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## EXECUTIVE SUMMARY

The Joint Select Committee on Research and Development was created by the 118th Maine Legislature to review legislation relating to research and development and report its finding and recommendations to the Legislature.

Research and development will play a vital role in Maine's economic future, but the State currently lags far behind where it needs to be in funding research and development. Investment in research and development is now a threshold requirement for the economic well-being of the State and it is crucial that state government make a long-term commitment to significant and steady funding for research and development through the state budget. Such a commitment will require leadership and vision on the part of the Legislature, the Governor and the research community. The State will achieve the most success from its investment by focusing on 7 target technology areas:

- biotechnology;
- marine sciences and aquaculture;
- composite materials engineering;
- environmental sciences and technology;
- advanced technologies for forestry and agriculture;
- information sciences and technology; and
- precision manufacturing technologies.

In developing its recommendations, the committee focused on three broad areas of need that must be addressed in order to attract and retain research and development activity in the State: a need for research and development infrastructure; a need for an educated and technically skilled workforce; and a need for business assistance. Based on these needs and the current programs and initiatives in place to support research and development in Maine, the committee supports the following 21 recommendations.

**Research and Development Infrastructure**

· The committee recommends increasing the University of Maine System's base funding for research and development by appropriating $10 million per year during the next biennium and eventually $20 million per year to the Maine Economic Improvement Fund.

· The committee recommends making a significant and steady investment at a level of $15 million per year for capital construction at the University of Maine System to renovate and construct research facilities.

· The committee recommends that Fogler Library at the University of Maine be designated the State Research Library for Business, Science and Technology. The committee further recommends appropriating approximately $5 million per year for the purchase of information resources and the negotiation of statewide licenses for on-line databases, for the equipment to house the databases and for staff support to interpret the databases.

· The committee recommends creating and funding a Center for Advanced Law and Management at the University of Southern Maine with an appropriation of $200,000 per year.

· The committee recommends supporting the expansion of the Center for Technology-Based Business Development at the University of Maine.

· The committee recommends supporting the development and maintenance of the University of Maine's Internet 2 system to create a high-speed research network.

· The committee strongly supports investing $15 million per year in a program to support applied research, development and commercialization in target technology areas. The committee recommends that the Targeted Industries Committee and other interested parties develop advisory recommendations on implementing such a program and provide these to the Joint Select Committee on Research and Development in January 1999. The committee further recommends that the Joint Select Committee report out legislation to the First Regular Session of the 119th Legislature.

**Educated and Technically Skilled Workforce**

· The committee recommends appropriating $1 million per year to the Maine Technical College System for the initial capitalization of new or expanded catalog programs to meet

the employment needs of growing high tech companies.

· The committee recommends appropriating $100,000 per year for 3 years to support expansion of the Department of Education's partnership with the National Aeronautic and Space Administration (NASA).

· The committee recommends appropriating $2 million per year for 5 years for professional development and curricular development programs to ensure that students in the K-12 system derive the maximum benefit from school-based technology.

· The committee recommends appropriating $100,000 to the Foundation for Blood Research's ScienceWorks program to provide adequate laboratory equipment in Maine high schools.

· The committee recommends appropriating $150,000 to the Maine Science and Technology Foundation for the MERITS program (Maine Research Internships for Teachers and Students) to provide expanded internship opportunities in the public and private sectors for science and mathematics teachers and students.

· The committee recommends appropriating $750,000 per year for 3 years to the University of Maine System to provide increased opportunities for Maine high school students to learn about and experience success in post secondary math, science and engineering programs.

· The committee recommends funding the Governor's Marine Studies Fellowship Program with an annual appropriation of $50,000 to connect Maine students with Maine researchers.

· The committee recommends that the Legislature carefully consider the recommendations of the Finance Authority of Maine with regard to financial aid repayment programs for students who choose to remain in Maine and obtain employment in one of the technology target areas.

· The committee tentatively supports appropriating $50,0000 per year to support the Maine Science and Technology Foundation's education initiative.

**Business Assistance**

· The committee recommends that the Legislature carefully consider the recommendations of the Finance Authority of Maine with regard to increasing access to capital and assisting fledgling businesses in locating and obtaining capital.

· The committee tentatively supports appropriating $55,000 for the Maine Science and Technology Foundation (MSTF) to identify new opportunities for innovation in Maine's businesses and to convene stakeholders to identify an implementation strategy for delivering training efforts.

· The committee tentatively supports appropriating funds for commercialization

initiatives, including training for SBIR service providers and grants through the Maine SBIR (Small Business Innovation Research) Assistance Program, and development of a web-based commercialization network.

· The committee tentatively supports appropriating $50,000 per year to MSTF to expand its role in identifying science and technology strategies for Maine, convene stakeholder groups to discuss implementation strategies and make recommendations to the Legislature.

**Other**

The committee recommends that the 119th Legislature establish a Joint Select Committee on Research and Development.

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## I. Introduction

The Joint Select Committee on Research and Development was created by a Joint Order of the 118th Maine Legislature in February 1998. The select committee is composed of 13 legislators representing seven joint standing committees of the Legislature. The Joint Order directs the committee to review all legislation relating to research and development and report its finding and recommendations to the Legislature.

The committee met in 5 different areas of the State to tour R&D facilities and gather information from industry, the university system, the technical college system and state agencies. These meetings were held in Bar Harbor, Fairfield, Portland, Presque Isle and Orono. The committee asked representatives from the biotechnology, marine biotechnology, aquaculture, agriculture, forestry, precision manufacturing, information technology, and composite materials industries to tell them about the research and development work they are doing in Maine and the challenges they face doing research and development in Maine. From this information and information gathered from the academic sector and state agencies about current programs, the committee developed a list of needs for attracting and retaining research and development activity in the State. Those needs fell into three broad categories:

· a need for research and development infrastructure;
· a need for an educated and technically skilled workforce; and
· a need for business assistance, including financial programs.

The committee then met several times in Augusta and developed recommendations to address those areas of need.

Several themes have emerged during the course of the committee's work and shape its recommendations.

¨ Research and development is the foundation upon which a strong Maine economy will be built.

¨ An educated and skilled workforce is a critical element in the development of the State's capacity to support research and development.

¨ A strong University of Maine System is fundamental to growing research and development in the State.

¨ Maine has several distinguished nonprofit research institutions that are key to attracting researchers and building a critical mass of research activity in the State.

¨ The private sector plays a pivotal role in the "development" piece of research and development and in the creation of jobs. It is therefore in the State's interest to support companies that do research and development in the target technology areas.

¨ An important objective of investing in research and development is to create and retain high-skilled, high-wage jobs in the manufacturing sector through technology development and product commercialization.

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## II. The Importance of R&D to the Maine Economy

Research and development will play a vital role in Maine's economic future. The Maine economy is at a crossroads, where the State remains dangerously reliant on industries that are expected to be stagnant or lose jobs over the next decade. According to the State Planning Office, Maine is 19 times more dependent than the nation as a whole on leather and leather products, 13.5 times more dependent than average on fishing services, 6.5 times more dependent on paper manufacturing, and 6 times more dependent on forestry services. The State's economy is vulnerable in its dependence on these industries that for the most part are not growing.

The economy needs a boost, and several previous studies have identified research and development as a critical element in a healthy Maine economy.

The Joint Select Committee on Research and Development made the following finding in its February 1998 report:

"Research and Development is important to the Maine economy. It's important for the State to support applied research and development (R&D) in Maine because R&D creates business opportunities, high-wage jobs, and tax revenues through development of new products and improvements in the current technology of existing businesses."

The Commission to Study the Restructuring of the State's Fiscal Policies to Promote the Development of High-Technology Industry in Maine recognized that "The establishment of a viable research and development infrastructure is important for the expansion of the high-technology industry."

One of the call statements in Maine's Science & Technology Action Plan is A Call for Research and Development Capacity Relevant to Maine's Industries. The plan identifies as one element of an

entrepreneurial economy “a stream of innovation moving from R&D into production.”

Research and development is now a threshold requirement for the well-being of the State. It is not a discretionary activity; it is as important as education, transportation and other state priorities.

The committee recognizes that the State must make a long-term commitment to support research and development in Maine. Maine is far behind where we need to be in funding for research and development, and it will take a significant investment to achieve long-term success. Based on 1993 data from the National Science Foundation, Maine ranks 49th in the United States on total R&D expenditures per capita, and 50th in academic R&D expenditures per capita.

Improving the State’s economic competitiveness will require leadership and vision on the part of the Legislature, the Governor and the research community. The committee believes that it is essential to make a continuous commitment to research and development on an annual basis through the state budget.

The State will achieve the most success from its research and development investment by focusing on 7 target technology areas that have been identified as the most likely to produce significant benefits to the State’s economy. These target areas are:

- biotechnology;
- marine sciences and aquaculture;
- composite materials engineering;
- environmental sciences and technology;
- advanced technologies for forestry and agriculture;
- information sciences and technology; and
- precision manufacturing technologies.

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## III. Key Areas of Need for Supporting R&D Activity in Maine

There is very exciting research and development activity taking place in Maine in the academic, nonprofit and private sectors. The committee traveled around the State and met with representatives from the following industries to hear about the research and development they are doing and the challenges they face: biotechnology, marine biotechnology, aquaculture, agriculture, forestry, precision manufacturing, information technology, and composite materials. The committee also heard from the University of Maine System, the Maine Technical College System, College of the Atlantic, the Department of Education, the Maine Science and Technology Foundation, the Department of Economic and Community Development, and the State Planning Office.

Out of those meetings, three broad areas of need were identified as necessary for attracting and retaining research and development activity in the State: a need for research and development infrastructure; a need for an educated and technically skilled workforce; and a need for business assistance. These needs are closely aligned with the call statements that provide the framework for the Science & Technology Action Plan:

· An Educated and Technically Skilled Workforce;
· Research and Development Capacity Relevant to Maine's Industries;
· Expanding Commercialization;
· Increasing Innovations in Maine Companies;
· A Networked Maine; and
· Improving Input of Science and Technology in Policymaking.

Some of the programs and studies that are currently working to meet these needs are discussed in section IV, but many gaps remain that the State must begin to fill.

**Research and Development Infrastructure**

The committee was told that the State needs leadership and a vision for its economic future. It will require a long-term commitment and strategic investment on the part of the State to develop the research capacity that will serve as the foundation for a strong state economy with quality jobs for its citizens. North Carolina was given as an example of a state that has had a long-term commitment to investing in research and development and now has a very active and dynamic research enterprise.

The State needs a research and development infrastructure with several essential elements: a critical mass of people and companies involved in conducting research and development in the target technology areas; a strong university system with the facilities and the researchers to support the target industries; a network of collaboration between the academic, nonprofit and private sectors; a good research library that provides access to information resources to researchers statewide; research facilities with adequate laboratory space and equipment; a fair tax structure; and a state-of-the-art telecommunications network that supports the high-speed transfer of information to researchers wherever they are located in the State.

**An Educated and Technically Skilled Workforce**

Almost every person that appeared before the committee emphasized that an available supply of educated and skilled workers is the most significant need of companies performing research and development, and that the State must do more to ensure that the K-12 system, the University of Maine System and the Technical College System are producing students that have the education and skills that are relevant to Maine industries. In addition, Maine must do more to retain its high school and college graduates in the State and to attract quality employees to the State.

According to a recent article in the Maine Policy Review, Maine is suffering from a science and engineering "brain drain." In a study based on 1993 data, Maine ranked among the bottom five states for retaining its science and engineering graduates. Furthermore, Maine has not been successful in attracting science and engineering graduates from other states. This has resulted in a negative net migration of educated workers. The implication of this is that Maine does not have the workforce to support research and development activity, so there is not the level of activity in Maine that would encourage recent graduates to remain in the State.

The need in Maine is for skilled workers at both the professional and technical levels. The need is especially great for science, engineering and computer professionals. Currently many high technology

businesses have to recruit professionals from out of state, although they would prefer to see the University of Maine System produce the employees they need. A state university system with a good scientific and research base contributes to the strength and growth of the private sector.

Producing an educated and skilled workforce must begin with the K-12 education system. It is necessary to expose students to science and engineering to motivate them to pursue higher education opportunities in those areas, and it is necessary to prepare them with the math, science and technology skills required in post-secondary programs. To do this, teachers need to be trained in the use of the technology that is now available to help students learn in those areas.

### Business Assistance

In order for research and development to grow the economy significantly, the private sector must be involved in innovative applied research and commercialization. The biggest need in this category cited by industry representatives is for access to capital, particularly early stage capital. The committee heard from several people that the need is for more capital and from others that capital is available but difficult to access.

The small research and development businesses in the State generally need relatively small amounts of seed and early stage venture capital to support research, start-up, product development, and to enhance the pace of commercialization. It is often difficult for these businesses to get traditional financing because of the risks involved at that stage of financing. Banks and other commercial lending institutions are often reluctant to invest in a new business or to invest small amounts of money, but this is a critical need for businesses that perform research and development.

Businesses also need other types of business assistance, such as programs to develop entrepreneurial skills, incentives to encourage product development and commercialization, tax incentives, and patent and intellectual property assistance.

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## IV. Current Support for R&D in Maine

As mentioned in the previous section, programs and initiatives have been put in place to meet some of the needs of the State's research and development community. The committee looked at the progress made to date in each of the identified areas of need and the following is a sample of what they found.

### Research and Development Infrastructure

#### The State's Economic Development Strategy

The Department of Economic and Community Development developed the State's Economic Development Strategy in January of 1996 and has issued two status reports since then. The Strategy is

built upon several efforts already completed, including work by the Maine Economic Growth Council and the Maine Chamber and Business Alliance. The Strategy identifies 23 targeted areas and a lead organization has been appointed to each area to be responsible for the strategic planning process and for coordinating implementation of their action plans.

**University of Maine System Research**

The University of Maine System has several established research programs with excellent reputations and collaborative relationships with business and nonprofit research institutions in the State. The following are just a few examples of partnerships between the university system and the nonprofit and private sectors.

The University of Maine, the University of Southern Maine, the Jackson Laboratory, the Maine Medical Center Research Institute and the Foundation for Blood Research have collaborated on several research projects in recent years. For example, the institutions are partnering to build a graduate program in biosciences that will use videoconferencing for courses between Orono, Bar Harbor and Portland. This network between Orono, Bar Harbor and Greater Portland has been termed the “research triangle.”

The University of Maine’s Laboratory for Surface Science and Technology is an interdisciplinary research unit with 6 faculty and 41 students. The program provides research training for undergraduates and graduate students, and two businesses have been direct spin-offs from the program and employ many of its graduates.

The University of Maine’s Advanced Engineered Wood Composites Center is a national leader in developing the next generation of engineered wood composites for construction. The Center has 15 senior researchers and 38 student researchers whose research in wood composites technology will add value to Maine’s forest resources and thus have a direct benefit to the economy.

The University of Southern Maine’s applied immunology program is housed at the Foundation for Blood Research (FBR), and its faculty come from FBR as well as private biotechnology firms. This encourages a network of collaboration between the University, FBR and the private sector.

**Maine Economic Improvement Fund**

The Maine Economic Improvement Fund was established in statute in 1997. The Fund, administered by the University of Maine System Board of Trustees, may be used to invest in applied research and development in 5 target areas within the University of Maine System and to support the development of private enterprise based upon research and development performed within the University of Maine System. These actions must be taken in partnership with private enterprise, the federal government or private and public research institutions. $4 million was transferred to the Fund from General Fund surpluses in 1998, and the University of Maine System is authorized to include the $4 million as part of its “current services” budget request for the 2000-2001 biennium.

**R&D Bond**

In November 1998 Maine voters approved a $20 million bond issue to support research and development in 5 target areas: biotechnology, marine technology, software engineering and

development, advanced technologies for forestry and agriculture, and advanced materials engineering and development. The funds will be used as follows:

· $13.5 will be allocated to the University of Maine System for capital improvements and equipment purchases;
· $3 million will be allocated to the Maine Science and Technology Foundation for a Marine Technology Fund to enhance Internet connections among public and private marine research institutions and to enhance research and education capability in those institutions;
· $1.5 million will be allocated to the Maine Science and Technology Foundation for a Research Challenge Grants Program to enhance research and development capacity and productivity in research institutions in the for-profit, nonprofit and academic sectors; and
· $2 million will be allocated to the Department of Economic and Community Development to provide partial funding for design and construction of the Gulf of Maine Aquarium Research Facility.

## An Educated and Technically Skilled Workforce

### Learning Results

In 1996 the Legislature established a statewide system of Learning Results, to be implemented by the Department of Education in consultation with the State Board of Education. Learning Results consists of content standards and performance indicators for all public school students. The goal and intent of the Legislature in establishing the learning results is “to ensure that the State’s schools will enable today’s students to gain the knowledge and skills necessary to be effective parents, citizens, workers and adults.”

### MERITS

Since 1992, the Maine Research Internships for Teachers and Students (MERITS) program has provided teachers and students with research opportunities by placing them in internships with businesses and non-profit laboratories around the state. The program allows math and science teachers and students to work hands-on with scientists and engineers in research institutions such as Bigelow Laboratory for Ocean Sciences, Maine Medical Center Research Institute, Bowdoin College, National Semiconductor and the Department of Marine Resources.

### Maine Quality Centers

The Maine Quality Centers were established by the Legislature in 1994 under the Maine Technical College System. Their mission is “to meet the workforce education and training needs of new and expanding businesses in the State and provide new employment and career advancement opportunities for Maine people.” The Quality Centers program offers customized education and training for new or expanding businesses at no cost to the business or the trainee. To participate, businesses must create a minimum of 8 full-time jobs with benefits. As of June 1998, over 50 companies have utilized the program, creating jobs with an average wage of $10.53 per hour. The program's goal is for employment resulting from each project to produce a return on investment within 36 months. As of

June 30, 1998 the return on investment was estimated at 17 months.

**Establishment of Ph.D. Programs**

The Chancellor of the University of Maine System is charged with identifying the high-technology disciplines that would be the most productive for the establishment of Ph.D. programs to provide educational and professional opportunities for Maine students. The Chancellor will report to the Legislature in January 1999 with a plan for the establishment of Ph.D. programs in a timely manner.

**Financial Aid Programs**

The Finance Authority of Maine (FAME) is required to review existing financial aid programs for supporting students pursuing high-technology courses of study and report to the Legislature in January 1999 with recommendations for providing additional resources to support such students.

## Business Assistance

**Maine Science and Technology Foundation**

The Maine Science and Technology Foundation (MSTF) is a nonprofit institution established in statute for the following purpose:

"[to] encourage, promote, stimulate and support: research and development of relevance to the State; technology transfer activities that increase the competitiveness of businesses and public institutions of higher education in the State; effective and efficient application of technologies in the public and private sectors; scientific and technological education and training; the development of new commercial products and the fabrication of such products in the State; and cooperative efforts among government, the private sector and universities and colleges for the purposes outlined in this chapter."

MSTF administers several programs that provide assistance to high-technology businesses in the State.

Experimental Program to Stimulate Competitive Research (EPSCoR): Maine EPSCoR is a cooperative federal-state initiative administered by MSTF and managed by the Research Capacity Committee. EPSCoR is designed to strengthen the State's science and engineering infrastructure by supporting research with funds from the National Science Foundation and the Department of Energy.

Maine SBIR Assistance Program: The federal Small Business Innovation Research (SBIR) program grants approximately $1 billion annually to qualifying small businesses to develop and commercialize new technologies that address the expressed needs of various government agencies. The Maine SBIR Assistance Program provides technical assistance to Maine's small businesses to help them develop competitive SBIR grant proposals and to commercialize the products they develop. The goals of the program are to expand the number of Maine SBIR applicants, to increase the competitiveness of the Maine SBIR applicants, and to increase the number of commercialized SBIR projects. The Maine SBIR Assistance Program was awarded the U.S. Small Business Administration's 1998 Tibbetts Award which recognizes firms, groups or individuals involved with the SBIR program.

Maine Technology Investment Fund (MTIF): The Maine Technology Investment Fund was established in 1995 by the 117th Legislature to strengthen employment opportunities in the State by increasing the science and technology investment level..." The Fund may be used for two purposes: to provide matching funds for federal, private and foundations awards; and to invest directly in small to mid-sized business with promising technology at the pre-commercialization stage. Investments must be in target technology areas and range from $25,000 to $100,000 with a 1:1 cash match required. $1.6 million has been appropriated to the Fund through FY 1998-99, and MSTF is encouraging private sector investment in the Fund.

**Small Enterprise Growth Fund**

The Small Enterprise Growth Fund was established in 1996 by the 117th Legislature and funded with a $5 million bond issue. The Fund, administered by the Finance Authority of Maine (FAME) and overseen by the Small Enterprise Growth Board, is a patient source of investment capital for small businesses that demonstrate the potential for high growth and public benefit. The Fund invests in early stage companies with promising projects needing less than $300,000. The maximum investment is $150,000 per loan and the investment must be matched with other financial resources. As of July 1998, the Fund had invested a total of approximately $1 million in 14 Maine businesses. FAME expects to recommend to the 119th Legislature that the maximum investment be increased to $500,000 per business.

**Analysis of Access to Capital**

FAME is required to analyze the availability of capital for business start-up and development to determine if sufficient capital is available for high-technology business needs. FAME will report to the Legislature in January 1999 with recommendations for increasing capital, if necessary, and for assisting fledgling businesses in locating and obtaining capital.

**Analysis of Tax Incentives**

The Bureau of Revenue Services (BRS) is required to gather and analyze data regarding businesses taking advantage of tax incentives affecting research and development and high-technology investments. The Department of Economic and Community Development (DECD) is required to examine that information and determine whether the tax incentives are effective means of promoting the growth of high-technology businesses in the State. BRS and DECD will report to the Legislature in January 1999 with any recommendations.

**R&D / High-tech Clearinghouse**

MSTF is required to work with several other groups to establish a statewide clearinghouse for information and assistance to persons seeking to conduct research and development and to develop high-technology businesses in the State. MSTF will report to the Legislature in September 1999 with a progress report.

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# V. Recommendations

The Joint Select Committee on Research and Development supports the following recommendations, divided into three categories: research and development infrastructure, educated and technically skilled workforce and business assistance.

## Research and Development Infrastructure

The committee recommends that state government invest in two paths to strengthen and support the research and development infrastructure in the State. The first path is an increased and ongoing investment in the University of Maine System and the second path is an investment in applied research, development and commercialization in target technology areas.

### University of Maine System

**1. The committee recommends increasing the University of Maine System's base funding for research and development by appropriating $10 million per year during the next biennium and eventually $20 million per year to the Maine Economic Improvement Fund.**

In 1998, the Legislature authorized the transfer of $4 million from the General Fund surplus to the Maine Economic Improvement Fund (MEIF). The MEIF, administered by the University of Maine System Board of Trustees, was established by the 118th Legislature to support research and development in 5 target areas (aquaculture and marine sciences and technology, biotechnology, composite materials engineering, environmental sciences and technology, and information sciences and technology). The Fund can be used by the University of Maine System to invest in applied R&D in the target areas and to support the development of private enterprise based upon the research and development performed within the University System.

The committee's long-term plan for R&D envisions an annual investment of $20 million in base funding for research and development at the University of Maine System. With this level of investment, the University of Maine System expects to attract $100 million per year in federal R&D funding. The investment will be used in 5 target areas as operating funds to hire new research faculty and technical support, to provide a pool of matching funds for research grants, and to provide funds for graduate assistantships.
Appropriating $10 million annually during the 2000-2001 biennium, increasing to $15 million annually during the following biennium, and reaching the long-term target investment of $20 million annually in FY 2003-04 will allow time for the expansion of facilities to accommodate new researchers and research activities.

**2. The committee recommends making a significant and steady investment at a level of $15 million per year for capital construction at the University of Maine System to renovate and construct research facilities.**

Modern university research facilities will enhance the State's research and development capabilities. Without major expansion of laboratory space on the university campuses, it will be difficult to bring additional researchers to the University System. Research space is extremely tight on the campuses, and the University of Maine has found itself needing to lease trailers to house researchers. Major investments must be made now to construct the high quality research space that will make the State's university system a world class research institution.

During the first 5 years of this investment in capital construction, the University of Maine would construct an engineering research facility to provide laboratory space for approximately 30 researchers, and a marine and biological sciences research facility to provide laboratory space for 30 researchers. Construction costs are estimated based on $250 per square foot for the engineering building, with an estimated total project cost of approximately $25 to $30 million, and $175 per square foot for the marine and biological sciences building, with an estimated total project cost of approximately $30 to $35 million.

The University of Southern Maine would use the new capital investment to construct an addition to the Mitchell Center on the Gorham campus to allow consolidation of the Departments of Computer Science and Physics with Electrical Engineering and Industrial Technology. Construction costs are estimated based on $250 per square foot with an estimated total project cost of approximately $3.625 million, which includes a telecommunications system. USM would also complete space in the Science Building on the Portland campus to provide an additional 30,000 square feet of research and teaching laboratories for the biosciences. Construction costs for this building are estimated based on $200 per square foot with an estimated total project cost of approximately $9.2 million.

These priority projects are critical to enhancing research and development activities at the University of Maine and the University of Southern Maine. Such a significant level of investment is necessary to provide the modern research and development infrastructure that will increase the number of research grants and contracts, increase the productivity of existing researchers, attract exceptional researchers and students, and give students vigorous research training.

**3. The committee recommends that Fogler Library at the University of Maine be designated the State Research Library for Business, Science and Technology. The committee further recommends appropriating approximately $5 million per year for the purchase of information resources and the negotiation of statewide licenses for on-line databases, for the equipment to house the databases and for staff support to interpret the databases.**

Being designated the State Research Library will allow Fogler Library to negotiate licenses for databases that will authorize the library to make those resources available to the statewide research community. The additional funding will allow the library to expand its electronic databases and its periodical subscriptions to meet the needs of researchers statewide.

It is anticipated that the total annual costs of a statewide research library will drop over the next 5 years, due to decreases in personnel and equipment costs as the library moves from setting up new information systems to simply managing them. The appropriation will therefore decrease somewhat over time. Although it is not possible to predict the future costs of electronic databases and journal subscriptions because they are too new to know how inflation will affect their cost, the library expects to institute cost recovery programs to help cover inflationary costs.

**4. The committee recommends creating and funding a Center for Advanced Law and Management at the University of Southern Maine with an appropriation of $200,000 per year.**

Appropriating $200,000 per year to the University of Southern Maine to support a Center for Advanced Law and Management will strengthen the competitive advantage of Maine firms and entrepreneurs by creating a forum through which lawyers, businesses and university faculty can work to address the many complex issues involving intellectual property, patent law, trade law, marketing

and venture capital that impact technology-based businesses. The Center will be a joint effort of the University of Southern Maine's schools of law and business.

**5. The committee recommends supporting the expansion of the Center for Technology-Based Business Development at the University of Maine.**

The Center for Technology-Based Business Development was created with a grant from the National Science Foundation (NSF). The Center will be a pro-active technology transfer office with business development expertise. It will provide an entrepreneurial environment for faculty, student and industry interaction, and provide shared laboratories, equipment and incubation space for small technology-based start-up companies. This will allow the University of Maine to take a leading role in technology transfer-related economic development.

Beginning July 1, 1998, NSF is funding the start-up costs for the first two budget years of the Center at a level of $184,229 for the first year and $315,341 for the following year. The award expires on June 31, 2000. If NSF funding is not continued beyond that date, the committee recommends that the Legislature appropriate $500,000 per year beginning in FY 2000-01. Of this appropriation, $300,000 per year would be used for operating expenses and $200,000 per year would be used for intellectual property protection. This level of funding will allow the Center to expand its activities to the University of Maine System and other Maine research institutions. The University of Maine anticipates that revenues from the licensing of intellectual property should cover the Center's operating costs within 10 years.

**6. The committee recommends supporting the development and maintenance of the University of Maine's Internet 2 system to create a high-speed research network.**

Building upon the high-speed Internet 2 system will increase the capacity for collaborative research and development in the State. The Internet 2 system is restricted to institutions that are conducting very specialized research that requires transmissions of very large data sets or very high speed transmissions of data in which immediate delivery is essential. Currently the University of Maine is the only institution in the State that is authorized to be part of this new system. The University anticipates that in the near future several nonprofit research institutions will receive permission from the National Science Foundation to connect to the Internet 2 system. The committee supports the connection of these institutions to the system and the collaboration that this will nurture. The committee encourages the university and the institutions to seek funding for the initial hardware costs and the annual connect charges for joining the Internet 2 system.

## Investment in Technology

**7. The committee strongly supports investing $15 million per year in a program to support applied research, development and commercialization in target technology areas. The committee recommends that the Target Industries Committee and other interested parties develop advisory recommendations on implementing such a program and provide these to the Joint Select Committee on Research and Development in January 1999. The committee further recommends that the Joint Select Committee report out legislation to the First Regular Session of the 119th Legislature.**

A significant state investment is needed to promote job creation in the target technology areas through applied research, development, and product commercialization. The committee supports an ongoing investment of $15 million per year through the state budget, to be made available on a competitive basis to all 7 target technology areas (biotechnology, marine sciences and aquaculture, composite materials engineering, environmental sciences and technology, advanced technologies for forestry and agriculture, information sciences and technology, and precision manufacturing technologies).

A structure and process for ensuring the efficient and direct distribution of this investment must be developed with the input of all interested parties. The committee therefor recommends that the Target Industries Committee, with added representation as needed, quickly work together to develop a proposal for the 119th Legislature's Joint Select Committee on Research and Development regarding such a structure and process. The group shall look at a minimum at the following issues:

- governance;
- administration;
- distribution of funds;
- returns on investment;
- ongoing evaluation, measurement and oversight;
- commercialization activities;
- incubators;
- a plan for further refining the distribution to target technologies; and
- a timeline for implementation by July 1, 1999.

In addressing these issues, the group shall base its decisions on the intended outcome of high wage jobs. The proposal must ensure access initially for all 7 target technologies to a fair and competitive process.

The Target Industries Committee shall present its advisory recommendations by January 15, 1999 to the Joint Select Committee on Research and Development, which shall invite comment, develop final recommendations and report out legislation to the full Legislature.

## Educated and Technically Skilled Workforce

**8. The committee recommends appropriating $1 million per year to the Maine Technical College System for the initial capitalization of new or expanded catalog programs to meet the employment needs of growing high tech companies.**

The Maine Technical College System (MTCS) currently serves about 20,000 Maine residents in credit and non-credit courses. The Maine Quality Centers is an economic development initiative administered by the MTCS that has responded to the needs of new and expanding high tech firms in Maine since 1993 by providing customized education and training at no cost. Maine Quality Centers projects are early indicators of new technical occupation and skill areas in which certificate, diploma or associate degree level education is needed.

With the additional $1 million per year appropriation, the MTCS will fund new or expanded catalog programs at the technical colleges that serve new and emerging high tech industries. The technical colleges will propose to the System President and Board of Trustees the introduction of new or the

expansion of existing diploma, certificate or associate degree programs, as driven by business demand for existing and new workers. The technical colleges will be required to provide evidence of ongoing demand from industry for workers with the skills provided by the program. The MTCS expects to serve 180-200 new students each year through programs supported by the additional appropriation.

The State appropriation will fund start-up costs for the new or expanded programs, including new equipment, faculty and curriculum development The tuition revenues generated during the start-up period will be set aside to help sustain the program after the initial capitalization has concluded. Businesses will need to commit to a partnership to support ongoing costs for the program after the initial capitalization.

**9. The committee recommends appropriating $100,000 per year for 3 years to support expansion of the Department of Education's partnership with the National Aeronautic and Space Administration (NASA).**

The Department of Education and the Maine Mathematics and Science Alliance have received two grants from NASA that have enabled Maine to build a strong NASA educational presence through intensive teacher training and access to NASA resources. Maine is poised to become a demonstration state in the use of NASA materials and technology to impact teaching and learning. With $100,000 in state funding, the Department of Education and the Maine Mathematics and Science Alliance will oversee and deliver NASA academies for professional development, teacher and student internships, curriculum materials development and dissemination and ATM broadcast of NASA videoconferences. The initial state financial support and the collaboration by state agencies that work with NASA are key to showing NASA and other federal agencies that science and technology are a major emphasis in Maine and securing additional funds to support this work long-term.

**10. The committee recommends appropriating $2 million per year for 5 years for professional development and curricular development programs to ensure that students in the K-12 system derive the maximum benefit from school-based technology.**

In 1995 Maine voters approved a $15 million bond issue to fund capital costs for telecommunications infrastructure and classroom technology equipment to enhance student learning opportunities in the State's schools. The $2 million annual appropriation will be used by the University of Maine System to implement professional development programs to train K-12 teachers to effectively use technology in the classroom, particularly as it relates to math and science instruction. The University System will collaborate with the Department of Education, the technical colleges and the regional education partnerships to provide professional development in the use of technology in curriculum, instruction and assessment by offering teacher training, summer workshops and other learning opportunities.

**11. The committee recommends appropriating $100,000 to the Foundation for Blood Research's ScienceWorks program to provide adequate laboratory equipment in Maine high schools.**

Over the last three years, the Foundation for Blood Research's (FBR) ScienceWorks for ME equipment donation project has provided $2 million worth of recycled science equipment to secondary schools throughout the State. FBR solicits used, surplus and outdated equipment from industry, hospitals, laboratories and other sources and then distributes lists of available equipment to the State's high school science teachers. FBR tries to fill at least one request from each school.

In 1998 FBR received $25,000 from the Maine Science and Technology Foundation, which was the

first State money appropriated to the program. With increased and ongoing funding, FBR will be able to expand the program to reach more schools with more equipment.

**12. The committee recommends appropriating $150,000 to the Maine Science and Technology Foundation for the MERITS program (Maine Research Internships for Teachers and Students) to provide expanded internship opportunities in the public and private sectors for science and mathematics teachers and students.**

The MERITS program provides research internship opportunities for K-12 teachers and high school and college students. The Foundation for Blood Research administers the program for the Maine Science and Technology Foundation. Last year the program was funded with $40,000 in federal EPSCoR money and matched with a $40,000 in-kind contribution from FBR. Additional funding will allow the program to continue and expand the number of students and teachers able to participate in this program.

**13. The committee recommends appropriating $750,000 per year for 3 years to the University of Maine System to provide increased opportunities for Maine high school students to learn about and experience success in post secondary math, science and engineering programs.**

The University of Maine System currently funds several programs designed to motivate high school students to pursue post secondary education in science and engineering, including the Math-4-ME program and the Expanding Horizons program for high school girls. These programs have reached many high school students, but more needs to be done to encourage and prepare students to pursue degrees in science and engineering.

The $750,000 per year appropriation for 3 years will be used by the University of Maine System to develop, pilot and assess accelerated learning programs. These programs will enable high school seniors to take university math, science and technology courses on campus or through technology-based options, to participate in summer learning programs and to maintain connections with university faculty via the Internet. After the 3-year pilot period, the programs that have proven to be most effective and most easily replicable statewide will be maintained and replicated within the University System either without state support or with a significantly reduced level of state funding. Alternative funding sources will also be explored during the pilot period.

These accelerated programs should motivate and better prepare high school students to succeed in post secondary education, and they will benefit the State by increasing the rate at which the University System can produce scientists and engineers for Maine's high tech industries and teachers of science and math for Maine's schools.

**14. The committee recommends funding the Governor's Marine Studies Fellowship Program with an annual appropriation of $50,000 to connect Maine students with Maine researchers.**

The Governor's Marine Studies Fellowship Program was created in 1997 to encourage the study of disciplines important to the conservation, management and utilization of marine resources. The program was not funded. The Department of Marine Resources, the State Planning Office and the University of Maine System are collaborating on developing guidelines for the program. State funds must be matched 2:1 with non-state dollars.

The committee recommends funding the program with $50,000 per year to provide support for

undergraduate and graduate students enrolled in Maine-chartered colleges or universities to work with Maine researchers in academic institutions, marine industries or marine industry associations.

**15. The committee recommends that the Legislature carefully consider the recommendations of the Finance Authority of Maine with regard to financial aid repayment programs for students who choose to remain in Maine and obtain employment in one of the technology target areas.**

An Act to Implement the Recommendations of the Commission to Study the Restructuring of the State's Fiscal Policies to Promote the Development of High-technology Industry in Maine (P.L. 1997, Chapter 784) requires the Finance Authority of Maine to review and make recommendations regarding financial aid programs for supporting students pursuing high-tech courses of study. The report is due to the Legislature on January 1, 1999.

**16. The committee tentatively supports appropriating $50,0000 per year to support the Maine Science and Technology Foundation's education initiative.**

MSTF's education initiative would provide staff support to work with the Department of Education, the Department of Labor, the University of Maine System, and the Maine Technical College System to facilitate cooperative initiatives and to build working relationships between Maine's technology-intensive companies and its education and training communities.

The committee supports this initiative in concept, but recommends that the Legislature delay action until the Joint Select Committee on Research and Development receives an update from MSTF in January 1999 on its revised role and budget requests.

## Business Assistance

**17. The committee recommends that the Legislature carefully consider the recommendations of the Finance Authority of Maine with regard to increasing access to capital and assisting fledgling businesses in locating and obtaining capital.**

An Act to Implement the Recommendations of the Commission to Study the Restructuring of the State's Fiscal Policies to Promote the Development of High-technology Industry in Maine (P.L. 1997, Chapter 784) requires the Finance Authority of Maine to analyze the availability of capital for business start-up and development and to develop strategies for increasing capital, if necessary, and for assisting businesses in locating and obtaining capital. The report is due to the Legislature on January 1, 1999.

**18. The committee tentatively supports appropriating $55,000 for the Maine Science and Technology Foundation (MSTF) to identify new opportunities for innovation in Maine's businesses and to convene stakeholders to identify an implementation strategy for delivering training efforts.**

MSTF would conduct a Best Practices study on how to innovate and work with a consultant to assemble case studies on how small organizations in Maine innovate. MSTF would also convene stakeholders in the state to identify who might best implement a program to run workshops for industry to learn how to innovate and to use the case studies to assist organizations in innovating internally.

The committee supports this initiative in concept, but recommends that the Legislature delay action until the Joint Select Committee on Research and Development receives an update from MSTF in January 1999 on its revised role and budget requests.

**19. The committee tentatively supports appropriating funds for commercialization initiatives, including training for SBIR service providers and grants through the Maine SBIR (Small Business Innovation Research) Assistance Program, and development of a web-based commercialization network.**

Through the Maine SBIR Assistance Program, MSTF provides technical assistance and grants to small businesses in the State to assist them in applying for federal SBIR (Small Business Innovation Research program) funds. Under this proposed initiative, MSTF would convene potential SBIR service providers and train them to bring SBIR awareness and one-on-one technical assistance to an increased number of Maine businesses. The funding would also provide $100,000 per year for 2 years in grants to first-time applicants, to be awarded by the SBIR statewide advisory panel with the goal of increasing the number of successful new SBIR proposals. After two years, MSTF would evaluate SBIR activity and make recommendations to the Joint Select Committee on Research and Development regarding ongoing service delivery and potential service providers. This proposal would be funded at a level of $225,000 per year for 2 years.

MSTF would also convene commercialization stakeholders to seek input on the ongoing development of a web-based commercialization network, which provides Maine businesses that are seeking commercialization assistance with referrals to in-state service providers. MSTF would contract with an outside agency to house and update the clearinghouse. This proposal would be funded at a level of $75,000 per year.

The committee supports these initiative in concept, but recommends that the Legislature delay action until the Joint Select Committee on Research and Development receives an update from MSTF in January 1999 on its revised role and budget requests.

**20. The committee tentatively supports appropriating $50,000 per year to MSTF to expand its role in identifying science and technology strategies for Maine, convene stakeholder groups to discuss implementation strategies and make recommendations to the Legislature.**

The committee supports this initiative in concept, but recommends that the Legislature delay action until the Joint Select Committee on Research and Development receives an update from MSTF in January 1999 on its revised role and budget requests.

## Other

**21. The committee recommends that the 119th Legislature establish a Joint Select Committee on Research and Development.**

The Joint Select Committee on Research and Development was established to review all legislation relating to research and development; it expires upon the convening of the 119th Legislature. The previous R&D Committee was established to review the current policies and programs within the State in support of applied research and development in 5 target areas and to develop a plan for the

support of research and development in those 5 target areas.

An ongoing legislative committee will provide the Legislature with continuity in overseeing issues relating to research and development. Research and development issues fall under the jurisdictions of many of the joint standing committees, and it is important to have one umbrella committee with representatives from the various policy committees to review research and development issues and coordinate R&D policy in the State.