadequate facilities adversely affect U.S. industry and science today includes:

- inability to provide the semiconductor industry with standards for ultratrace wafer contamination and thin-film thicknesses;
- backlogs of up to one year for important reference materials needed by the health care, food processing, and energy and power industries;
- delays in the delivery of pressure and temperature calibrations to the pharmaceutical, jet engine, semiconductor, utility, and other industries;
- setbacks in providing "nanoscale" standards for the $60 billion data storage industry; and
- delays in delivery of antenna calibrations for satellite communications and radar operations.

The aggregate effect of NIST facilities inefficiencies on the U.S. economy is large. According to several economic impact studies conducted for NIST, the benefit-cost cost ratio for specific NIST research programs has ranged from 3 to 1 to more than 100 to 1. In other words, for every dollar spent on NIST research in the studied areas, benefits of $3 to more than $100 were realized by the economy. However, NIST researchers are being forced to devote more and more of their time to controlling experimental environments rather than conducting actual measurement research and passing their results on to industry and science.

Although the construction phase of the AML will have some disruptive effect on the adjacent General Purpose Laboratories, NIST anticipates that the scientist will continue to make the necessary adjustments required to meet their programmatic goals.

Quantitative Performance Measures

The focus of this program is to keep the laboratory and office space safe and as conducive to scientific work as possible within the funding available. The following measure will track how well NIST achieves this goal.

- Keep AML construction on schedule and within budget by not exceeding 110 percent of estimates.

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations
Program Change: Facilities technical obsolescence

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	55,000
41	Grants, subsidies and contributions	0
99	Direct obligations	55,000

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
DECREASE FOR FY 2000
(Dollar amounts in thousands)

		2000 Base		2000 Estimate		Increase/(Decrease) Over 2000 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Modifications and improvements	Pos./BA	20	$16,798	20	$11,798	0	($5,000)
	FTE/Obl.	21	16,798	21	11,798	0	(5,000)

Safety, capacity, maintenance and major repairs (BA -$5,000,000, Direct Obligations -$5,000,000) - This one-time decrease provides a sufficient level of funding to address the highest priority safety, capacity, maintenance and major repair projects in FY 2000. While a significant backlog of projects remains, this reduction is proposed to partially offset the cost of the AML construction.

Exhibit 15

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations
Program Change: Safety, capacity, maintenance, and major repairs

Object Class		2000 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	(5,000)
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(5,000)

Exhibit 16

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) 0ver 2000 Base
11	Personnel compensation					
11.1	Full-time permanent	827	1,807	1,864	1,864	0
11.3	Other than full-time permanent	95	95	97	97	0
11.5	Other personnel compensation	3	3	3	3	0
11.9	Total personnel compensation	925	1,905	1,964	1,964	0
12.1	Civilian personnel benefits	186	191	216	216	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	19	19	19	19	0
22	Transportation of things	7	7	7	7	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications,utilities, and miscellaneous charges	97	97	97	97	0
24	Printing and reproduction	0	0	0	0	0
25.1	Advisory and assistance services	0	0	0	0	0
25.2	Other services	12,773	21,234 1/	10,351	5,351 1/	(5,000)
25.3	Purchases of goods and services from Gov. accounts	0	0	0	0	0
25.7	Operation and maintenance of equipment	2,051	2,051	2,051	2,051	0
26	Supplies and materials	1,783	1,783	1,783	1,783	0
31	Equipment	310	310	310	310	0
32	Land and structures	3,221	111,413 1/	40,000	95,000 1/	55,000
41	Grants, subsidies and contributions	0	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0	0
99	Total obligations	21,372	139,010	56,798	106,798	50,000

	Object Class	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) 0ver 2000 Base
99	Total obligations	21,372	139,010	56,798	106,798	50,000
	Less: Prior year unobligated balance	(8,668)	(82,296)	0	0	0
	Plus: EOY unobligated balance	82,296				
	Total Requirements	95,000	56,714	56,798	106,798	50,000

1/ Numbers have been updated since MAX submission.

Personnel Data	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) 0ver 2000 Base
Full-time equivalent employment:					
Full-time permanent	18	31	31	31	0
Other than full-time permanent	2	2	2	2	0
Total	20	33	33	33	0
Authorized Positions:					
Full-time permanent	32	32	32	32	0
Other than full-time permanent	0	0	0	0	0
Total	32	32	32	32	0

Exhibit 17

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
Detailed Requirements by Object Class
(Dollar amounts in thousands)

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level	0	0	0	0
	Senior executive service	0	0	0	0
	Career path	36	1,302	1,302	0
	Wage board	21	562	562	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Subtotal	57	1,864	1,864	0
11.3	Other than full-time permanent				
	Career path	0	95	95	0
	Wage board	2	2	2	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Experts & consultants	0	0	0	0
	Student	0	0	0	0
	Subtotal	2	97	97	0
11.5	Other personnel compensation				
	Overtime	0	0	0	0
	SES performance awards	0	0	0	0
	Cash awards	0	3	3	0
	Merit pay awards	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	3	3	0
11.9	Total personnel compensation	59	1,964	1,964	0

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
12.1	Civilian personnel benefits		.	.	
	Civil service retirement	(1)	34	34	0
	Federal employees' retirement	11	64	64	0
	Contribution to civil svc ret. fund	0	0	0	0
	Thrift savings plan	3	23	23	0
	Federal Insurance Contribution Act	8	54	54	0
	Health insurance	4	40	40	0
	Life insurance	0	1	1	0
	Employees' Compensation Fund	0	0	0	0
	Other	0	0	0	0
	Subtotal	25	216	216	0
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
21	Travel and transportation of persons				
	Common carrier	0	3	3	0
	Mileage	0	3	3	0
	Per diem/actual	0	11	11	0
	Other	0	2	2	0
	Subtotal	0	19	19	0
22	Transportation of things	0	7	7	0
23.2	Rental payments to others	0	0	0	0

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
23.3	Communications, utilities, and miscellaneous				
	Rental of ADP equipment	0	0	0	0
	Rental of office copying equipment	0	0	0	0
	Other equipment rental	0	10	10	0
	Federal telecommunications system	0	0	0	0
	Other telecommunications services	0	87	87	0
	Postal Service by USPS	0	0	0	0
	Utilities:	0	0	0	0
	Electric	0	0	0	0
	Gas	0	0	0	0
	Water/Sewer	0	0	0	0
	Subtotal	0	97	97	0
24	Printing and reproduction				
	Publications	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
25.1	Advisory and assistance services				
	Management and professional support svc	0	0	0	0
	Studies, analyses, & evaluation	0	0	0	0
	Subtotal	0	0	0	0
25.2	Other services				
	Training:	0	18	18	0
	Other	0	0	0	0
	Maintenance of equipment	0	0	0	0
	ADP Services	0	491	491	0
	Other non-government contracts	0	9,842	4,842	(5,000)
	Subtotal	0	10,351	5,351 1/	(5,000)

	Object Class	2000 Adjustments to Base	2000 Base	2000 Estimate	Increase/ (Decrease) over 2000 Base
25.3	Purchases of goods and svc from Gov. accounts				
	Payments to GA, WCF	0	0	0	0
	OPM training	0	0	0	0
	Other Federal agencies:	0	0	0	
	Dept. of Commerce	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
25.7	Operation and maintenance of equipment	0	2,051	2,051	0
26	Supplies and materials				
	Office & laboratory supplies	0	1,783	1,783	0
	Scientific publications & journals	0	0	0	0
	Fuel oil	0	0	0	0
	Reactor Fuel	0	0	0	0
	Subtotal	0	1,783	1,783	0
31	Equipment				
	Office machines and other equipment	0	233	233	0
	ADP equipment	0	76	76	0
	Equipment amortization	0	1	1	0
	Subtotal	0	310	310	0
32	Land and structures	0	40,000	95,000 1/	55,000
41	Grants, subsidies and contributions	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	84	56,798	106,798	50,000
	Less: Prior year unobligated balance	0	0	0	0
	Total Requirements	84	56,798	106,798	50,000

1/ Numbers have been updated since MAX submission.

Department of Commerce
National Institute of Standards and Technology

Construction of Research Facilities
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For construction of new research facilities, including architectural and engineering design, and for renovation of existing facilities, not otherwise provided for the National Institute of Standards and Technology as authorized by 15 U.S.C. 278c-278e,

   15 U.S.C. 278c provides that ... “the Secretary of Commerce is authorized to acquire land for such field sites as are necessary for the proper and efficient conduct of the activities authorized herein.”

   15 U.S.C. 278d provides... “the Secretary of Commerce is authorized to undertake such construction of buildings and other facilities... as are necessary for the proper and efficient conduct of the activities authorized herein.”

   15 U.S.C. 278e provides that... “ in the performance of the functions of the National Institute of Standards and Technology the Secretary of Commerce is authorized to undertake the following activities: ... (b) the care, maintenance, protection, repair, and alteration of Institute buildings and other plant facilities, equipment, and property; ...”

2. $106,798,000, to remain available until expended.

   no specific authority

   31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

3. Additional authorizing legislation will be proposed for FY 2000.

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Exhibit 5

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations
Currently Available, 1999	691	718	$398	$398
less: Working Capital Fund adjustment	0	(5)	(398)	(398)
2000 Base	691	713	0	0
plus: Working Capital Fund transfer from STRS Program Changes	0	0	282	282
2000 Estimate	691	713	282	282

Exhibit 6

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Page No.	Comparison by activity:	1998 Actual FTE	1998 Actual Amount	1999 Currently Available FTE	1999 Currently Available Amount	2000 Base FTE	2000 Base Amount	2000 Estimate FTE	2000 Estimate Amount	Increase/ (Decrease) Over 2000 Base FTE	Increase/ (Decrease) Over 2000 Base Amount
	Measurement and engineering research and standards										
NIST- 34	Electronics and electrical engineering										
	Direct obligations		0		$380		0		0		0
	Reimbursable FTE/Obl	101	$13,693	98	14,171	95	$14,021	95	$14,021	0	0
	Subtotal	101	13,693	98	14,551	95	14,021	95	14,021	0	0
NIST- 46	Manufacturing engineering										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	52	8,355	52	7,040	52	7,125	52	7,125	0	0
	Subtotal	52	8,355	52	7,040	52	7,125	52	7,125	0	0
NIST- 58	Chemical science and technology										
	Direct obligations		0		0		0		82		$82
	Reimbursable FTE/Obl	117	13,090	115	15,560	114	14,448	114	14,448	0	0
	Subtotal	117	13,090	115	15,560	114	14,448	114	14,530	0	82
NIST- 78	Physics										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	71	12,622	70	12,546	70	12,538	70	12,538	0	0
	Subtotal	71	12,622	70	12,546	70	12,538	70	12,538	0	0
NIST- 88	Materials science and engineering										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	53	7,876	54	6,775	54	6,600	54	6,600	0	0
	Subtotal	53	7,876	54	6,775	54	6,600	54	6,600	0	0

Page No.	Comparison by activity:	1998 Actual FTE	1998 Actual Amount	1999 Currently Available FTE	1999 Currently Available Amount	2000 Base FTE	2000 Base Amount	2000 Estimate FTE	2000 Estimate Amount	Increase/ (Decrease) Over 2000 Base FTE	Increase/ (Decrease) Over 2000 Base Amount
NIST- 98	Building and fire research										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	73	8,999	72	8,957	72	8,470	72	8,470	0	0
	Subtotal	73	8,999	72	8,957	72	8,470	72	8,470	0	0
NIST- 112	Computer science and applied mathematics										
	Direct obligations		0		0		0		200		200
	Reimbursable FTE/Obl	68	11,204	68	9,680	68	9,680	68	9,680	0	0
	Subtotal	68	11,204	68	9,680	68	9,680	68	9,880	0	200
NIST- 134	Technology assistance										
	Direct obligations		0		8		0		0		0
	Reimbursable FTE/Obl	142	20,200	140	19,680	139	19,913	139	19,913	0	0
	Subtotal	142	20,200	140	19,688	139	19,913	139	19,913	0	0
NIST- 144	National quality program										
	Direct obligations		0		10		0		0		0
	Reimbursable FTE/Obl	2	4,087	2	1,650	2	2,000	2	2,000	0	0
	Subtotal	2	4,087	2	1,660	2	2,000	2	2,000	0	0
NIST- 152	Research support activities										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	47	23,726	47	9,071	47	8,281	47	8,281	0	0
	Subtotal	47	23,726	47	9,071	47	8,281	47	8,281	0	0

Page No.	Comparison by activity:	1998 Actual FTE	1998 Actual Amount	1999 Currently Available FTE	1999 Currently Available Amount	2000 Base FTE	2000 Base Amount	2000 Estimate FTE	2000 Estimate Amount	Increase/ (Decrease) Over 2000 Base FTE	Increase/ (Decrease) Over 2000 Base Amount
	Extramural Programs										
NIST- 188	Advanced technology program										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	0	2	0	0	0	0	0	0	0	0
	Subtotal	0	2	0	0	0	0	0	0	0	0
NIST- 202	Manufacturing extension partnership										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	0	1,424	0	578	0	50	0	50	0	0
	Subtotal	0	1,424	0	578	0	50	0	50	0	0
	Total, National Institute of Standards and Technology										
	Direct obligations		0		398		0		282		282
	Reimbursable FTE/Obl	726	125,278	718	105,708	713	103,126	713	103,126	0	0
	Total	726	125,278	718	106,106	713	103,126	713	103,408	0	282

Exhibit 7

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) Over 2000 Base
Total Obligations	$125,278	$106,106	$103,126	$103,408	$282
Financing:					
Offsetting collections from:					
Federal funds	(78,464)	(68,473)	(65,343)	(65,343)	0
Non-Federal sources	(40,432)	(37,235)	(37,783)	(37,783)	0
Recoveries	0	0	0	0	0
Unobligated balance, start of year	(38,604)	(32,497)	(32,497)	(32,497)	0
Unobligated balance transferred					
Unobligated balance, end of year	32,497	32,497	32,497	32,497	0
Unobligated balance lapsing					
Budget Authority	275	398	0	282	282
Financing:					
Transfer from other accounts	(275)	(398)	0	(282)	(282)
Appropriation	0	0	0	0	0

Split of offsetting collections has been revised since submission of MAX.

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
JUSTIFICATION OF PROGRAM AND PERFORMANCE

Goal Statement

The Working Capital Fund (WCF) reflects the full-time equivalent (FTE) employment and dollar estimates associated with the reimbursable work performed by NIST for other agencies and the public. In addition, these estimates reflect the transfer of appropriated funds to the WCF for the purchase of invested equipment and the production of Standard Reference Materials. The WCF contains reimbursable obligations and transfers associated with the Scientific and Technical Research and Services Appropriation and the Industrial Technology Services Appropriation.

Base Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state, and local governments, and the private sector, including calibrations and special tests, advisory services, and the sale of Standard Reference Materials. The unique measurements and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other agency work based on an established set of criteria which include: (1) the need for traceability of measurements to national standards; (2) the need for work which cannot or will not be addressed by the private sector; (3) work supported by legislation that authorizes or mandates certain services; (4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and (5) requests by the private sector for NIST action or services.

Performance Measures

Relevant quantitative output measures are presented in the NIST General Statement.

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) Over 2000 Base
11	Personnel compensation					
11.1	Full-time permanent	0	0	0	0	0
11.3	Other than full-time permanent	0	0	0	0	0
11.5	Other personnel compensation	0	0	0	0	0
11.9	Total personnel compensation	0	0	0	0	0
12.1	Civilian personnel benefits	0	0	0	0	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	0	0	0	0	0
22	Transportation of things	0	0	0	0	0
23.1	Rental payments to GSA	0	0	0	0	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charge	0	0	0	0	0
24	Printing and reproduction	0	0	0	0	0
25.1	Advisory and assistance services	0	0	0	0	0
25.2	Other services	0	0	0	0	0
25.3	Purchases of goods and services from Government a	0	0	0	0	0
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and maintenance of equipment	0	0	0	0	0
26	Supplies and materials	0	0	0	0	0
31	Equipment	$250	$398	0	$282	$282
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	0	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0	0
99	Total Obligations	250	398	0	282	282

Personnel Data	1998 Actual	1999 Currently Available	2000 Base	2000 Estimate	Increase/ (Decrease) Over 2000 Base
Full-time equivalent employment:					
Full-time permanent	652	644	639	639	0
Other than full-time permanent	74	74	74	74	0
Total	726	718	713	713	0
Authorized Positions:					
Full-time permanent	688	667	667	667	0
Other than full-time permanent	24	24	24	24	0
Total	712	691	691	691	0

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2000 Adjustment to Base	2000 Base	2000 Estimate	Increase/ (Decrease) Over 2000 Base
31	Equipment				
	Office machines and other equipment	0	0	$282	$282
	ADP equipment	0	0	0	0
	Equipment depreciation	0	0	0	0
	Subtotal	0	0	282	282
99	Total Obligations	0	0	282	282

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Management and Professional Support Services	806	806	804
Studies, analyses, and evaluations	327	327	327
Total	1,133	1,133	1,131

Significant Activities

Advisory and assistance services funded by the Working Capital Fund represent services funded by reimbursable funds in support of reimbursable work conducted at NIST.

Working Capital Fund, National Institute of Standards and Technology (NIST)

The operations of the NIST Working Capital Fund are reported in a program and financing schedule printed in the President's Budget, as well as reflected in the reimbursable amounts throughout this budget. The fund finances the initial costs of work performed by NIST and is reimbursed by applicable appropriations and advances or reimbursements from other agencies. A detailed cost accounting system is used to ensure that the actual cost of work performed for each job or task is recorded and identified with the appropriate source of financing. In addition to its function as a revolving fund, the Working Capital Fund is also used to handle annual and sick leave on an accrued basis, to acquire equipment as an investment to be recovered through depreciation charges to programs, to distribute indirect costs to programs as overhead, to carry the recoverable costs associated with the production of Standard Reference Materials, and to carry supply inventories until issued for program use.

The table below summarizes the total NIST program, according to the source of financing. Following this table is a summary of the NIST reimbursable program by sponsor and source of support.

Summary of Total NIST Program
(Obligations in thousands)

	FY 1998			FY 1999			FY 2000			
Source and Use of Funds Spent	Perm. Pos. [1]	FTE	Oblig.	Perm. Pos. [1]	FTE	Oblig.	Perm. Pos. [1]	FTE	Oblig.	Approp. Requested
Direct Funding										
Scientific and technical research and services	2,041	2,047	$280,170	2,062	2,113	$286,801	2,011	2,063	$290,340	$289,622
Industrial technology services	377	381	350,921	377	391	358,708	379	393	351,336	338,536
Construction of research facilities	32	20	21,758	32	33	139,010	32	33	106,798	106,798
Gifts and bequests	. . .	. . .	8	. . .	. . .	8	. . .	. . .	8	. . .
Total, direct funding	2,450	2,448	652,857	2,471	2,537	784,527	2,422	2,489	748,482	734,956
Reimbursable Funding and WCF Investments										
Research, development and supporting services:										
Federal government	421	428	69,105	408	423	68,473	408	421	65,343	
Calibrations and tests, technical and advisory services:										
Federal government	28	28	4,108	27	28	3,601	27	28	3,665	
Public and non-federal government	147	151	21,992	143	149	19,283	143	148	19,621	
Subtotal, Services	175	179	26,100	170	177	22,884	170	176	23,286	
National Voluntary Accreditation Program	26	27	4,022	26	27	4,460	26	26	4,460	
Standard reference materials (SRMs):										
SRM Sales:										
Government	3	3	261	2	3	261	2	3	261	
Public	87	89	8,972	85	88	8,981	85	87	8,981	
Subtotal, SRM sales	90	92	9,233	87	91	9,242	87	90	9,242	
SRM Program adjustments	. . .	. . .	1,077	. . .	. . .	649	. . .	. . .	795	
Subtotal, SRM	90	92	10,310	87	91	9,891	87	90	10,037	
WCF investments and operating adjustments	. . .	. . .	15,741	. . .	. . .	398	. . .	. . .	282	
Total, Reimbursable funding and WCF investments	712	726	125,278	691	718	106,106	691	713	103,408	
Total, NIST program	3,162	3,174	778,135	3,162	3,255	890,633	3,113	3,202	851,890	

[1] Most NIST scientists and engineers are not engaged solely on one research project. An individual may divide his time between two or more projects financed by different sources of support. Also, salary costs of many staff members are charged to an overhead account and subsequently prorated to all directly funded projects. For these reasons, it is not possible to report employment directly for any source of financing. The Permanent Positions above are statistically-derived numbers, based on the estimated work years distribution for NIST programs.

Department of Commerce

National Institute of Standards and Technology

REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT

(Dollar amounts in thousands)

	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate
Department of Defense			
Air Force	$8,426	$9,438	$8,603
Army	2,703	2,682	2,729
Navy	3,117	3,395	3,398
Other	12,628	11,337	11,221
Subtotal, Department of Defense	26,874	26,852	25,951
Department of Agriculture	246	223	185
Department of Commerce	7,664	7,530	7,326
Department of Energy	7,636	6,941	7,127
Department of Health & Human Services	1,613	1,954	1,921
Department of Housing & Urban Development	604	1,361	1,200
Department of the Interior	813	593	652
Department of Justice	4,985	6,541	6,518
Department of Labor	555	421	250
Department of Transportation	1,540	1,487	1,417
Department of the Treasury	991	993	993
Department of Veterans Affairs	377	439	439
Environmental Protection Agency	2,715	1,633	1,163
Federal Emergency Management Agency	553	248	250
General Services Administration	1,662	1,106	1,106
National Aeronautics & Space Administration	6,271	6,083	6,001
National Science Foundation	1,909	2,226	2,046
Nuclear Regulatory Commission	941	381	180
Other	1,156	1,461	618
Total, Other Agency	69,105	68,473	65,343
Calibrations & Testing	7,797	7,734	7,779
Standard Reference Materials	10,310	9,891	10,037
Technical & Advisory Services	22,325	19,610	19,967
WCF Investments/Operating Adjustments	15,741	398	282
Total, Other Reimbursables	56,173	37,633	38,065
Grand Total, Reimbursable Program	125,278	106,106	103,408

Department of Commerce
National Institute of Standards and Technology

PERIODICALS, PAMPHLETS, AND AUDIOVISUAL PRODUCTS
(Obligations in thousands)

	1997 Actual	1998 Actual	1999 Estimate	2000 Estimate
Periodicals	$25	$12	$17	$17
Pamphlets	25	81	52	112
Audiovisuals	0	2	0	0
Total	42	95	69	129

The National Institute of Standards and Technology produces only one periodical - The Journal of Research. *The Journal of Research of the National Institute of Standards and Technology*, issued six times a year, reports NIST research and development in those disciplines of the physical and engineering sciences in which NIST is active (physics, chemistry, engineering, mathematics, and computer sciences).

Department of Commerce
National Institute of Standards and Technology

Average Salary

	1998 Actual	1999 Estimate	2000 Estimate
Average ES salary	$120,345	$124,774	$130,264
Average Career Path Salary	63,051	63,877	67,646
Average salary of ungraded positions	34,735	36,013	36,264