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FIRST REGULAR AND FIRST SPECIAL SESSIONS

Final Report of the JOINT SELECT COMMITTEE ON RESEARCH AND DEVELOPMENT

February 1998

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EXECUTIVE SUMMARY

The Joint Select Committee on Research and Development was created by the Legislature to review current policies regarding applied research and development in the State and to recommend a plan to support applied research in five technologies:

- aquaculture and marine sciences & technology;
- biotechnology;
- composite materials engineering;
- environmental sciences & technology; and
- information sciences and technology.

These technologies have been identified by the Maine Science and Technology Foundation as having economic growth potential for the State. Developing an economy based on these technologies requires a number of resources -- human, physical and financial.

Maine has some fine resources in these areas -- the University of Maine educational and research resources, several world-renown nonprofit research organizations such as the Jackson Laboratories and the Foundation for Blood Research, major companies like Fairchild and National Semiconductor, and support organizations and programs such as the Centers for Innovation, the Maine Science and Technology Foundation and tax incentives for seed capital investment. But the state lacks the critical mass of resources needed to sustain economic growth in technology-based industry.

Maine ranks 50th in the nation in spending on University-based research. In all sectors, the state ranks 49th. This lack of funding has impact all along the "science and technology pipeline" that leads to economic growth. Lack of research equipment may discourage talented students and faculty from associating with the University; lack of an educated workforce from which to hire discourages technology-based companies from locating in the state; lack of capital to perform research or to commercialize an idea prevents economic growth; lack of funds for nonprofits to hire researchers or purchase equipment denies the state the benefit of important innovations such as ways to manage the herring industry or ways to prevent or treat disease in important finfish and shellfish populations.

Public investment in applied research and development can bring many returns. First, private and federal grants can be obtained when state money is available for a match; this can double or triple the value of each dollar of state investment. Second, research dollars end up in the hands of faculty and staff who perform the research and in the hands of local businesses that provide

supplies to the researchers. Finally, the companies and products created from, or improved by, such research provide long-lasting benefit to the economy.

In light of its understanding of the importance of research and development to the development of technology-based industry, and of the outcomes expected from state investment, the committee makes the following recommendations:

- That $10 million be appropriated to the Maine Economic Improvement Fund (MEIF) to support research and development within the University of Maine system and among the University and other research sectors, The MEIF was created in 1997 to provide resources such as matching funds for federal and private research grants, funds to hire faculty and research assistants and to help develop products and companies created through University-based research. The Board of Trustees of the University of Maine system are directed to take all actions necessary to obtain revenue from sources other than the General Fund to continue its efforts after 5 years of General Fund support.

- That a $20 million bond be issued to build research and development capacity in the for-profit, non-profit and academic sectors.

    - $13.5 million to fund capital expenses in the University of Maine system, including purchase of equipment and renovation of labs;
    - $2.0 million to provide partial funding for design and construction of a marine research facility in association with the non-profit Gulf of Maine Aquarium to provide collaborative research space for nonprofit and academic marine researchers and marine biotechnology companies;
    - $3.0 million to create a marine technology fund to improve telecommunications connections among public and non-profit marine research institutions and to provide funds for building R&D capacity in other ways in those institutions; and
    - $1.5 million to fund a Research Challenge Grants program by which matching funds would be made available to target-technology researchers in all sectors -- private, nonprofit and academic;

- That the Seed Capital Tax Credit be expanded to make more investments and more businesses eligible for the credit. Industry representatives clearly stated that lack of access to capital was a major impediment to growth of their businesses. The tax credit is available for investments made by the business itself and for investments in a business by individuals. The

expansion proposed would increase the maximum investments eligible for the credit to more realistically reflect the needs of technology-based businesses.

- That a legislative Joint Select Committee on Science and Technology be created to provide the Legislature with continuing ability to plan, oversee and encourage the use of science and technology to improve the state's economy.

Expected outcomes from these public investments include enhanced communication and collaboration among researchers throughout the State, increased access to capital for growing businesses, a greater ability to educate students in technologies that promise economic growth, greater ability to attract high-quality researchers, faculty, students and companies to the State and an increased public awareness of the exciting research and economic development opportunities available in the State.

I. Introduction - Purpose and Method of Study

The Joint Select Committee on Research and Development was created by a Joint Order of the Maine Legislature on May 29, 1997.[1] Comprised of 14 legislators from seven different legislative standing committees, the study committee was directed to develop and recommend a plan for the support of applied research and development (R&D) in five technologies identified as having growth potential in the state's Science and Technology Action Plan:

- aquaculture and marine sciences & technology;
- biotechnology;
- composite materials engineering;
- environmental sciences & technology; and
- information sciences and technology.

The study order came at the end of a legislative session in which several proposals to support R&D were presented to legislative committees, including proposals to provide tax incentives for R&D in the business community, bond packages for the non-profit and academic research sectors and requests for General Fund dollars for research at the University of Maine system.[2] Although some of the proposals were adopted in that session, the Legislature felt that more study was needed before it could approve major state investments in R&D through bonding and appropriations. The Joint Select Committee on Research & Development was created to perform that study.

The committee was directed to review current policies and programs in the State supporting R&D in the 5 target technologies and to develop a plan to further support R&D in those target areas, including recommendations for funding, bonding and tax policies.

The Committee held its first meeting on September 24th. At that meeting, members elected Senator Mary R. Cathcart (D-Orono) and Senator Richard A. Bennett (R-Norway) as committee co-chairs. The committee received briefings on:

- The status of Maine's technology-intensive industries and the importance of R&D to economic development in Maine;
- The State Science & Technology Action Plan and implementation of the plan;

[1] Senate Paper 669, May 29, 1997. See Appendix A for the Joint Order.
[2] See Appendix B for a list of proposals from the First Regular and First Special Sessions of the 118th Legislature.

- University efforts in R&D and outcomes of the efforts;
- Executive branch efforts in R&D (the Jobs from the Sea Initiative);
- Private and nonprofit sector R&D; and
- What other states do to support R&D.

For the second meeting, on October 19th, committee members traveled to Portland for a tour of research labs at the University of Southern Maine and tours of the Foundation for Blood Research in Scarborough and the new billion-dollar semi-conductor manufacturing facility at National Semiconductor in South Portland. The tours provided members with a brief view of some of the research being performed at those institutions, and the collaborations developed between the University and the nonprofit and private technology sectors. Committee members had an opportunity to talk informally with members of the private, nonprofit and academic research communities. Members also received a briefing from the Gulf of Maine Aquarium Development Corporation on plans for the Gulf of Maine Aquarium and the role of a marine research facility associated with the Aquarium.

The University of Maine in Orono was the site of the third committee meeting on November 19. Again, members were given a tour of various lab sites on the Orono campus where Research & Development are taking place. A number of businesses that use the resources of the University spoke with the committee, as did representatives from businesses formed by technologies developed at the University. Lunch consisted of a number of dishes created with food products developed through research at the University, including cryogenically frozen lobster, Maine blue potatoes and salmon sausage. The Agricultural Council of Maine (AgCOM) also spoke with the committee, stressing the importance to Maine agriculture of the research performed at the University.

In Augusta for the fourth meeting on December 10th, members refined their goals, interests and concerns regarding the plan to support Research & Development. Members identified potential recommendations relating to bonding for University infrastructure, marine technology infrastructure, business incubators, challenge grants and the Gulf of Maine Aquarium Research Facility and General Fund appropriations for non-capital University research needs. Members expressed the need for additional information and additional time to evaluate the proposals and seek consensus. The December meeting culminated in a request for approval to hold an additional committee meeting and for extension of the reporting date to January 15, 1998. That request was granted by the Legislative Council.[3]

[3] The Legislative Council later extended the reporting deadline to January 30, 1998.

Prior to the fifth meeting on January 6th, committee members received information packets from staff describing the various proposals, setting forth the financial needs and the expected outcomes of public funding of the proposals.

During January meetings of the full committee and subcommittees formed to work on various parts of the proposal, members resolved their concerns and on January 27th voted unanimously to support the recommendations and proposed legislation set forth in this report.

II. The Importance of Research & Development to the Maine Economy

Maine's economy needs a boost. While employment is expected to grow in the next 8 years, growth will be slow and the number of jobs created will not be enough to attract workers to the State or to spread wealth from urban to rural Maine. The expected rate of job growth, about 1% a year, is less than the national average and not enough to create a vibrant Maine economy.[4]

A number of studies by private and governmental organizations have identified areas of potential economic growth in Maine.

The Maine Science and Technology Foundation (MSTF) is charged by law to identify emerging technologies that provide significant promise for the development of job-creating businesses in the State. Based on research by a consultant,[5] the Foundation has identified the following promising technologies:

- biotechnology;
- composite materials;
- computers and other information technologies;
- marine science; and
- environmental sciences & technology.

The State of Maine Economic Development Strategic Plan, developed by the Department of Economic and Community Development includes marine sciences, biotechnology and environmental services & technology in its list of emerging industries that hold the greatest growth potential for the State, given its human and natural resources.

These identified areas are technology- intensive industries, defined as industries that have at least 2 of the following characteristics -- high levels of spending on R&D, high levels of spending on capital resources, and a high percentage of scientists and engineers on staff. Technology-intensive industries are increasingly important to economic prosperity -- they grow faster and pay higher wages than other sectors of the economy. [6]

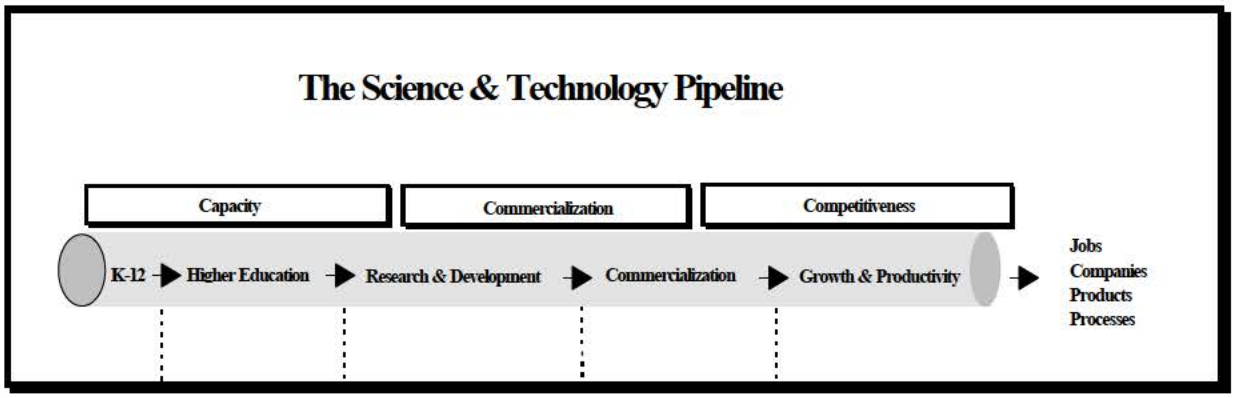
Maine has a fledgling community of technology-intensive industry and support organizations -- e.g., the nonprofit Centers for Innovation

[4] Dr. Charles Colgan, Professor at the Edmund S. Muskie School of Public Service, University of Southern Maine, in an October 29, 1997 presentation to the R&D committee.
[5] Consultant report by the Nexus Associates, Inc. of Belmont, Mass.
[6] Maine's Science and Technology Environment, Nexus Associates, Inc., Belmont, Mass., 1997. Prepared for the Maine Science and Technology Foundation

(biotechnology and aquaculture), major companies such as Fairchild and National Semiconductors, the nonprofit Jackson Laboratory and University research programs.

A technology-based community needs many elements to grow and thrive. The Maine Science and Technology Foundation, among other governmental and private agencies, is working on ways to ensure success.

To illustrate what's needed to nurture technology-intensive industries and to realize the economic growth benefits, the Maine Science and Technology Foundation presents the "science and technology pipeline."



The illustration shows the importance of R&D to the Maine economy -- it is a critical element in developing well-paying jobs, successful companies, and innovative products and processes.

The Joint Select Committee on Research and Development acknowledges the importance and interrelatedness of the other elements of the pipeline -- an educated work force and commercialization opportunities. But in following its legislative charge, the committee focused its efforts on the need to build research and development capacity.

III. Building Research and Development Capacity

A state's capacity to support research and development in important technologies is measured by several factors. MSTF provided the Joint Select Committee with a list of human, physical and financial resources needed to support research and development efforts:

- Laboratories and other research facilities;
- An excellent education system from kindergarten to postgraduate to develop human resources;
- Tax policy and regulations conducive to private sector investments in R&D;
- Collaboration between private and public sector researchers;
- Access to international R&D and technology development;
- Technical assistance to commercialize ideas developed through research;
- Incentives for higher education institutions to collaborate with the private sector;
- Research and development instrumentation;
- Pre-seed, seed and venture capital;
- Information technology networks;
- Up-to-date library holdings;
- Faculty and graduate students in target technologies;
- State matching funds to access federal research dollars; and
- A supportive business community, Legislature and Governor.

Maine has made some efforts to build capacity: providing tax incentives to encourage investors to provide seed capital; directing the Maine Science and

Technology Foundation to nurture capacity; and creating the Small Enterprise Growth Fund to match capital investments in small businesses.

But researchers and others involved in technology fields say there's still a wide gap between currently available resources and the resources needed to support a thriving technology-based economy. The lack of required state funds has forced the University to turn down federal funds that would have matched one dollar of state investment with 3, 4 or 5 dollars of federal investment. A world-renown researcher seeking to relocate to Maine was nearly turned away because the research infrastructure and community he sought was not immediately available. Owners of technology-based industry say they are stymied by the lack of capital available to commercialize new ideas.

Maine ranks poorly in its financial support of research and development compared to other states. In 1993, Maine ranked 49th in the nation in total R&D expenditures as a percent of gross state product (GSP).

Spending on industrial R&D is ranked 43rd in the nation, and spending on University research ranked last in the nation.[7] This 50th place ranking on University R&D is especially critical in Maine because the state relies more heavily than the national average on University research. While University research accounts for only 12% of R&D performance nationally, the figure for Maine is nearly 22%.[8]

Maine also ranks poorly in the receipt of federal R&D dollars for academic research. The federal government is a major source of funding for R&D. In fiscal year 1997, the federal government provided $13.5 billion for University R&D. Maine captured only 0.2% of that total.

The lack of funds has a cumulative impact. Without funds to support laboratory space and equipment at the University, the University cannot attract faculty and students with promising research abilities. Without a reliable source of matching funds, the University misses out on available federal dollars that can multiply the state's investment by 4 or 5 times. Without a stock of students educated in science and technology, businesses that might develop here locate elsewhere to access the work force they need. And without a community of technology-oriented businesses, students may not be encouraged to enter technology-related fields of study, and those who do enter those fields will have to leave the state to find jobs.

[7] Nexus Associates report, p. 22, based on data from the National Science Foundation and the U.S. Bureau of Economic Analysis

[8] Nexus Associates report, p. 23

IV. Efforts to Support R&D in Maine

Maine has made a good start in adopting programs to plan for the development of technology-intensive business and to support the R&D and other investments necessary to develop those businesses. Appendix C includes a chart describing many of the financial programs available in the state. The following are descriptions of the major financial and technical assistance programs.

Planning and Technical Assistance Programs

Maine Science and Technology Foundation (MSTF)

The Maine Science and Technology Foundation is a nonprofit 501(c)(3) organization created by Maine law to serve as "the principal science and technology organization for State Government." [9] The Foundation is directed to facilitate research and development of relevance to the State, transfer of technology among sectors developing and using technology, appropriate application of technology in the public and private sectors, science & technology education and training, development of new commercial products, and cooperative efforts among government, the private sector and the academic sector. The Foundation is governed by a Board of Directors comprised of representatives of the private sector, public and educational sectors and labor, with 2 legislators serving as ex officio members. The Foundation developed the Maine Science & Technology Action Plan[10], a blueprint for action to improve science & technology in the state, and is working through committees to plan ways to implement the plan. In addition to its planning function, the Foundation administers or cooperates with a number of technical and financial assistance programs, including the EPSCoR program, the Centers for Innovation and the Maine Technology Fund.

Experimental Program to Stimulate Competitive Research (EPSCoR)

EPSCoR is a federal program created to build research capacity in states that have historically captured a small percentage of federal academic research dollars. Concern over the undue geographic concentration of federal grants and the lack of ability of some states to compete fairly for dollars led to creation of the program. EPSCoR is administered in Maine by the Maine Science and Technology Foundation.[11] The program works to improve the human and technical research infrastructure and to build collaborations between the

[9] 5 MRSA §13123-A
[10] See Appendix D for a copy of the Maine Science & Technology Action Plan.
[11] 5 MRSA §13124-B

university and other research sectors to provide long-term improvement in the state's competitiveness for federal research grants. Eighteen states and the Commonwealth of Puerto Rico are included on the basis of historically low receipt of federal R&D funding and a commitment to develop R&D resources and improve the quality of science, math and engineering research at the university.

Centers for Innovation

Maine currently has 3 centers for innovation: the Center for Innovation in Biomedical Technology; the Center for Technology Transfer (serving the metals and electronics industries) and the Maine Aquaculture Innovation Center. Each center is associated with the Maine Science and Technology Foundation[12], but is a separate private-public partnership designed to meet the needs of a specific sector of the business community.

Loans, Grants, Capital Access

The Maine Economic Improvement Fund (MEIF), administered by the University of Maine System Board of Trustees, was established by statute during the 1997 legislative session to support research and development in the 5 target areas.[13] The Fund can be used by the University system to invest in applied R&D in the target areas and to support development of private enterprise based on R&D performed within the University. These actions must be taken in partnership with private enterprise, the federal government, or public or private research institutions. State dollars were not appropriated to the Fund during the session. The Select Committee was specifically directed in its enabling legislation to recommend a funding level for the MEIF.

The Maine Technology Fund, administered by the Maine Science and Technology Foundation, was established in 1995 to increase the science and technology investment level in the state through partnerships among State government, the Federal government, private enterprise and private and public research institutions.[14] The Fund is divided into 2 parts:

- the Maine Technology Investment Fund, which provides pre-seed dollars to small, private, for-profit companies, to be used to commercialize a product or processes in a targeted technology area; and

[12] 5 MRSA §13124
[13] 10 MRSA c. 107-C; a copy of the law is found in Appendix E.
[14] 5 MRSA §13131

- the Maine Technology Capacity Fund, which can be used to build research capacity.

Financial Incentives to Invest in R&D

Maine provides tax incentives for investment in research & development in the State by businesses themselves or by persons providing investment dollars.

Purchases of machinery and equipment to be used in research and development or to be used in biotechnology applications are **exempt from sales tax** in the State.[15]

Maine law provides 2 **tax credits for business investment in research & development**, the research expense tax credit and the super credit for substantially increased research and development.[16] To qualify for either credit, a business must have increased expenditure on R&D over a base period amount. For the so-called "super-credit," enacted in 1997, a business must have spent more than 150% of the 3-year average expenditures on R&D to qualify for the credit. **A third tax credit, the high-technology investment tax credit,**[17] can be taken by businesses that invest in equipment to be used in designing, creating or producing computer software or hardware or in providing Internet or electronic communication access services or support.

Incentives for equity investors are provided by the Maine Seed Capital Tax Credit Program, which allows investors to take a credit of 30% of cash equity provided to qualifying businesses,[18] and the Linked Investment Program for Commercial Enterprises, through which the state invests in financial institutions that agree to finance eligible small businesses at reduced rates.

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[15] 36 MRSA §1760, sub-§32
[16] 36 MRSA §§5219-K and 5219-L
[17] 36 MRSA §5219-M
[18] 10 MRSA §1100-T and 36 MRSA §5216-B; see Appendix F for a copy of the law

V. Current Target-Technology Research in Maine

Maine's current R&D community, though small, is innovative and fascinating. Research occurs in and among 3 sectors: the academic sector, the nonprofit sector and the private, for-profit sector. Committee members were invited to tour facilities at some of the R&D facilities: the University of Southern Maine, the University of Maine, the nonprofit Foundation for Blood Research, and National Semiconductor and Fairchild Semiconductor. Members met representatives of the organizations and heard information about many others.

Academic Sector Research

In the academic arena, the University of Maine System plays the biggest role. The system has over 240 active researchers and over $20 million in major research equipment and dedicates over 280,000 square feet to research laboratory space. In fiscal year 1997, the university system received $23 million in R&D funding, 79% from the federal government. The University of Maine and the University of Southern Maine work with the private and nonprofit R&D sectors to share faculty, equipment and ideas. They also focus research efforts on questions and problems relevant to Maine's business community. Appendix G contains a description of the key University research efforts in the target areas, along with the industry partners and funding sources for each project. Examples of research initiatives and collaborative efforts are described below.

- University of Maine is a national leader in **composite reinforced wood technology**, through which advanced synthetic materials (composites) are combined with wood to produce stronger, more durable and more cost effective materials. Reinforced wood products such as "glulam," for which the University has a patent application pending, can increase the use of under-utilized Maine wood species in the construction market. In 1995, University researchers constructed the first wood-composites ocean pier for the Bar Harbor Yacht Club. Industry partners include Brunswick Technologies Inc., Georgia Pacific Corporation and North End Composites.

- In **other composites research**, University researchers and students are assisting in the design and optimization of a composite aeroshell for NASA's X-38 crew return vehicle, which will replace the Russian SOYUZ capsule.

- The University of Southern Maine created a graduate degree program in **applied immunology** in response to the needs of area biotechnology companies. The program is housed in the Foundation for Blood Research, a nonprofit research institution in Scarborough. Faculty for the program comes

from the foundation and from private biotechnology firms and laboratories. Students in the program benefit from internships and collaborations with working biotechnology researchers; the private and nonprofit sectors benefit when well-trained students graduate and bring their talents to the workplace.

- Academic researchers have a close relationship with Maine's **semiconductor and sensor technology** industries, which include National Semiconductor, Fairchild Semiconductor and Sensor Research & Development Corporation. The University of Maine is working to perfect technology for placing thin film coatings on the silicon wafers used in manufacturing semiconductors. The microsensor lab works on technology to detect pollutants such as airborne mercury, and is in competition for a research grant from the U.S. Department of Defense to build sensors for use in detecting chemical or biological weapons. In partnership with the BIODE company, UM researchers have developed a biosensor to detect antibodies for use in medical diagnosis.

- **Computer and information technologies** are needed in every arena of modern life: from manufacturing plants to schools to scientific research units. The University of Maine is a National Center for Geographic Information and Analysis, which works through a consortium of 3 universities to design geographic information systems (GIS) for use in monitoring oil spills, inventorying natural resources and keeping track of municipal land records. The GIS industry is a multibillion dollar industry, with 7 companies in the Bangor area alone involved in the design of software for GIS. Other research includes creation of a spatial information system for research on genetic material in collaboration with the Jackson Laboratory and creation of computer systems to pilot robots into deep sea, contaminated and other areas where humans cannot survive.

- Maine's traditional **natural resource-based industries** are improved and new industries created through University research in areas such as forest productivity and value-added product manufacturing. The University of Maine forest genetics program is working with the Cooperative Forestry Research Unit and SD Warren to develop fast-growing larch hybrids, which are by far the fastest growing conifers in the state. Researchers have also developed new food processing techniques such as flash freezing of shellfish to extend shelf-life and freeze-drying of blueberries for use in commercially marketed mixes. With the help of this research, food processors are able to develop new and improved exportable products.

- **Marine biotechnology and aquaculture** research at the University includes genetic studies of commercial species with the aim of identifying genes that

control desired characteristics and developing selective breeding or transgenic methods for improving broodstock. Other research efforts focus on diagnosing, treating and preventing disease in fish and shellfish populations. University of Maine development of treatments to prevent the spread of sea lice among salmon and procedures to control Red Tail, a fatal bacterial infection in lobster, has prevented significant losses to 2 important marine industries in the state.

Nonprofit sector research

The nonprofit research sector in Maine consists of a small group of well-known and well-respected institutions, ranging in specialty from genetics testing and counseling, to cold-water marine research and fisheries management. In brief, the nonprofit sector includes the following:

- The **Bigelow Laboratory for Ocean Sciences**, located in West Boothbay Harbor, focuses on the sea as a biological unit. Collection and analysis of phytoplankton lead to strengthening the aquaculture industry in Maine, to combating harmful algae blooms and to possible biomedical and other biotechnology uses. Other areas of study include red tide toxicology, study of the early life stages of herring, cod and lobster, and study of sea floor pollution.

- **Mt. Desert Island Biological Laboratory** in Salisbury Cove is the largest cold water research facility in the Eastern United States and is known for its investigation of electrolyte and transport physiology, developmental biology and electrophysiology

- Although a facility has yet to be constructed to house them, the staff of the **Gulf of Maine Aquarium** (GMA) provide education for the public and research services to the fisheries industry. GMA has developed a nationally recognized marine education program with funding from NASA, using the Internet and other digital technology to make programs accessible to students and teachers throughout the State. One program uses satellite imagery, some of it real-time, to teach about aquatic environments; another equips Maine marine researchers with cameras and software to transmit photographs of research sites and description of research to GMA's website for classroom use. GMA has also initiated an applied fishery research program, through which herring industry participants and governmental researchers and regulators were brought together to coordinate research efforts, making research more efficient and stimulating participants to fund and complete important research.
- The **Foundation for Blood Research**, in Scarborough, conducts research in immunology, immunochemistry, genetics and preventive medicine. The

- Foundation has developed a number of tests for diseases such as arthritis, cancer and lupus, as well as providing counseling services for genetics testing. The Foundation serves as a clearinghouse for the collection and distribution of used scientific equipment to school science programs and invites students, teachers and scientists to educational programs at the Foundation.

- The **Jackson Laboratory**, located in Bar Harbor, specializes in the study of genetics. The Lab also raises genetically standardized and mutant mice and mouse DNA for use by scientists around the world in a wide array of research programs. With an operating budget of $48 million and research budget of about $23 million, the lab employs 830 people, including 111 scientists and technicians.

- **Maine Medical Center Research Institute** in Portland houses research and development resources in basic and applied biomedical research and specializes in the biomedical application of molecular and cellular analysis

Private, for-profit sector research

The private, for-profit sector in Maine is small in terms of the number of companies that conduct research and development and also in terms of the size of the companies. According to the State Planning Office, Maine is home to approximately 350 companies related to the 5 target technologies; 90 of those companies perform research and development. Preliminary results from a survey of the for-profit sector indicate that the average number of research employees is 5 per company; that the overwhelming majority believe there's likely to be company expansion in the next 3 to 5 years; and that primary impediments to company growth include the educational level of the workforce and availability of capital.

Examples of 2 smaller companies that are focusing on the development end of research and development are Capricorn Products and ImmuCell.

Capricorn Products, Inc. located in Scarborough, manufactures and distributes immunodiagnostic products for the human and veterinary diagnostic industry. Capricorn Products employs 7 people.

ImmuCell Corporation of Portland is a biotechnology firm that employs 26 people. The company develops, manufactures and markets milk-based passive antibody products to prevent and treat gastrointestinal infections in humans and animals. ImmuCell was recently awarded a $700,000 grant from the National Institutes of Health to study the ability of its antibody-based

product to prevent *E.coli*-caused diarrhea in a natural environment. The grant is the eighth NIH grant awarded to the company under the Small Business Innovation Research program.

National Semiconductor and Fairchild Semiconductor, both located in South Portland, are two of the larger companies that conduct research and development in Maine. **National Semiconductor** produces computer chips, for use in cellular phones, broadcast satellites and global positioning systems, that are able to process information faster using less power. National employs 520 people at its South Portland facility. National Semiconductor was a major force in establishing the electrical engineering department at the University of Southern Maine, and has provided funding for equipment and labs for the engineering program.

Fairchild Semiconductor designs, develops and manufactures semiconductor integrated circuits in a highly competitive market. Fairchild's products are incorporated into satellites, personal computers, aerospace systems, telecommunications equipment and automotive sound systems. Fairchild employs 1,200 people at its South Portland headquarters.

VI. Committee Findings

After reviewing current programs in support of R&D, observing a number of R&D programs and hearing suggestions from the research community in Maine, the committee makes the following findings.

Finding: 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.

Finding: The Maine Science & Technology Action Plan is the basis for the committee's recommendations.

Given the work that has already been done by interested parties to prepare the State Science & Technology Action Plan, we find it appropriate to use that plan as the guiding document for recommendations in this report. Specifically, the committee designed its recommendations to support the plan's Call for R&D Capacity Relevant to Maine's Industries. Although our recommendations primarily address the Call for R&D Capacity, we believe that support of all 6 calls is necessary to achieve the economic benefit that R&D promises for the State.

Although the committee did not fully examine the basis for selecting the 5 target industries, the committee feels those industries do hold promise for the state economy and are worthy of the state's attention and resources.

Finding: Seeds of opportunity exist in Maine in 5 promising economic areas.

Maine has the seeds of opportunity in 5 economically promising technologies. We have successful businesses and research institutions and some collaborations between the industry, nonprofit and academic research sectors.

Finding: The public is not aware of the exciting developments in Maine R&D.

We are impressed with the research accomplishments of the state's University system and the nonprofit and business sector. We were unaware of much of the exciting activity in Maine, and we believe the general public is equally unaware. We must ensure that the public understands the promise of such enterprise, the long-term benefit to the state and why the state is spending public dollars on it.

Finding: Maine is behind in its support of R&D.

Maine lags behind other states in its support of R&D. We must improve our position to remain viable competitors. Lack of capital stymies businesses from discovering new technologies and then commercializing their innovative ideas; lack of funds for academic research infrastructure and faculty hinders the education of students who will serve as the work force and the technology entrepreneurs of tomorrow and prevents the discovery and development of important new technologies.

Finding: The University system is critical to the development of technology-intensive industry in the State.

The University system is a critical element in the development of technology-intensive industry in Maine. It educates professionals in applied science and technology to work in and to create such industry and shares its human and technological resources with other sectors of the industry.

Finding: The State has an important role to play in supporting private and nonprofit research efforts through capital access improvements, tax incentives and technical assistance.

Programs to expand access to capital and to provide tax incentives to developing technology-intensive industries have been created in recent years. However, private and non-profit organizations have asked for additional help with capital, incentives and technical assistance to enable them to grow.

Finding: A significant return on investment of public dollars for R&D is essential.

Significant return on public investment in R&D must be promised and delivered. Public investment in academic R&D capacity must create a better education and improved employment opportunities for Maine students; investments in R&D in all sectors must result directly or indirectly in greater economic opportunity for the state; the public must receive its share of royalties, equity or other valuable rights in intellectual property developed with public funds. Organizations must be held publicly accountable when accepting public funds, incentives and technical assistance.

Finding: Collaboration among research sectors must continue.

The State currently enjoys the benefits of collaborative efforts among all sectors in the research community. Examples include: the USM School of Applied Immunology collaboration with the Foundation for Blood Research, collaboration between USM and UM on a master's degree program in computer science, and contracting for development of technology. Such efforts must be encouraged and expanded to make the most of scarce research dollars.

Finding: There is more work to be done in planning and overseeing the state's efforts to encourage development of technology-intensive industries through R&D.

State support of R&D must be an ongoing effort. Existing groups such as MSTF must continue planning and working for this development. In addition, the Legislature must play an ongoing role. The Legislature should create a mechanism, such as a joint select committee, to oversee the use of funds provided for R&D, to track outcomes of state efforts and to keep abreast of the changing needs of the R&D community to ensure long-term success.

VII. Recommendations and Expected Outcomes of State Investment

The Joint Select Committee voted unanimously to support the following recommendations.

1. **We recommend that $10 million be appropriated to the Maine Economic Improvement Fund to support research and development within the University of Maine system and among the University and other research sectors;**

   The Maine Economic Improvement Fund (MEIF), administered by the University of Maine System Board of Trustees, was established by statute during the 1997 legislative session to support research and development in the 5 target technologies. The Fund can be used by the University system to invest in applied R&D in the target areas and to support development of private enterprise based on R&D performed within the University. These actions must be taken in partnership with private enterprise, the federal government, or public or private research institutions.

   This investment by the state leverages federal and private research dollars. The past history of University research funding leads us to expect that each state dollar can leverage three, four or even five federal or private dollars.

Year	University of Maine Dollars	Sponsor Dollars	Total Dollars	Return on the Dollar
1997	$ 6,693,117	$26,470,919	$33,164,036	4.0
1996	$ 3,690,901	$20,349,167	$24,040,068	5.5
1995	$ 6,328,157	$27,072,260	$33,400,417	4.3
1994	$ 4,789,839	$24,627,151	$29,416,990	5.1
1993	$ 5,671,438	$20,524,023	$26,195,461	3.6
5-Year Total	**$27,173,452**	**$119,043,520**	**$146,216,972**	**4.4**

Source of data: University of Maine system

In addition to attracting funds from other sources, research expenditures add dollars to the Maine economy through the payment of

salaries to researchers and research assistants and the purchase of supplies and equipment.

When combined with infrastructure improvements funded by a bond issue and when sustained for a period of time, the MEIF appropriation is expected to produce the following additional results:

- New disclosures of invention, patent and/or copyright applications and licensing agreements in the target technologies;

- Spin-off of at least one new computer software company, stimulation of new commercial food products and cultured marine products; attraction and retention of biotechnology firms and industry-based senior scientists; stimulation or recruitment of at least 1 new wood composite manufacturing company in Maine;

- Improved biotechnology/biomedical education at USM;

- A doubling of the rate of BS, MS, and Ph.D. degrees conferred in computer science and engineering to provide the work force for a growing technology-based industry;

- Protection from disease for the aquaculture and agriculture industry; and

- Collaboration for research, education and training.

Charts in Appendix I give more specific outcomes for state investment in each target technology.

Committee members felt that revenue from inventions, joint ventures and other relationships with private and governmental sectors could eventually produce sufficient funds to enable the state to lessen its financial obligation to the MEIF. Proposed legislation to appropriate the $10 million to the fund includes language indicating an expectation that non-General Fund dollars would replace General Fund money within 5 years.

2. We recomend that a $20 million bond be issued to build research and development capacity in the for-profit, non-profit and academic sectors.

A. $13.5 million to fund capital expenses in the University of Maine system;
B. $2.0 million to provide partial funding for design and construction of a marine research facility in association with the non-profit Gulf of Maine Aquarium;
C. $3.0 million to create a marine technology fund to improve telecommunications connections among public and non-profit marine research institutions and to provide funds for building R&D capacity in other ways in those institutions; and
D. $1.5 million to fund a Research Challenge Grants program by which matching funds would be made available to target-technology researchers in all sectors -- private, nonprofit and academic.

Physical infrastructure is crucial to support research -- up to date equipment, telecommunications structures, and lab space are a must. The $20 million bond will build R&D capacity in all research sectors.

The University of Maine System expects to use its portion of the bond, if approved, to renovate existing lab space and to update equipment, especially in its information technology labs. For many of the projects, additional federal and private money will be raised to complement the state investment.

The Gulf of Maine Aquarium Research Facility will be built in 2 phases and will be funded by a mix of public and charitable dollars. The facility will provide marine research lab space to Maine's public and non-profit research institutions and to qualified private marine biotechnology companies to encourage cross-fertilization and collaboration among marine researchers. The lab will be designed so that occupants can share reception space, office equipment, conference rooms, specialized lab resources and overhead expenses, but maintain private space to conduct proprietary activities. A public exhibit gallery and reception area will exhibit research underway by lab occupants to educate and engage visitors with Maine's marine research challenges and community. The first phase of the project will be to obtain funds to match the state investment, and to build a 20,000 square foot building to include lab space, shared space and the public exhibit area. This phase would provide lab space for 16 non-profit and public research scientists and attract 2 marine biotechnology companies with total of at least 20 employees. Phase 2, to be funded with leveraged private and federal

funds, calls for building of an additional 20,000 square feet of lab and exhibit space. The facility is associated with plans for the Aquarium, but would probably be built before the aquarium itself. Once the aquarium is built, visitors attracted to the aquarium would also be encouraged to visit the research facility to see educational exhibits.

The Marine Technology Fund will be administered by the Maine Science and Technology Foundation. A third of the $3 million earmarked for the fund will be used to connect the 14 public and private academic and not-for-profit marine research labs through improved Internet and other communications equipment. The remaining $2 million would be available to those same institutions for other marine research infrastructure needs to help improve educational capacity, research capacity, productivity and collaboration. Eligible research facilities would be required to provide a 1:1 cash match for both grant programs. Federal dollars leveraged by the state money would triple the value of the state's investment, and an additional $1 million from the MSTF would further magnify the impact of this grant program. Expected outcomes include additional federal funds of up to $8 million and a 50% increase in research collaboration among participants in the program.

Near the conclusion of its study, the committee became aware of the Maine/New Hampshire Sea Grant program, whose task is also to manage the awarding of grants relating to marine research. The committee asked the Maine Science & Technology Foundation to work with that group to coordinate efforts. The agreement reached between MSTF and the Sea Grant office was to have MSTF and its Research Capacity Committee administer the program and make final grant awards, but to contract with the Sea Grant office to manage the peer review process and outreach on behalf of the Research Capacity Committee.

The Research Challenge Grant program provides matching grants to for-profit researchers as well as non-profit and academic researchers and centers for innovation. Applicants from the non-profit and academic sectors would be required to partner with a business or community co-applicant, to stimulate partnerships. Applicants would be required to provide a 1:1 cash match to the state grant. Applicant match money and funds leveraged from the federal and private sector would increase the state's $1.5 million investment 2 or 3 times.

3. We recommend that the Seed Capital Tax Credit be expanded to make more investments and more businesses eligible for the credit.

This program allows investors to take a credit on their state taxes for a portion of the investments they make in qualifying small businesses, which are manufacturers or businesses that provide services or products predominantly outside the State or that bring capital into the State.

Industry representatives who met with committee members, and those who responded to a survey by the State Planning Office, named access to capital as one of the greatest impediments to the success of their businesses. The Seed Capital Tax Credit program is one of the state programs that gives incentive to businesses and outside investors to provide seed capital to new businesses or new products.

The program in its current form is helpful to the industry, but it needs to be expanded to reflect current-day economic reality. The $600,000 limit on investment by a single entity and the $1 million per company limit are too low to really help today's technology-intensive businesses. The $2 million limit on the size of a business that is eligible for investment is also too small. The committee supports increasing all those limits to a more realistic level. In light of the increased eligibility, the committee also supports increasing the cap on tax credit certificates that can be distributed. Under current law, the cap is phased in to a level of $7 million in calendar year 2001. The committee recommends speeding up the phase-in to raise the cap to $5.5 million in calendar year 1998 and $7 million a year thereafter.

4. We recommend that a legislative Joint Select Committee on Science and Technology be created to provide the Legislature with continuing ability to plan, oversee and encourage the use of science and technology to improve the state's economy.

Since the issue of science and technology is one that spreads across almost all policy areas addressed in the Legislature, it is important to have one umbrella committee with representatives from the various policy committees to review S&T issues.

The Legislature to date has not played a major role in developing plans to incorporate science and technology into education and the economic sector in the State. Through serving on the Joint Select Committee on Research and Development, a small number of legislators received an introduction to many aspects of the subject -- including the

remarkable research that is occurring in Maine, the potential for economic development in the state and the resource deficiencies in the public and private sectors. Committee members also became convinced of the need to create a legislative group to oversee the complex and multi-disciplinary issue on an ongoing basis.

Meaningful legislative participation in planning and overseeing science and technology in the state can best be assured by a Joint Select Committee, comprised of members from all affected committees. The committee would serve as liaison to the many governmental, non-profit and private groups working on these issues, would seek to be continually updated on developments and needs of the science and technology community and would oversee the use of state funds invested in science and technology projects, to ensure that the State is receiving sufficient benefit for the dollars it is spending on R&D.

VIII. Appendices

A. Joint Order creating Joint Select Committee on Research and Development

B. Research-Related Proposals from the 1st Regular and 1st Special Sessions

C. Chart -- programs available for applied R&D in Maine

D. Answering the Call for an Entrepreneurial State, High Quality Jobs through Investment in Science & Technology, Maine's Science & Technology Action Plan, prepared by the Maine Science & Technology Foundation, 1997

E. Maine Economic Improvement Fund statute, as enacted by Public Law 1997 chapter 556

F. Maine Seed Capital Tax Credit Statute

G. Research and Development at the University of Maine System and non-profit research organizations

H. Proposed Legislation from the Joint Select Committee on Research and Development

I. Charts of proposed recommendations and funding levels, prepared for the committee, December 1997

APPENDIX A

Joint Order creating the
Joint Select Committee on Research and Development

JOINT SELECT COMMITTEE ON RESEARCH AND DEVELOPMENT

ORDERS

Joint Orders

(4-1) On motion by Senator Lawrence of York, the following Joint Order: S.P. 669

ORDERED, the House concurring, that the Joint Select Committee on Research and Development is established as follows.

1. Establishment. The Joint Select Committee on Research and Development, referred to in this order as the "committee," is established.

2. Membership. The committee consists of 14 Legislators appointed jointly by the President of the Senate and the Speaker of the House. The 14 members must include at least one member from each of the following joint standing committees: the Joint Standing Committee on Appropriations and Financial Affairs; the Joint Standing Committee on Business and Economic Development; the Joint Standing Committee on Education and Cultural Affairs; and the Joint Standing Committee on Taxation; the Joint Standing Committee on Natural Resources; the Joint Standing Committee on Marine Resources; and the Joint Standing Committee on Agriculture, Conservation and Forestry.

3. Duties. The committee shall review the current policies and programs within the State in support of applied research and development in the following target areas:

A. Aquaculture and marine sciences and technology;

B. Biotechnology;

C. Composite materials engineering;

D. Environmental sciences and technology;

E. Information sciences and technology;

4. Meetings. In conducting its duties, the committee may meet with any individuals, departments, organizations or institutions it considers appropriate. At a minimum, the committee shall meet with the representatives of the following:

A. The University of Maine System, including representatives of the chancellor's office, the University of Maine and the University of Southern Maine;

B. The Maine Technical College System;

C. The Maine Science and Technology Foundation;

D. The Department of Economic and Community Development;

E. The Department of Marine Resources;

F. The State Planning Office;

G. The Department of Agriculture, Food and Rural Resources;

H. The Department of Environmental Protection; and

I. The Gulf of Maine Aquarium.

5. Plan. The committee shall develop and recommend a plan for the support of research and development in the 5 target areas within the State set forth in section 3. The plan must address the following issues:

A. The role of research and development in the economic development strategy of the State;

B. The relative role of educational institutions, governmental agencies, private research facilities and businesses within the State's research and development strategy;

C. The level of bonding for capital investments in support of research and development in the target areas and the manner in which such funds should be expended;

D. The level of funding for the Maine Economic Improvement Fund, established pursuant to L.D. 1854, the manner in which such funds should be expended and the source for the funding; and

E. The proper tax policy in support of research and development and, if that policy includes tax exemptions or other tax breaks, the method of funding that tax policy.

6. Appointments. All appointments must be made no later than 30 days following the effective date of this order. The appointing authorities shall notify the Executive Director of the Legislative Council upon making their appointments. When the appointment of all members is complete, the Chair of the Legislative Council shall call and convene the first meeting of the committee no later than October 15, 1997. The committee shall select a chair from among its members.

7. Staff assistance. The committee shall request staffing and clerical assistance from the Legislative Council, which must be provided within the available resources.

8. Compensation. Members of the committee are entitled to receive the legislative per diem as defined in the Maine Revised Statutes, Title 3, section 2 and reimbursement for travel and other necessary expenses for attendance at meetings of the committee.

9. Report. The committee shall submit its findings and plan, along with any necessary implementing legislation, to the Second Regular Session of the 118th Legislature by January 1, 1998. If the committee requires an extension of time to make its report, it may apply to the Legislative Council, which may grant the extension.

APPENDIX B

Research-Related Proposals from the
1st Regular and 1st Special Sessions of the 118th Legislature

PROPOSALS MADE in the FIRST REGULAR and FIRST SPECIAL SESSION TO FUND OR PROMOTE RESEARCH & DEVELOPMENT

Proposed Bond Issues

LD 1658 (Lawrence) -- An Act to Authorize a General Fund Bond Issue to Implement a Statewide Economic Improvement Strategy.

- LD 1658 proposes a $17 million bond to fund construction and improvement of facilities and purchase of equipment for research and development in 5 target areas within the University of Maine system.
    - $4 million for construction of an aquaculture research and demonstration facility at the University of Maine's Darling Marine Center in Walpole, an oceanographic research staging facility and a food processing pilot plant
    - $5 million for laboratory renovations, including biotechnology labs at the University of Southern Maine, the aquaculture research facility at the University of Maine, intelligent manufacturing systems labs and environmental engineering labs
    - $3 million for major equipment, including composite materials manufacturing and intelligent manufacturing systems equipment
    - $5 million for matching funds needed to leverage federal and private investment
- LD 1658 was carried over in the Appropriations Committee

LD 1810 (Governor's Bill sponsored by Sen. Goldthwait) -- An Act to Authorize a General Fund Bond Issue in the Amount of $6 million for Critical Marine Infrastructure and Technology Investments

- Proposes a $6 million bond to fund investment in critical marine infrastructure ($1.5 million for ports and harbors) and to create a Marine Technology Fund within the Maine Science and Technology Foundation ($4.5 million)
- LD 1810 was carried over in the Appropriations Committee

LD 1268 (Rowe) -- An Act to Authorize a General Fund Bond Issue in the Amount of $12 Million to Support the Construction of the Gulf of Maine Aquarium and Marine Research Facility

- Proposed a $12 million bond issue to be used by the Department of Economic and Community Development to support the design and construction of the Gulf of Maine Aquarium and Marine Research Facility

- Appropriations Committee voted ONTP on LD 1268; interested party proposal (see below) proposed to include funds for the Gulf of Maine Aquarium Research Facility in a combined bond proposal

Combined Bond Proposal -- $20 million Proposal to the Appropriations Committee by Interested Parties

- $12 million for cold water marine jobs, science and education
    - $5 million for University of Maine System School of Marine Science
    - $3 million for Marine Technology Fund (MSTF)
    - $4 million for Gulf of Maine Aquarium Research & Education Facility

- $2.4 million for wood fiber and synthetic materials engineering
    - University of Maine system instruments and labs

- $5.6 million for biotechnology, information sciences and environmental technologies
    - $2.25 million for biotechnology and analytical chemistry and the University of Southern Maine
    - $3.3 million for intelligent systems and environmental engineering at University of Maine system campuses

- Proposal was presented to the Appropriations Committee as a suggested compromise, not as an LD

Proposed Appropriations

Original Request from the University of Maine System

- $7 million in FY98 to $16 million in FY99

Public Law 1997, chapter 24 (Enacted Budget Bill)

- $500,000 in FY98 and $500,000 in FY99 to the University of Maine System "to implement the Maine Economic Improvement Strategy"

- Potential additional funds of $2 million at the end of FY98 if sufficient funds are available from original projected revenue amounts, following payment of all other obligations

Other Financial Assistance & Incentives

Super credit for substantially increased research and development (36 MRSA §5219-L) -- provides an additional tax credit for persons who increase their R&D expenditures by more than 50% over their 3-year average expenditures. The credit is equal to the amount by which the expenditures exceed 150% of the 3-year average, but may not reduce the tax to an amount below the prior tax year's liability. This credit is in addition to the regular research expense tax credit in 36 MRSA §5219-K.

High Technology Investment Tax Credit (36 MRSA 5219-M) -- provides a tax credit for purchase or lease of computer, electronics or communications equipment for use in "high-technology activity." High-technology equipment includes design, creation and production of computer software, equipment or communications components; and provision of Internet or electronics communications services or access to electronic media and data, or "advanced telecommunications capability". The credit is equal to the cost basis of purchased equipment and the lease payment amount for leased equipment, but the credit may not reduce the taxpayer's liability to less than the previous year's liability.

Sales tax exemption for purchase of machinery and equipment used in research (36 MRSA §1760, sub-§32) -- exemption was amended to specify biotechnology materials eligible for the exemption.

Maine Economic Improvement Fund (10 MRSA c. 107-C) -- creates a fund to provide dollars for research in the target areas by the University of Maine system, its member institutions, its employees and students. The Fund is administered by the Board of Trustees of the University of Maine system and is to be used to invest in applied R&D in the 5 target areas in the University system and to support the development of private enterprise based on R&D performed at the University, in partnership with private enterprise, the federal government, and private and public research institutions. No appropriation was made to the Fund in the First Regular Session.

APPENDIX C

Programs Available for
Applied Research and Development in Maine

Programs Available for Applied Research and Development

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Maine Economic Improvement Fund (University of Maine)	Administer investments in targeted research and development and product innovation and to provide the basic investment necessary to obtain matching funds and competitive grants from private and federal sources	Aquaculture and marine sciences technology, biotechnology, composite materials engineering, environmental sciences and technology and information sciences and technology				Started: 1997	Specifics of the funding and usage are to be recommended by Research and Development study committee
Maine Technology Fund (MSTF)	Two components: Maine Technology Investment Fund: invests directly in small businesses with promising technology at the pre-commercialization stage Maine Technology Capacity Fund: invests in program service and program match to increase commercialization opportunities	Marine Science, Biotechnology, Precision manufacturing, Software development, Composite materials, Environmental science and technology	Direct investment with royalty based return (or other, as agreed upon).	State funds: 1996-$400,000 1997-$400,000 1998-$400,000 MSTF seeking private sector investment to increase dollars available for direct investment.	First round range between $25,000 and $100,000	First closing of applications to Investment Fund October 15, 1997; decisions to be made by December 15, 1997.	Requires minimum 1:1 cash match from applicant.

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Research and Development Tax Credit (Taxation)	• Tax credit of 5% of qualified research expenses above the base amount spent on R&D expenditures over the past three years • 7.5% tax credit of basic research payments	Research and development	Allowable expenses and eligible business entities are provided in Tax Code Section 41		Credit limited to 100% of first $25,000 of taxes due, plus 75% of taxes due in excess of $25,000	Bureau of taxation estimates credit for FY97 at $500,000	
Super Credit for Substantially Increased Research and Development (Taxation)	Additional tax credit for qualified research expenses above 150% of the base amount spent on R&D expenditures over the past three years	Taxpayers qualifying under Research and Development Tax Credit			Limited to 50% of tax due after allowance for other tax credits Cannot reduce tax liability to less than tax due in previous year after allowance of credits	Fiscal note on legislation estimates revenue loss for R&D Super Credit and High-Technology Tax Credit at $2,629,512	

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Centers for Innovation (MSTF)	Matching grants provided by MSTF to non-profit groups to establish centers to promote competitiveness	Science and technology research, technology transfer or application of technology Three Centers have been established: Technology Transfer (precision manufacturing), Biomedical Technology and Aquaculture	Research and development that leads to new technologies and creates jobs, transfer of R&D to marketplace and applying new technology to Maine firms	$426,000 per year of state funds (FY97 and FY98), plus matching funds from private sector and other sources (Annual matching funds have ranged from $2.6 million in 1993 to $1.3 million in 1996)			Each center is a separate non-profit corporation The program is currently being examined to see how technology is delivered to industry
Small Enterprise Growth Fund (FAME)	Provide "patient" venture capital to small Maine business and entrepreneurs	Marine Science, Biotechnology, Manufacturing, Exporting, Software Development, Environmental Sciences, Value Added Natural Resources and other businesses that meet high growth potential and public benefit requirements	Provides capital on a matching basis with other financial resources Businesses must have fewer than 25 employees and sales of less than $2,000,000 per year	$5,000,000 from bond issue approved by voters in November 1996	Up to $150,000	Program implemented in 1997	"Patient capital" component allows investments to be repaid according to cash needs of the company. Matching investment must be at risk for a minimum of 5 years Fund is overseen by an eleven-member board

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
EPSCoR (Experimental Program to Stimulate Competitive Research) (MSTF)	Through the Research Capacity Committee (RCC), which is the state EPSCoR Committee, solicit and review proposals from public/private research institutions across the state for funding through federal agencies. Projects are federal/state/ institutional partnerships. RCC recommends application of state dollars.	Research and development that is responsive to the needs of the industry sectors targeted for development by the Governor. Selected projects must be meritorous, promote collaborations, and demonstrate that support will increase the state's technological capacity and workforce skills needed by Maine's industries.	Responsive to federal agency focus areas.	1997- $1,806,000 state funds, $2,022,000 federal funds 1998- $1,370,000 state funds, $2,319,000 federal funds	Funded projects are often multi-year	Current year includes funding from the following sources: Department of Energy: (year 4 of 6) state funds $802,000; federal funds $600,000 to $750,000; institutional $1,245,000 National Aeronautics and Space Administration: (year 7 of 10) state funds $100,000; federal funds $205,000 National Science Foundation: (year 2 of 3) state funds $468,000; federal funds $1,514,000; institutional $734,000; industry $485,000	EPSCoR began in 1980

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Maine Small Business Innovation Research (MSTF)	Grants to assist individuals and companies in applying for Federal Business Innovation Research funds MSTF program provides education and guidance to applicants. Goal is to increase number of successful stage 1 applicants and number of stage 3 into commercialization	Phase One: Feasibility study of new technology Phase Two: Development of prototype Phase Three: Commercialization	Consultants for pre-application work and prototype development	State funds for grants to assist with applications for federal funds: 1997: $22,500 1998: $22,500 Federal funds available: $1 Billion annually in SBIR grants	Pre Phase-One: $5,000 Phase Two and beyond: $5,000	Program implemented in 1997	Federal Program: Research sponsored by 10 federal agencies in three stages: • feasibility • prototype • commercialization Maximum federal funds available: Stage 1: up to $100,000 Stage 2: up to $750,000

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Sales Tax Exemption for Machinery and Equipment used in Research (Taxation)	Sales of machinery and equipment for use by the purchaser directly and exclusively in research and development in the experimental and laboratory sense and sales of machinery, equipment, instruments and supplies for use by the purchaser directly and primarily in biotechnology applications are exempt from sales tax					Fiscal note on legislation estimates revenue loss at $118,720 in fiscal years 1997-98 for this change in sales tax exemptions	
High Technology Investment Tax Credit (Taxation)	Tax credit for the purchase of equipment for use in high-technology activity	Equipment used in the design, creation and production of computer software and computer equipment or the provision of Internet or electronic communication access services or support	Eligible equipment includes computer and electronic components and accessories and communications equipment		Cannot reduce tax liability to less than tax due in previous year after allowance of credits	Fiscal note on legislation estimates revenue loss at $2,629,512 for R&D Super Credit and High-Technology Tax Credit	

Program	Description	Targets	Eligible Projects	Amount Currently Available and Source of Funds	Maximum Amount	Loans Made/Year Program Started	Other
Linked Investment Program for Commercial Enterprises (FAME/private)	State of Maine makes investments in financial institutions at a reduced rate (2% below current interest rates) who in turn agree to finance eligible small businesses at reduced rates	Must have fewer than 25 employees and less than $2,500,000 annual sales	Must concentrate in exports or be a Maine-resident owned manufacturer Loan proceeds must be used for acquisition of or improvement to real property or fixed assets, research and development or working capital	$4,000,000 of state funds to be invested in financial institutions	$200,000 per qualified loan At least one job must be created or retained for each $20,000 in loans	Investment levels: FY92-$1,369,563 FY93-$1,468,300 FY94-$2,877,406 FY95-$3,999,999 FY96-$3,978,708	Number of businesses receiving loans: FY92-12 FY93-10 FY94-30 FY95-41 FY96-34
Maine Seed Capital Tax Credit Program (FAME/Taxation)	Equity investors in young, dynamic business ventures receive income tax credits equal to 30% of cash equity provided to Maine businesses	Businesses must be for-profit corporations, partnerships or joint ventures; annual sales in the last 12 months of no more than $2,000,000; manufacturers or sell more than 60% of goods outside Maine or bring capital into the state (equal to the amount of the credit)	Investments must be in cash and used for fixed assets, research and development or working capital	Maximum amount of credits available: 1996-$2,000,000 1997-$3,000,000 1998-$4,000,000 1999-$5,000,000 2000-$6,000,000 $7,000,000 thereafter	Maximum of $100,000 per investor per business Maximum of $600,000 per business No limit on the number of businesses in which an investor can invest	Total investments (credits are 30% of investments): FY89-$90,000 FY90-$229,000 FY91:$0 FY92-$115,000 FY93-$626,000 FY94-$1,064,000 FY95-$1,239,000 FY96-$1,174,000	Currently there are 31 businesses participating; 218 investments Investment is unsecured and unguaranteed and remains in the business for at least 5 years with no principal paid to the investor during this period

APPENDIX D

Answering the Call for an Entrepreneurial State, High Quality Jobs through Investment in Science & Technology,
Maine's Science & Technology Action Plan,
prepared by the Maine Science & Technology Foundation, 1997

Answering The Call For An Entrepreneurial State

High Quality Jobs Through Investment In Science And Technology

MAINE IN 2005

- 500 new internationally competitive high technology firms
- 10,000 new high skilled jobs paying 50% above the average employment wage
- Approximately 15,000 additional jobs in other sectors of Maine's economy
- A high technology sector that contributes 15% to the Gross State Product
- A research and development enterprise that infuses $400 million a year into Maine's economy
- A robust manufacturing sector competing globally on cost and quality

MAINE'S
SCIENCE
TECHNOLOGY
ACTION
PLAN

PREPARED BY THE MAINE SCIENCE AND TECHNOLOGY FOUNDATION

Answering The Call For An Entrepreneurial State

THE VISION: 2005

Maine has a stark choice to make. In one option the citizens find themselves in a state falling ever farther behind in economic opportunities. In the other option, Mainers create and benefit from a vibrant, balanced economy. Our vision is the latter.

In the year 2005 Maine is an entrepreneurial state, building on a history of Yankee ingenuity and high quality. A place where business, government and educational institutions work together as partners in creating a skilled workforce employed at good jobs in successful businesses. A state with a robust manufacturing sector competing successfully on cost and quality, where mature industries take full advantage of technological advances and emerging industries find an encouraging environment. A place where high school graduates demonstrate a measurable competency in core skills and go on in record numbers to higher education at vocational, undergraduate and graduate levels.

Investments in science and technol have enabled Maine's entrepreneurial e my to create about 10,000 high wage jo paying one and a half times the averag employment wage, 500 companies that emerged in the last 8 years from Maine technology sector and roughly 15,000 additional jobs in other sectors of Mair economy through a ripple effect. The h technology sector now contributes 15% of the Gross State Product - twice its contribution in 1997!

A CALL For An Educated and Technically Skilled Workforce

To ensure an educated and technically skilled workforce, Maine must have a coordinated, customer-focused, high performance-based educational system.

ACTIONS

Fully support and implement Learning Results in every public school in Maine (1997).

The Governor should appoint a task force to make recommendations to create a collaborative educational system focused on the needs of Maine's citizens (1999).

MAINE ECONOMIC GROWTH COUNCIL (MEGC) MEASURES IMPACTED:

Fundamental Performance Measures
Innovative Businesses
Skilled and Educated Workers
Vital Communities
Efficient Government
State-of-the-Art Infrastructure
Healthy Natural Resources

A CALL For Research And Development Capacity Relevant To Maine's Industries

To stimulate growth in key sectors, Maine must have a critical m of intellectual resources and modern equipment and facilities. Developing and maintaining these resources requires that Maine s a significantly larger share of the $9 billion worth of federally-spo research opportunities. In Maine, the public sector must invest i ence and technology resources to ensure a supportive environm our target industries to capitalize on potential niches in biotech information technology, marine science & technology, compo materials and environmental technology.

ACTIONS

The Governor should call for a comprehensive audit of Maine's science and technology assets to determine the proper arenas for investment of resources and the best approaches to capitalizing on market driven technologies such as marine biotechnology, high-speed networking and pollution control. The audit will examine existing and needed resources in a way that makes clear that industry, educational, and governmental resources will be treated as an integrated system benefit the entire state. The American Association for the Advancement of Sci (AAAS) will provide technical advice in this effort (1997).

Based on the outcomes of the audit:

- Expand, in 1997, state investment in the publicly-supported Maine Techno Capacity Fund as the state's vehicle for matching federal R&D opportunitie for seeding private/public research partnerships in key technology areas ic in the audit. The Fund must leverage federal, industry and participant in at a 3:1 ratio. Total leveraged investment should reach $50 million per y 2002. State investment in the Fund should ramp-up to a $10 million pe operating level by 2002.
- Invest in the University of Maine System's infrastructure to support t industries and technology areas (1997).
- Send to Maine voters a bond issue for capital facilities and equipm colleges which fit the target areas (1998).

MEGC MEASURES IMPACTED

Fundamental Performance Measures
Innovative Businesses
Skilled and Educated Workers
Vital Communities

Maine's scientific and business communities function as an integrated cluster and have become one of the hot spots for venture capitalists to look for promising ideas. The state boasts a base of experienced entrepreneurs in high growth companies, a base of Ph.D. scientists and engineers trained and employed in Maine and its own seed and venture capital industry.

An achievable dream! One in which science and technology investments made now will yield significant returns in the future. The Maine Science and Technology Action Plan spells out the steps to be taken and the investments to be made to achieve this vision for 2005.

THE CONTEXT: AN ENTREPRENEURIAL ECONOMY

Technology is an engine of economic growth, creating high wage jobs, building new industries and accounting for as much as two-thirds of national productivity since the Depression. An entrepreneurial environment in which technology enhances economic growth will enable Maine to take advantage of the opportunities ahead. The elements of an entrepreneurial economy are:

- a well-educated and technically skilled workforce to produce higher value added products and services;
- firms that are high performance-based, invest in themselves, are modern, able to compete globally on cost and quality and provide high-wage employment;
- a stream of innovation moving from R&D into production; and
- fiscal policies and regulations that encourage growth and creation of companies.

THE WORK OF MANY

This vision of Maine's future did not develop in isolation. It began with a joint venture between the Maine Alliance and the Maine Chamber of Commerce and Industry proposing an image of Maine as an entrepreneurial state. That work led to "The Course For 1995 and Beyond," a series of recommendations necessary in furthering this image.

A CALL For Expanding Commercialization

The lack of early investment capital is a significant impediment to the creation and growth of high technology firms in Maine. Developing private sector sources of investment money is crucial. Equally important is improving access to existing sources of seed and venture capital. Maine also needs a highly aggressive effort to collaboratively bring all appropriate resources together in support of developing high tech companies and jobs.

ACTIONS

Capitalize, with private sector support, the Maine Technology Investment Fund to make direct investments in early stage technologies and product development (1998).

Provide access to ACEnet to link entrepreneurs with venture capitalists via the Internet (1997).

Establish a virtual, private/public technical assistance collaborative among current service providers to enhance the pace of technology commercialization and improve the effectiveness of recruitment of entrepreneurs into Maine (1997).

MEGC MEASURES IMPACTED

Fundamental Performance Measures
Innovative Businesses
Vital Communities
Healthy Natural Resources

A CALL For Increasing Innovations In Maine Companies

To realize growth in the high technology sector, companies must invest in themselves, and state policies should foster such behavior. Adoption of productivity enhancement tools, such as information technology, is a key strategy for successfully competing in the 21st century. Existing private/public partnerships that deliver productivity enhancement tools, such as the Centers for Innovation and the Maine Manufacturing Extension Partnership, are indispensible to Maine's science and technology strategy. Their successes and lessons learned should be applied across Maine's entire economy. Synergy among all service providers should be pursued in order to maximize scarce resources with a renewed focus on improving competitiveness of Maine companies across all sectors.

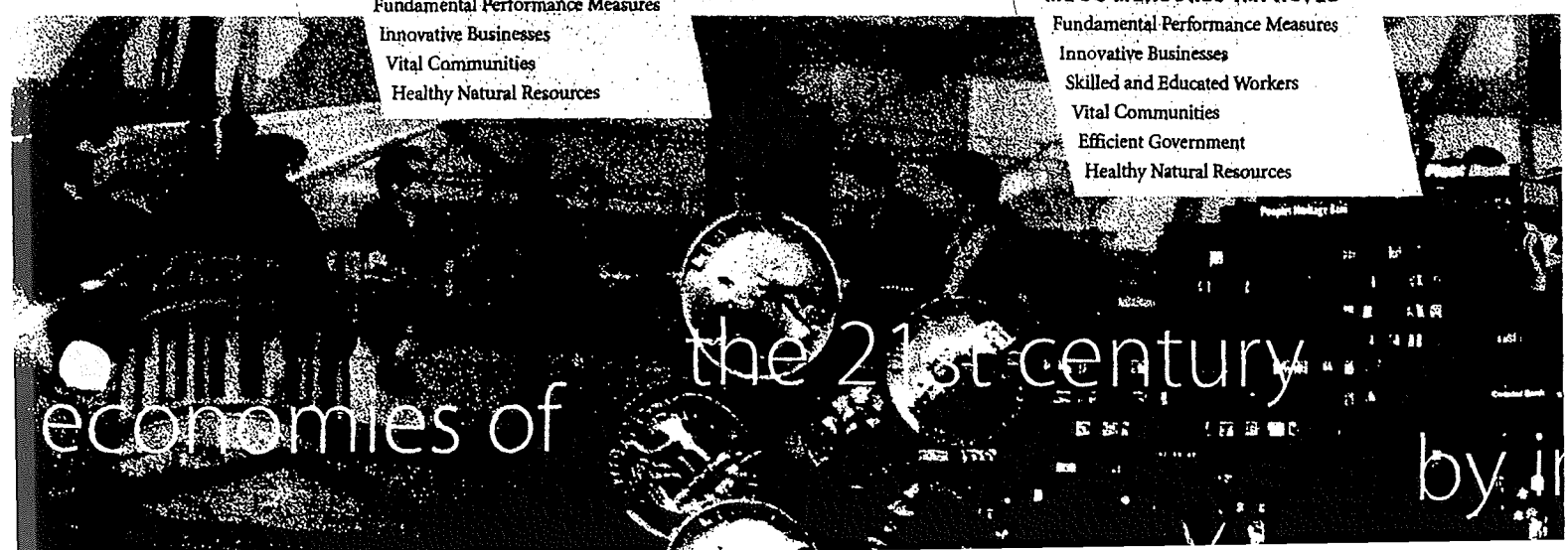
ACTIONS

The Governor and Legislature should conduct a comprehensive review of Maine's fiscal policies and regulations with the specific goal of increasing entrepreneurship and incentives for investments. This review should identify and recommend specific actions to remove barriers to growth and development of high technology industry (1998).

Establish an extension service for the 21st century which reaches out to every sector of Maine's economy (1998).

MEGC MEASURES IMPACTED

Fundamental Performance Measures
Innovative Businesses
Skilled and Educated Workers
Vital Communities
Efficient Government
Healthy Natural Resources



At the same time, the Maine Economic Growth Council was developing perfomance measures and benchmarks for achieving Maine's long term economic goals. This effort complemented the Alliance and Chamber work by measuring and articulating progress towards a similar vision. The Growth Council's report outlines 13 goals for achieving that vision, and describes 57 performance measures and benchmarks to measure progress. The benchmark for Technology Resources states that Maine's rank among the 50 states on technology resources will improve from 43rd in 1995 to 35th by 2005.

Maine's Department of Economic and Community Development (DECD) tied all this work together by describing where the state should focus attention and investment during the coming years. The DECD also identified specific industries to serve as focal points for Maine's job creation efforts. Specific agencies and organizations were charged with developing Action Plans in their areas of expertise to keep the initiative moving forward.

A PLAN FOR SCIENCE AND TECHNOLOGY

In response to its legislative mandate and responsibility under DECD's Economic Development Strategic Outline, the Maine Science and Technology Foundation developed this Action Plan to improve the state's technology resources to achieve an entrepreneurial economy through private and public investments in targeted areas. Critical to the effort is increasing the competitiveness of Maine's manufacturing sector and establishing new emerging-technology business in the state. Building on the 1992 state science and technology plan and the work of our partners, this Action Plan developed with assistance from the Science and Technology Plan Steering Committee and numerous focus group participants.

WHAT NEEDS TO BE DONE

The Maine Science and Technology Action Plan describes 18 actions necessary for moving target sectors forward towards the future. These sectors include: biotechnology, composite materials, software, precision manufacturing, marine science, environmental sciences and technology, telecommunications, and the broad sector of manufacturing. The Plan clearly describes each action, a timetable for implementation, and the impact on the Maine Economic Growth Council's measures. Each step completed moves Maine closer to a brighter future.

A CALL For A Networked Maine

To establish a level playing field and to ensure Maine's place in the global economy, our telecommunications infrastructure must be continuously expanded and upgraded.

ACTIONS

Continue to invest in the creation of, and access to, a 21st century information infrastructure. A key step is for Maine to invest in developing and accessing the next generation of Internet through the University of Maine System (1997).

Challenge every Maine community and every Maine business to establish its own World Wide Web page (1998).

Challenge each Maine school and library to make its information technology resources available to its community by opening its facilities at times in which they traditionally are not used, and to create proactive community outreach programs for nontraditional students to make them aware of the free information technology public resources available and help them to utilize the facilities (1998).

MEGC MEASURES IMPACTED

Innovative Businesses
Skilled and Educated Workers
Vital Communities

A CALL For Improving Input Of Science And Technology In Policymaking

The complexity of science and technology challenges confronting the state requires a competent and accessible source of technical advice.

ACTIONS

Create the Maine Academy of Science and Engineering, modeled after the National Academy of Sciences, to provide technical scientific advice to the Legislature and the Executive Branch upon request. Maine's recent experiences with bioengineered milk products and Reformulated Gasoline would have benefited from such an organization (1997).

Establish a science and technology coordinating committee comprising state agencies to ensure S&T issues are addressed in the broadest possible forum within the Executive Branch (1997).

Establish an ad hoc legislative committee on science and technology to coordinate science and technology input to all policy committees within the Legislature (1998).

MEGC MEASURES IMPACTED

Efficient Government

WHY INVEST IN SCIENCE AND TECHNOLOGY ?

Investments made in science, technology, education and associated forms of infrastructure make Maine citizens partners in a vibrant, balanced economy, and beneficiaries of the significant economic improvements that follow.

Maine residents have always looked to the forests and sea for their livelihoods. Those resources have been, and will remain, essential parts of our economy. But the world and its demand for our products is changing. Bright spots of entrepreneurial innovation and budding technology exist all over Maine, but not in sufficient numbers to move our citizens and state successfully into the future. Maine must explore new ways of adding value to its natural resource assets and capitalize on emerging technology opportunities.

Economic development and the best paying jobs depend upon technology resources. In turn, technology resources depend on higher education and industries willing to innovate and take risks for economic gain. Innovation and risk-taking require a business climate that nurtures such action. Maine can create such a climate, and this Science and Technology Action Plan outlines the strategies and actions necessary for reaching that goal.

Key to this success will be collaboration and cooperation among Maine's industries, its educational institutions, research institutions and state government. The choice is ours to make. Maine can be at the forefront, or lag further behind. The responsibility for action lies with each of us, and the time for that action is NOW. There is an enormous cost if Maine does not seize this best opportunity for investment.

The Challenge

We challenge Maine's leaders and policymakers to move forward with the vision of this plan. The choice is simple and ours to make. There is much to be gained by making choices and investments delineated in the plan.

We challenge Maine's agencies, businesses and individuals to implement the action items and to begin the process collaboratively. The responsibility for action lies with each of us, and the time for that action is now. Each step completed moves Maine closer to a brighter future.

We challenge the people of Maine to organize a Marine Science and Technology Congress and Exposition in the year 2002 to showcase to the world our progress in achieving our vision to make Maine a quality place to live, obtain a quality education and run a profitable business.

ACTION

The Maine Science and Technology Foundation will facilitate implementation of the Maine Science and Technology Plan and work with lead partners to develop and present specific implementation steps, based on the comprehensive audit of Maine's science and technology assets, at a Conference on High Quality Jobs Through Science and Technology (1997).

INVESTMENT STRATEGIES

- Expansion of a publicly supported Maine Technology Capacity Fund as Maine's vehicle for federal R&D opportunities and for seeding private/public research partnerships in key areas.
- Capitalization of the Maine Technology Investment Fund with private sector support.
- Investment in the University of Maine System's research and development infrastructure to support target industries and technology areas.
- A bond issue for capital facilities and equipment for Maine's colleges.

KEY TARGET AREAS

Biotechnology

Composite materials

Software

Precision manufacturing

Marine science

Environmental sciences and technology

Telecommunications

Broad sector of manufacturing

MAINE'S SCIENCE TECHNOLOGY ACTION PLAN

FOR MORE INFORMATION

For more information concerning the State of Maine Science and Technology Action Plan, or to obtain a copy of the detailed Action Plan, please contact:

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Approximately 70 focus group participants

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The Center for Technology Transfer

The Center for Innovation in Biomedical Technology

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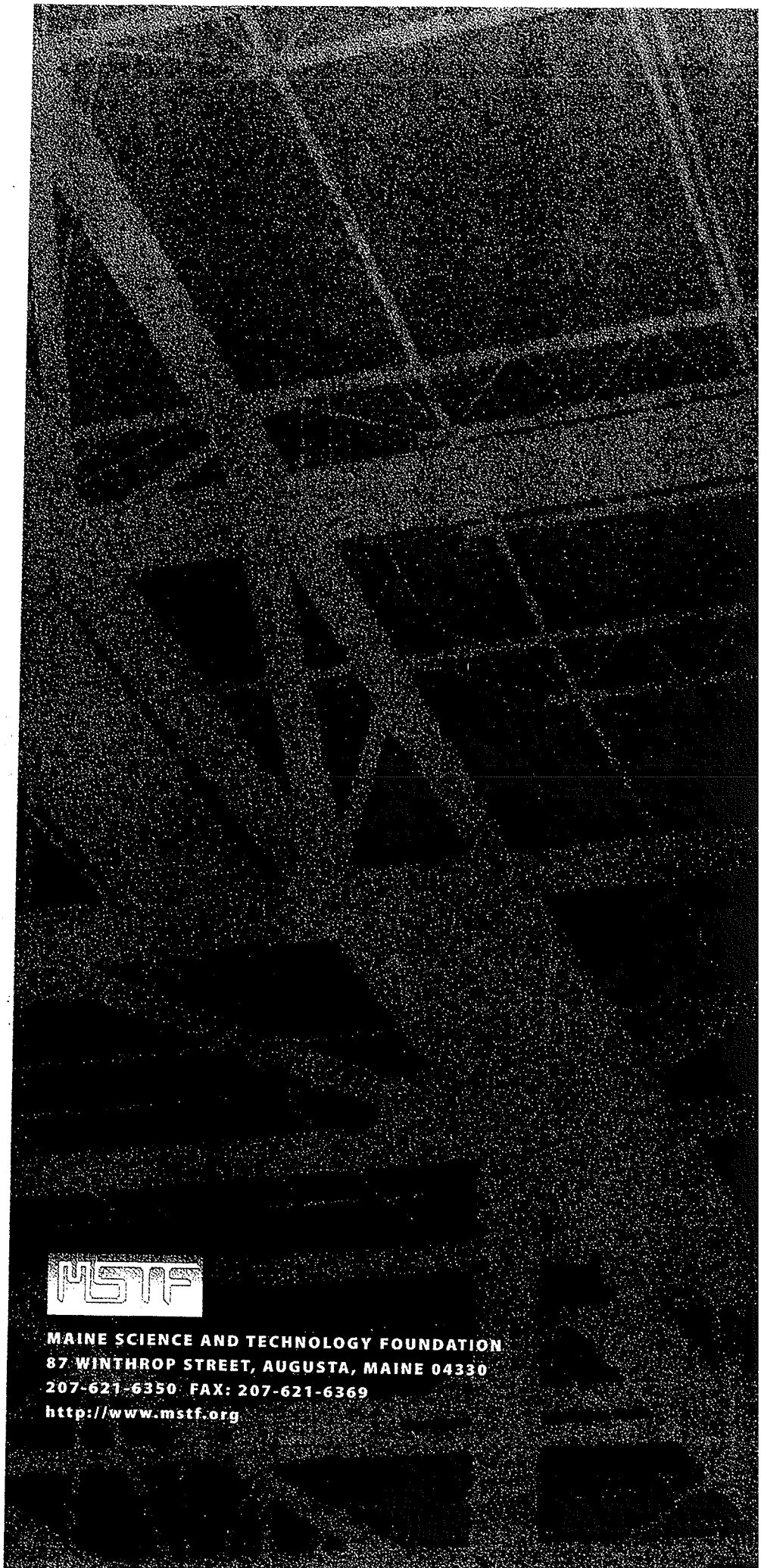

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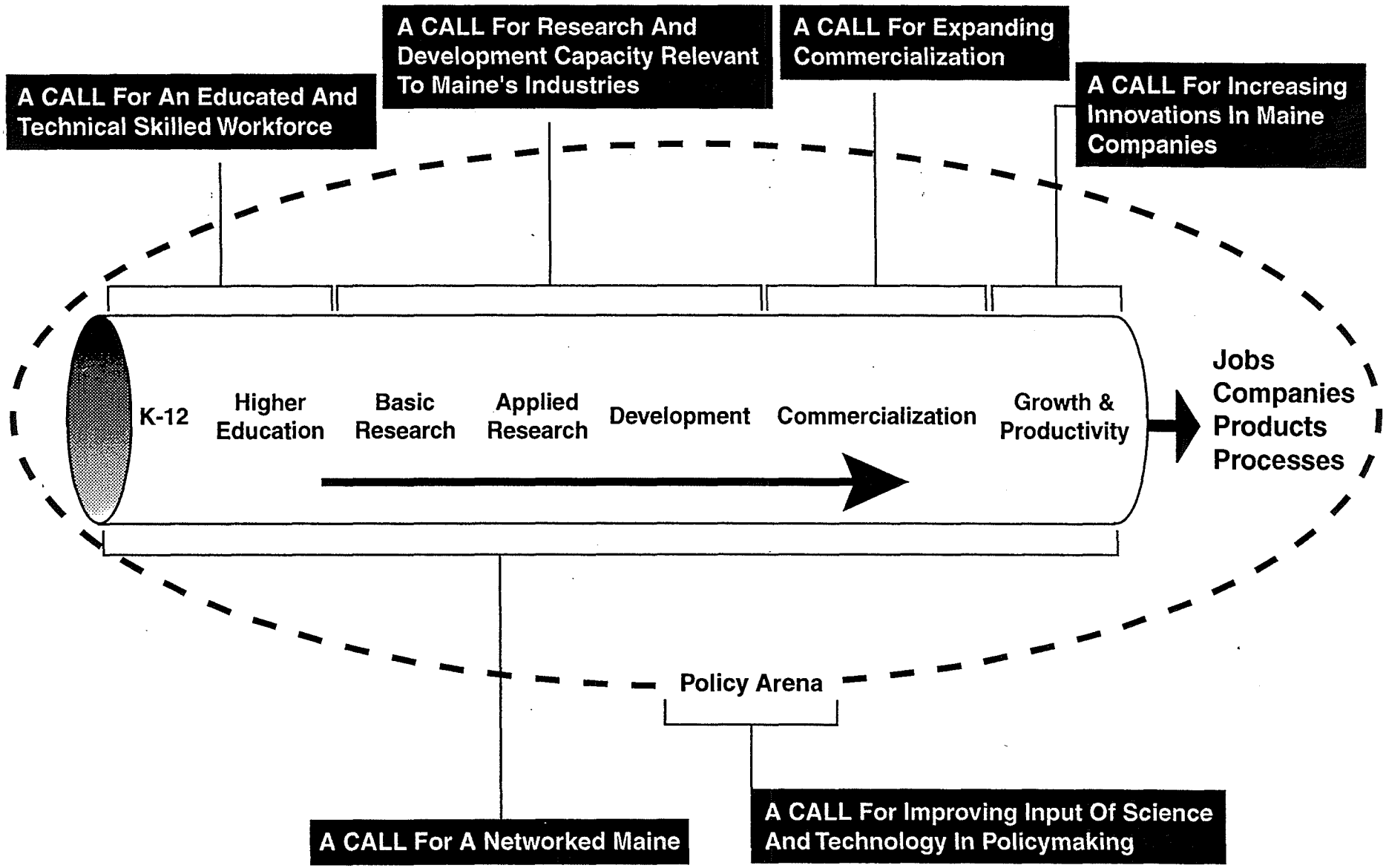
Calls for Action Within the Science & Technology Pipeline



APPENDIX E

Maine Economic Improvement Fund statute
(Public Law 1997 chapter 556)

TITLE 10, Maine Revised Statutes
CHAPTER 107-C
MAINE ECONOMIC IMPROVEMENT FUND

10 § 946. Establishment

The Maine Economic Improvement Fund is established to administer investments in targeted research and development and product innovation and to provide the basic investment necessary to obtain matching funds and competitive grants from private and federal sources.

10 § 947. Definitions

As used in this chapter, unless the context otherwise indicates, the following terms have the following meanings.

1. Fund. "Fund" means the Maine Economic Improvement Fund.

2. Research and development. "Research and development" means applied scientific research and related commercial development conducted by the University of Maine System, its member institutions and its employees and students in the target areas.

3. Target areas. "Target areas" mean the following economic sectors for which applied research and development is considered most likely to produce significant benefits to the people and economy of the State:

A. Aquaculture and marine sciences and technology;
B. Biotechnology;
C. Composite materials engineering;
D. Environmental sciences and technology; and
E. Information sciences and technology.

10 § 948. Administration of fund

The Board of Trustees of the University of Maine System shall administer the fund. The board may utilize the assets of the fund to carry out and effectuate the purposes, duties and responsibilities of this chapter, including, but not limited to:

A. Taking actions in partnership with private enterprise, the Federal Government and private and public research institutions to:

(1) Invest in applied research and development in the target areas within the University of Maine System; and

(2) Support the development of private enterprise based upon research and development performed within the University of Maine System;

B. Receiving money from any public or private source to augment state contributions to the fund;

C. Approving an annual budget for the fund and investing and expending money from within the fund;

D. Contracting with public entities as necessary to further the directives of this section;

E. Carrying forward any unexpended state appropriations into succeeding fiscal years;

F. Providing an annual report to the Governor and the Legislature by January 1st of each regular session of the Legislature setting forth:

(1) The operations and accomplishments of the fund during the fiscal year; and

(2) The assets and liabilities of the fund at the end of its most recent fiscal year; and

G. Protecting all intellectual property in accordance with the "University of Maine System Statement of Policy Governing Patents and Copyrights," including, but not limited to, proprietary information contained in proposals, grants, contracts or other legal agreements. Publication of information may be reasonably delayed until appropriate measures have been taken to protect the intellectual property.

APPENDIX F

Maine Seed Capital Tax Credit Statute

Title 10 of the Maine Revised Statutes
§ 1100-T. Tax credit certificates
(Maine Seed Capital Tax Credit)

1. Legislative findings; authorization. The Legislature finds that the growth of new and existing small businesses in the State results in increased job opportunities for Maine residents, produces more spending in the State and increases municipal tax bases. Businesses that export their products or services out of the State bring capital into the State and help to develop export markets for Maine products. Small new and existing businesses can provide significant economic benefits to the State if they can obtain sufficient seed equity financing to carry them from start-up through the initial development phases of a business. In order to encourage the increased availability of risk equity capital to enterprises that bring capital into the State, the authority is authorized to issue certificates of eligibility for the seed capital investment tax credit permitted by Title 36, section 5216-B, subject to the requirements of this section. This program is known as the Maine Seed Capital Tax Credit Program.

2. Eligibility for tax credit certificate. The authority shall adopt rules in accordance with the Maine Administrative Procedure Act, Title 5, chapter 375, to implement the program. Without limitation, the requirements for eligibility for a tax credit certificate include the following.

A. A tax credit certificate may be issued in an amount not more than 30% of the amount of cash actually invested in a Maine business in any calendar year.

B. The Maine business must be a manufacturer; must provide a product or service that is sold or rendered, or is projected to be sold or rendered, predominantly outside of the State; or must bring capital into the State, as determined by the authority.

C. Aggregate investment eligible for tax credits may not be more than $600,000 for any one business as of the date of issuance of a tax credit certificate.

D. The investment with respect to which any individual is applying for a tax credit certificate may not be more than an aggregate of $100,000 in any one business in any 3 consecutive calendar years, except that this paragraph does not limit other investment by any applicant for which that applicant is not applying for a tax credit certificate.

E. The business receiving the investment must have annual gross sales of $2,000,000 or less and the operation of the business must be the full-time professional activity of the principal owner, as determined by the authority. The principal owner and the principal owner's spouse are not eligible for a credit for investment in that business. A tax credit certificate may not be issued to a parent, brother, sister or child of a principal owner if the parent, brother, sister or child has any existing ownership interest in the business.

F. The investment must be expended on plant, equipment, research and development, or working capital for the business or such other business activity as may be approved by the authority.

G. The authority shall establish limits on repayment of the investment. The investment must be at risk in the business.

H. The investors qualifying for the credit must collectively own less than 1/2 of the business.

2-A. Eligibility of private venture capital funds for tax credit certificate. The authority shall adopt rules in accordance with the Maine Administrative Procedure Act to implement application of the program to investment in a private venture capital fund. Without limitation, the requirements for eligibility for a tax credit certificate for investment in a private venture capital fund include the following.

A. A tax credit certificate may be issued in an amount not more than 30% of the amount of cash actually invested in a private venture capital fund in any calendar year.

B. Each state business in which the private venture capital fund invests must be a manufacturer; must provide a service that is sold or rendered, or is projected to be sold or rendered, predominantly outside of the State; or must bring capital into the State, as determined by the authority.

C. Aggregate investment eligible for tax credits may not be more than $600,000 for any one private venture capital fund as of the date of issuance of a tax credit certificate.

D. The investment with respect to which any individual is applying for a tax credit certificate may not be more than an aggregate of $100,000 in any one private venture capital fund in any 3 consecutive calendar years, except that this paragraph does not limit other investment by any applicant for which that applicant is not applying for a tax credit certificate.

E. Each business receiving an investment from a private venture capital fund must have annual gross sales of $2,000,000 or less and the operation of the business must be the full-time professional activity of the principal owner, as determined by the authority. The principal owner and principal owner's spouse are not eligible for a credit for investment in that business or the private venture capital fund. A tax credit certificate may not be issued to a parent, brother, sister or child of a principal owner if the parent, brother, sister or child has any existing ownership interest in the business.

F. Each investment received by a business from a private venture capital fund must be expended on plant maintenance and construction, equipment, research and development or working capital for the business or on such other business activity as may be approved by the authority.

G. The authority shall establish limits on repayment of the investment by an individual in and the investments made by a private venture capital fund. The investments must be at risk in the private venture capital fund and the business, respectively.

H. The investors qualifying for the credit must collectively own less than 1/2 of the private venture capital fund and less than 1/2 of any business in which an investment is made by the private venture capital fund.

3. Priority. The authority may reserve $500,000 in tax credit authorization for "natural resource enterprises," as defined in section 963-A, subsection 41.

4. Total of credits authorized. The authority may issue tax credit certificates to investors eligible pursuant to subsection 2 in an aggregate amount not to exceed $2,000,000 up to and including calendar year 1996, $3,000,000 up to and including calendar year 1997, $4,000,000 up to and including calendar year 1998, $5,000,000 up to and including calendar year 1999, $6,000,000 up to and including calendar year 2000, and not to exceed $7,000,000 thereafter. In addition, the authority may issue tax credit certificates to investors eligible pursuant to subsection 2-A in an aggregate amount not to exceed $1,000,000.

5. Revocation of tax credit certificate. The authority may revoke a tax credit certificate if any representation to the authority in connection with the application for the certificate proves to have been false when made or if the applicant violates any conditions established by the authority and stated in the tax credit certificate. The revocation may be in full or in part as the authority may determine. The authority shall specify the amount of credit being revoked and shall send notice of the revocation to the investor and to the State Tax Assessor.

Title 36 of the Maine Revised Statutes
§ 5216-B. Seed capital investment tax credit

1. Definitions. As used in this section, unless the context indicates otherwise, the following terms have the following meanings.

A. "Certificate" means a tax credit certificate issued by the Finance Authority of Maine pursuant to Title 10, chapter 110, subchapter IX.

B. "Investment" means an investment for which a certificate has been received.

C. "Investor" means a taxpayer who has received a certificate.

2. Credit. An investor shall be entitled to a credit against the tax otherwise due under this Part equal to 30% of the amount of the investment. In the case of partnerships and nontaxable trusts, the individual partners or beneficiaries shall be treated as the investors under this section and shall be allowed a credit against the tax otherwise due from them under this Part in proportion to their respective interests in those partnerships or trusts. Except as limited or authorized by subsection 3 or 4, 50% of the credit shall be taken in the taxable year the investment is made and 50% in the next taxable year.

3. Limitation. The amount of the credit allowed under this section for any one taxable year shall not exceed 50% of the tax imposed by this Part on the investor for the taxable year before application of the credit.

4. Carry forward. Credits not taken because of the limitation in subsection 3 shall be taken in the next taxable year in which the credit may be taken, provided that the limitation of subsection 3 shall also apply to the carry-forward years. In no case may this carry-forward period exceed 15 years.

5. Recapture. In the event that the Finance Authority of Maine revokes a certificate, there shall be added to the tax imposed on the investor under this Part for the taxable year in which the revocation occurs an amount equal to the excess of the amount of credit revoked over the amount of credit not yet taken.

APPENDIX G

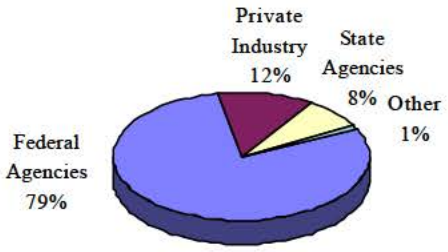
Target-Technology Research at the
University of Maine System
and Non-profit Research Organizations

Appendix G

Academic Sector (public universities)

The University of Maine System has over 240 active researchers, over $20 million in major research equipment and 280,000 square feet of dedicated research laboratory space. In fiscal year 1997, the university system received $23 million in R&D funding. 79% came from the federal government.

University R&D Funding by Source
$23,000,000 FY97



University of Maine

The University of Maine (UM) in Orono is Maine's land-grant and sea-grant institution, and is the University of Mainecampus with primary responsibility for research and doctoral education in the science and technology fields.

Research and development are conducted at UM in the target technology areas identified as key to economic development in the state: advanced materials engineering and development, marine biotechnology, software engineering and development, and advanced technologies for forestry and agriculture.

Advanced Materials Engineering and Development:

UM currently has 4 working groups involved in the area of advanced materials engineering and development. UM's goal for this target area is to develop a comprehensive R&D program focused on emerging opportunities for Maine's composites, wood products, and semiconductor manufacturing industries and on creating new opportunities in biomaterials development.

The Composite Reinforced Wood Working Group is composed of 7 researchers from several departments at the university. Two new composites specialists will be hired in 1998 as part of a National Science Foundation EPSCoR

award. The researchers have shown that composite reinforced wood (CRW) is stronger, more durable, more environmentally friendly and more cost effective than traditional construction materials for many structural applications.

- UM is a national leader in CRW technology and has attracted research grants totaling $8 million in recent years.
- UM is constructing a $4.1 million facility to house its CRW research activities, including materials processing and characterization, and testing of full-scale structural elements.
- Industry partners include Brunswick Technologies, Inc., Dupont, North End Composites, Morrison Molded Fiberglass, Georgia Pacific, Inc., the SPI Composites Institute, and the APA Engineered Wood Association.
- New products on the horizon include composite-reinforced oriented strand board for building construction and composite-reinforced I-joist (a flooring support) that will use Maine's under-utilized wood species.

The Composite Materials Working Group is composed of 3 researchers from the Department of Mechanical Engineering.

- UM provides research and engineering support, including design and mechanical testing, for numerous Maine companies through research contracts and student design courses.
- Industry partners include Brunswick Technologies, Inc., North End Composites, Inc., Aegis Bicycles, Inc., and Bath Iron Works.
- UM researchers and students are assisting in the design and optimization of a composite aeroshell for NASA's X-38 crew return vehicle, which will replace the Russian SOYUZ capsule.
- Federal sponsors of UM's research in the use of engineered composites for structural applications include the US Office of Naval Research and the national Aeronautic and Space Administration.

The Semiconducting Materials Working Group is composed of 3 researchers from different departments working in the Laboratory for Surface Science and Technology. Research into new materials and advances in manufacturing processes for the semiconductor industry is conducted in the field of nanotechnology -- the study of materials interactions at an atomic scale and the development of atomic scale devices.

- UM research in the field of nanotechnology is focused on development of semiconducting oxide films for miniature sensor devices, coatings on optical storage media and bipolar transistor devices.
- Industry partners include BIODE, Inc., Fairchild Semiconductor, First Light Technologies, and Sensor Research and Development Corporation.

- Over the past decade, UM has used state, federal and industrial funds to establish a well-equipped facility for the synthesis, analysis, and processing of surfaces, interfaces, thin films, and electronic devices.
- Federal funding has come from the National Science Foundation and the US Department of Energy.

The BioMaterials Working Group is composed of 4 researchers from different departments working to develop engineered biomaterials and bio-surfaces for medical and sensor applications.

- UM has a state-of-the-art facility that currently specializes in thin film technology, sensor development and microtribology.
- Industry partners include IBM, Dupont, Champion International, Wastec International, BIODE, Inc., Sensor Research and Development Corporation, Control Devices, First Light Technologies and Fairchild Semiconductor.
- In partnership with BIODE, UM researchers have developed a biosensor to detect antibodies for use in medical diagnostics. That product is being marketed by BIODE.
- Federal supporters currently include the National Science Foundation the National Institute of Health, NASA, the US Department of Energy, and the US Department of Defense.

Marine Biotechnology:

UM currently has 3 working groups involved in the area of marine biotechnology. UM's goal for this target area is to develop R&D capacity in marine biotechnology focused on Maine's marine aquaculture, commercial fishing and emerging marine products industries.

The Genetics Working Group is composed of 3 researchers from the School of Marine Sciences who conduct genetic research for fisheries and aquaculture. A new fish geneticist will be hired in 1998 as part of a National Science Foundation EPSCoR project.

- UM researchers are developing genetic maps of commercial species of interest. Within the next few years they should be able to identify specific genes that control desired characteristics in these organisms and consequently develop either selective breeding programs or transgenic methods for improving broodstock.
- UM faculty and students are using genetic studies in an effort to determine why the population of Atlantic haddock in the Georges Bank region of the Gulf of Maine fluctuates so dramatically.

- The National Science Foundation and the Sea Grant program fund UM's fish genetics research.

The Disease Working Group is composed of 6 researchers from different departments. A new marine microbiologist will be hired in 1998 as part of a National Science Foundation EPSCoR project. These scientists conduct strategic research on native and introduced diseases of cultured marine plants and animals for purposes of disease diagnosis and control.

- UM scientists have developed fast and cost-effective diagnostic tests for several fish viruses. UM hopes to commercialize these products, which have been tested and accepted by fish disease specialists worldwide.
- In 1995, UM researchers identified a treatment that would prevent sea lice from spreading and devastating Maine's salmon farms. Applications to salmon pens in Cobscook and Passamaquoddy Bays were more than 80% effective.
- UM researchers developed a medicated lobster feed and feeding procedure to control Gaffkemia (Red Tail), which is a fatal bacterial infection. The medicine is now used routinely by lobster pound owners throughout Maine, and is protecting the industry from significant losses.
- The National Science Foundation, USDA and the Sea Grant program support this research.

The Physiology and Biochemistry Working Group is composed of 6 researchers from different departments conducting physiological and biochemical research on marine organisms for the development of new marine products.

- UM has special facilities for marine physiological and biochemical research, including the Darling Marine Center, an electron microscope laboratory, computing facilities, cell culture facilities and equipment.
- UM researchers and Sea Run Holdings, Inc. are examining the potential of salmon Sera (a waste product) to be used as a sterile culture medium.
- UM researchers conducted pioneering research on natural compounds that appear to protect red seaweeds from ultraviolet light.
- The National Science Foundation and the Sea Grant program fund UM's marine physiological and biochemical research efforts.

<u>Software Engineering and Development:</u>

UM currently has 3 working groups involved in the area of software engineering and development. UM's goal for this target area is to establish an Institute for Software Engineering and Development focused on research and training activities for the advancement of Maine's software development and software intensive industries.

The User-Interface Working Group is composed of 6 researchers from different departments working to develop new user interfaces for computer software products.

- UM faculty and students have developed a computer software product that allows people to sort through large, computer-based archives of maps and aerial photographs and to select materials of interest just by sketching the desired characteristics with a pen.
- Federal sponsors of research and development in this area include the National science Foundation and the US Department of Defense.

The Intelligent Systems Working Group is composed of 6 researchers from different departments working to develop "intelligent" computer systems for use in manufacturing industries.

- UM faculty and students are working with several Maine companies to design and apply intelligent computer systems to different types of manufacturing processes.
- Industry partners include S.D. Warren, Champion International, Control Devices, Acorn, Dexter Shoe, Sonoco Products and Central Maine Power.
- Federal funding comes primarily from the US Department of Energy.

The Biomedical Software Systems Working Group is composed of 6 researchers from different departments working to develop sophisticated computer software systems for biomedical applications.

- UM researchers are developing a genome spatial information system, and are working together with colleagues at the Jackson Laboratory on a chromosome diagnostic system.
- UM researchers expect to develop marketable products for the biomedical industry, including software for automated pattern recognition and for matching genetic material from different species.
- The National Science Foundation and the US Department of Energy fund this research activity.

<u>Advanced Technologies for Forestry and Agriculture:</u>

UM currently has 4 working groups involved in the area of advanced technologies for forestry and agriculture. UM's goal for this target area is to strengthen Maine's ability to develop and apply advanced technologies in biological, environmental, information and manufacturing science and engineering to address the needs of Maine's agriculture, forestry and related manufacturing sectors.

The Crop Productivity Working Group is composed of 6 researchers from the Department of Applied Ecology and Environmental Sciences and the Department of Biological Sciences developing advanced technologies for increasing crop productivity with minimal environmental impact.

- UM scientists are currently developing ways to use biologically produced chemicals to replace tradition chemical pesticides. This technology is attracting global attention because it poses little risk to human health or to the environment, while contributing significantly to food and fiber production.
- UM researchers are using biotechnology to determine how agricultural crops respond to insect damage and mechanical injury. They are developing genetic improvement strategies to solve these problems.
- UM researchers are studying the genetics of potato viruses to explain variations in the degree of virulence of different strains. These studies will allow genetic engineering of virus resistant potatoes.

The Forest Productivity Working Group is composed of 10 researchers from different departments working to develop new technologies to sustain and improve the productivity of Maine's forests.

- Researchers are studying the effects of harvest practices on genetic variation in growth rate and stress resistance of red spruce and balsam fir to address an apparent decline in the area and productivity of the spruce-fir forest.
- The impact of man-made and natural disturbances on forest productivity is being evaluated with support from the Nature Conservancy.
- The forest genetics program is developing fast-growing larch hybrids that are the fastest growing conifers in the state.

The Remote Sensing Working Group is composed of 5 researchers from different departments working to develop advanced remote sensing technologies for use in forest and marine resource management.

- From 1988 to 1991, UM collaborated with NASA and the James W. Sewall Co. on a project that facilitated development of marketable remote sensing products and services.
- UM researchers are currently working in International Paper company's Northern Experimental Forest to study new sensors for the forest industry.
- UM researchers are applying remote sensing tools to produce coastal and marine resource maps for the Gulf of Maine.

The Value-Added Products Working Group is composed of 8 researchers from different departments working in the area of natural resource-based value-added product and process development.

- UM researchers are developing environmentally sound processes for the manufacture of high-quality, internationally competitive paper products from fiber supplies of increasingly lower quality.
- UM researchers are developing new food processing techniques such as flash freezing of shellfish to improve shelf-life, freeze-drying of blueberries and other small fruits for use in commercially marketed mixes, and “extruded” potato products for the snack food industry.
- UM researchers are using chemical, x-ray and acoustic analysis to assess and improve the structural integrity of wood products.

University of Southern Maine

The University of Southern Maine (USM) has developed programs in the target areas of biotechnology, engineering and information technology. Much of USM's research role has emerged in response to growing demands for research-based industrial support and technically trained personnel in southern Maine.

Biotechnology:

USM's Graduate Program in Applied Immunology was established in response to the needs of the biotechnology industry, and is part of a partnership between the university and industry. The program, housed in the Foundation for Blood Research in Scarborough, has 4 faculty, 31 adjunct faculty and instructors from private biotechnology firms and laboratories, and 40 students. The program maintains close collaborative relationships with the biotechnology industry and public agencies. Faculty in the program are a recognized source of research and continuing education support for the biotechnology industry, and students in the program have the opportunity to interact with scientists through internships and thesis projects.

USM has received an EPSCoR grant to develop its molecular biology infrastructure. The biotechnology program initiative will enable USM to build new laboratory facilities on the Portland campus and attract new faculty.

Engineering:

USM's Electrical Engineering Department was established in 1988 with support from industry. The department, housed on the Gorham campus, has 6 faculty and 93 students. The department maintains an important partnership with National Semiconductor and Fairchild Semiconductor. Many students in the department are employed at National and Fairchild, and many go to work there after graduation. National has also established a faculty summer internship for department faculty. Both companies are helping to develop a new microfabrication lab within the department and have donated equipment to the program. The department works extensively with National and Fairchild engineers in the simulation of semiconductor properties and operations.

The Department of Engineering is also collaborating with the Old Orchard Beach school system and the Southern Maine Partnership through a federal grant to create an interactive Web site that will share information on the most effective ways to evaluate student performance.

USM's Department of Technology has 7 faculty, 1 adjunct faculty and 294 majors. Students from this department are also employed at National and Fairchild. Many Maine industries depend on the department's Product Testing Laboratory to verify the safety and reliability of the products they manufacture.

Information Sciences and Technology:

USM's Computer Science Department, housed on the Portland campus, has 6 faculty, 2 adjunct faculty and 155 majors. The department works with local industries to address their needs, and has recently been working with the Software developers Association to address work force shortages. The department promotes applied research initiatives with private industry that address specific R&D areas. For example, a professor recently conducted projects with IDEXX and Cleversoft which involved graduate students in the development of software for automated testing and monitoring performance of client/server systems. Another professor created the Maine Economic Development Network to link small business development centers and six economic development districts with instant on-line access to economic databases.

Non-Profit Sector

There are 5 major non-profit research institutions in the state: Bigelow Laboratory for Ocean Sciences, the Foundation for Blood Research, the Jackson Laboratory, Maine Medical Center Research Institute, and Mount Desert Island Biological Laboratory. These institutions have been successful in bringing federal grant money in to the state to support research. They have also formed long-term partnerships with the university system, and in many cases, with industry.

Bigelow Laboratory for Ocean Sciences

Areas of Research:

Bigelow Laboratory for Ocean Sciences, located in West Boothbay Harbor, is an internationally renown private non-profit research laboratory. Research on the biology of the ocean focuses on the sea as a unit. Home to the Provasoli-Guillard National Center for Culture of Marine Phytoplankton, Bigelow has the world's largest collection of phytoplankton strains and species available for study. Its work in this area has been extremely helpful to Maine's aquaculture industry and to combating harmful algae blooms. At its J.J. MacIsaac Facility for Individual Particle Analysis, Bigelow scientists use a flow cytometer to analyze new species of phytoplankton and adapt them to possible biomedical and other biotechnology uses.

Bigelow scientists also work all over the world to investigate critical global and regional environmental issues. Projects include:

- ◊ studies on the early life stages of herring, cod and lobster;
- ◊ red tide toxicology and ecology;
- ◊ acid rain;
- ◊ pollution of the sea floor;
- ◊ sea level rise;
- ◊ cloud formation; and
- ◊ ozone depletion.

Bigelow formed a partnership with the University of New England (UNE) in 1994 to collaborate in producing a distinguished marine sciences curriculum. As part of the affiliation, Bigelow staff teach at UNE, Bigelow hosts UNE interns, and Bigelow scientists collaborate with UNE professors on research projects.

Employees and Budget:

Bigelow is home to 15 scientists and a total of 50 staff. In 1996, Bigelow's operating budget was about $3.2 million. Federal grants support most of its basic operation and administration needs. Major sources of research funding are the National Science Foundation, the Office of Naval Research, the National Oceanographic and Atmospheric Administration, and the National Aeronautics and Space administration. In 1996 Bigelow scientists brought into Maine about $2.6 million in federal research funds.

The Foundation for Blood Research

Areas of Research:

The Foundation for Blood Research (FBR), located in Scarborough, is a non-profit medical research and education institute. Research is conducted in the areas of immunology, immunochemistry, genetics and preventive medicine, with the goal of developing new and important clinical applications. FBR also provides clinical services for rheumatic disease, prenatal screening, molecular genetics and general genetic services

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Programs at the Foundation for Blood Research:

- ⇒ **Rheumatic Disease Laboratory**: conducting clinical research and testing in autoimmune diseases such as arthritis and lupus, and testing for cancer and infectious diseases
- ⇒ **Prenatal Screening Laboratory**: providing specialized prenatal screening for such conditions as Down Syndrome and spina bifida
- ⇒ **Molecular Genetics Laboratory**: performing DNA testing and research
- ⇒ **Southern Maine Regional Genetics Clinic**: providing clinical services and genetic counseling
- ⇒ **Biometry**: conducting statistical and data analysis for research design

FBR's science education program has been developed to respond to perceived needs in Maine and elsewhere. FBR has built its education program upon the specialized scientific expertise and resources available among its staff, and as part of the program it hosts conferences, sabbaticals and internships for students, scientists and providers. FBR conducts science education programs for students and high school

biology teachers, and has collected and recycled $2 million worth of lab equipment for donation to high school labs.

Employees and Budget:

FBR has a staff of 65, including 41 scientists and technicians. It has an operating budget of about $4.7 million. It is funded primarily by fees for clinical and consulting services, grants and private donations. Last year, FBR scientists brought into Maine about $4.5 million in federal and private grants and contracts.

The Jackson Laboratory

Areas of Research:

Jackson Laboratory, located in Bar Harbor, is an independent, non-profit research institution specializing in the study of genetics. Research is focused in eight major areas: cancer, bioinformatics and computational biology; developmental biology; immunology / hematology; metabolic diseases; neurobiology and sensory deficits; genomics; and resource-related research.

The 3 Missions of The Jackson Laboratory:

⇒ Conducting basic biomedical research
⇒ Training and education of scientists worldwide
⇒ Providing genetic resources to the global scientific community

The Jackson Laboratory also is a provider of genetically standardized and mutant mice and mouse DNA. Laboratory scientists routinely use mouse models to support research programs in a wide array of disease areas.

Employees and Budget:

The Jackson Laboratory is home to over 30 Principal Investigators conducting research within the scope of mammalian genetics. The Lab employs a total of about 830 people, including 111 scientists and technicians.

The Lab's operating budget last year was about $48 million, including a research budget of about $23 million. The research carried out at the Laboratory is funded by federal grants and private funding earned by each Principal Investigator. Last year, the Laboratory collected about $24 million in private grants.

The Maine Medical Center Research Institute

Areas of Research:

The Maine Medical Center Research Institute (MMCRI), located in Portland, is the research and development facility of the Maine Medical Center. MMCRI houses research and development capabilities in both basic and applied biomedical research and specializes in the biomedical application of molecular and cellular analysis. Its on-site facilities include a 600 square foot animal care facility that can house approximately 1,500 mice and is equipped with laminar air flow cages; three sterile tissue culture rooms with laminar flow hoods, incubators and microscopes; and the hospital's immunogenetics laboratory.

Employees and Budget:

MMCRI employs about 100 scientists and technologists. It currently receives grant support from the National Institutes for Health, the Leukemia Society of America, the Davis Family Foundation, the Davenport Foundation, Maine Medical Center Annual Fund, and the Maine Cancer Research and Education Foundation. It receives about $6 million in funding.

Mt. Desert Island Biological Laboratory

Areas of Research:

Mt. Desert Island Biological Laboratory (MDIBL), located in Salsbury Cove, is a non-profit marine research institution. It is the largest cold water research facility in the eastern United States, and is world renown as a center for investigation in electrolyte and transport physiology, developmental biology and electrophysiology.

Employees and Budget:

MDIBL employs 8 people full time. On a seasonal basis, about 50 scientists come from around the world to bring their research to the lab. Research at MDIBL brings in about $1,000,000 in federal and private grants.

Gulf of Maine Aquarium

The Gulf of Maine Aquarium has a threefold mission: to teach Maine residents and visitors about the Gulf of Maine and its watershed; to support research regarding Maine's fresh and saltwater environments; and to provide a

neutral forum for discussion and debate regarding management of Maine's aquatic resources. GMA is currently seeking a mix of public and charitable funding to develop a collaborative marine research laboratory that would provide space to Maine's non-profit research institutions, Maine's public marine research institutions and qualified private marine biotechnology companies to encourage cross-fertilization and collaboration. The lab will be designed so that occupants can share reception space, office equipment conference rooms, specialized lab resources and overhead expenses, yet control their own proprietary lab and office space. A public exhibit gallery and reception area will be designed to exhibit on -site and off-site research underway by lab occupants and engage visitors with Maine's marine research challenges and research community.

Current activities of the Gulf of Maine Aquarium include initiation of a prototype applied fishery research program by convening Gulf of Maine herring interests to develop and implement a joint industry / science / management research strategy. The project is 50% funded by voluntary herring industry contributions. GMA has also developed a nationally recognized marine education program with funding from NASA, using the Internet and other digital technology to make programs accessible to students throughout the state.

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APPENDIX H

Proposed Legislation from the
Joint Select Committee on Research and Development

DRAFT LEGISLATION
Proposed by the Joint Select Committee on Research and Development

Relevant to the Maine Economy

Be it enacted by the People of the State of Maine as follows:

. 10 MRSA §949 is enacted to read:

The Board of Trustees shall take all actions necessary to obtain revenue from

from research or joint ventures funded by the Fund and to ensure that those revenues replace General Fund appropriations by June 30, 2003.

The following amount is appropriated from the General Fund for the following purpose:

1998-99

Maine Economic Improvement Fund

Provides funds for the first year of a 5-year
General Fund funding strategy for the Maine Economic

with Title 5, chapter 107-C to fund
applied scientific research and related

the University of Maine system, its members
institutions and its employees and students

SUMMARY

This bill appropriates $10 million to the Maine Economic Improvement Fund requires the Board of Trustees to take all actions necessary to replace General Fund dollars with other sources of revenue such as royalties by June 30, 2003.

DRAFT LEGISLATION
Joint Select Committee on Research and Development

An Act to Authorize a General Fund Bond Issue in the Amount of $20 Million to Stimulate the Maine Economy through Research and Development

Be it enacted by the People of the State of Maine as follows:

PART A

(Bond boilerplate language is excluded from this draft)

Sec. 1. Authorization. The Treasurer of State is authorized, under the direction of the Governor, to issue bonds in the name and on behalf of the State in an amount not exceeding $20 million to raise funds for capital expenditures to support applied research and development in biotechnology, aquaculture and marine sciences, information technologies, advanced materials and advanced technologies for forestry and agriculture, as authorized in section 6.

Sec. 3. Sale; how negotiated; proceeds appropriated. ...
The proceeds of the sale of the bonds, which must be held by the Treasurer of State and paid by the Treasurer of State upon warrants drawn by the State Controller, are appropriated solely for the purposes set forth in this Act. Proceeds may be released to the University of Maine System only upon receipt by the Treasurer of State of evidence satisfactory to the Treasurer that the University of Maine System has complied with any requirement to establish and fund a maintenance account for office, laboratory or other building space to be constructed or renovated with the proceeds. .....

Sec. 6. Allocations. The proceeds of the sale of bonds must be expended as designated in the following schedule:

UNIVERSITY OF MAINE SYSTEM

For capital improvements and equipment purchases to support research and development in marine biotechnology, software engineering and development, advanced technologies for forestry and agriculture, biotechnology and advanced materials engineering and development	**$13,500,000**

DRAFT LEGISLATION
Proposed by the Joint Select Committee on Research and Development

Relevant to the Maine Economy

Be it enacted by the People of the State of Maine as follows:

. 10 MRSA §949 is enacted to read:

The Board of Trustees shall take all actions necessary to obtain revenue from

from research or joint ventures funded by the Fund and to ensure that those revenues replace General Fund appropriations by June 30, 2003.

The following amount is appropriated from the General Fund for the following purpose:

1998-99

Maine Economic Improvement Fund

Provides funds for the first year of a 5-year
General Fund funding strategy for the Maine Economic

with Title 5, chapter 107-C to fund
applied scientific research and related

the University of Maine system, its members
institutions and its employees and students

SUMMARY

This bill appropriates $10 million to the Maine Economic Improvement Fund requires the Board of Trustees to take all actions necessary to replace General Fund dollars with other sources of revenue such as royalties by June 30, 2003.

MAINE SCIENCE & TECHNOLOGY FOUNDATION

For a Marine Technology Fund to provide funds to enhance Internet connections among public and private educational institutions conducting marine research and non-profit marine research institutions ($1 million) and to provide funds to enhance research and education capability in those institutions ($2 million)	$3,000,000
For a Research Challenge Grants Program to provide funds for research institutions in the for-profit, non-profit and academic sectors to enhance research and development capacity and productivity	$1,500,000

DEPARTMENT OF ECONOMIC AND COMMUNITY DEVELOPMENT

To pay a portion of design and construction costs for the Gulf of Maine Aquarium Research Facility	$2,000,000

Sec. 10. Referendum question:

... voting on the following question:

Do you favor a $20 million bond issue to improve the Maine economy by supporting innovative research and development by businesses, and non-profit and educational institutions in the fields of biotechnology, computers and other information technology, aquaculture and marine technology, forestry and agriculture and advanced materials?

PART B

Sec. B-1. 20-A MRSA §10904-A is enacted to read:

§10904-A. Maintenance Fund

The treasurer of the university shall establish and maintain a fund for maintenance of building space constructed with proceeds of any bond issued pursuant to an Act that requires such an account. The board of trustees shall acquire sufficient private and other non-General Fund contributions to maintain the space for the expected duration of its use.

Sec. B-2. Contingent effectiveness. This Part takes effect only if Part A takes effect.

SUMMARY

This bill proposes a $20 million bond issue to fund a variety of programs designed to improve the Maine economy through research and development relevant to biotechnology, aquaculture and marine sciences, information technologies, advanced materials engineering and advanced technologies for forestry and agriculture. It proposes to require the University of Maine system to establish, fund and maintain an account for maintenance of building space renovated or constructed with the proceeds of the bond. It also prohibits the Treasurer from releasing bond proceeds to the University of Maine system until they provide evidence of sufficient funds in the account.

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DRAFT JOINT ORDER

On motion by Senator _____ , the following Joint Order:

ORDERED, the House concurring, that the Joint Select Committee on Science and Technology is established as follows.

1. Establishment. The Joint Select Committee on Science and Technology, referred to in this order at the "committee," is established.

2. Membership. The presiding officers in each chamber shall appoint the members no later than 15 days following the effective date of this order. The members must include at least one member from each of the following joint standing committees: the Joint Standing Committee on Agriculture, Conservation and Forestry; the Joint Standing Committee on Appropriations and Financial Affairs; the Joint Standing Committee on Business and Economic Development; the Joint Standing Committee on Education and Cultural Affairs; the Joint Standing Committee on Marine Resources; the Joint Standing Committee on Natural Resources; and the Joint Standing Committee on Taxation.

3. Responsibilities. The responsibilities of the committee include the following:

A. To review proposed legislation relating to science and technology;

B. To conduct oversight and review of the State's science and technology plans and policies and to make recommendations to the Legislature on appropriate actions to promote science and technology in the State, including appropriate funding levels; and

C. To perform other tasks assigned to it, including conducting studies on assigned topics and issuing reports to the Legislature on policy issues related to science and technology.

DRAFT LEGISLATION
Submitted by the Joint Select Committee on Research and Development pursuant to Joint Order (S.P. 669)

Title: An Act to Expand the Maine Seed Capital Tax Credit Program

Be it enacted by the People of the State of Maine as follows:

Sec. 1. 10 MRSA §1100-T, sub-§2 is amended to read:

2. Eligibility for tax credit certificate. The authority shall adopt rules in accordance with the Maine Administrative Procedure Act, Title 5, chapter 375, to implement the program. Without limitation, the requirements for eligibility for a tax credit certificate include the following.

A. A tax credit certificate may be issued in an amount not more than 30% of the amount of cash actually invested in a Maine business in any calendar year.

B. The Maine business must be a manufacturer; must provide a product or service that is sold or rendered, or is projected to be sold or rendered, predominantly outside of the State; or must bring capital into the State, as determined by the authority.

C. Aggregate investment eligible for tax credits may not be more than ~~$600,000~~ $1,000,000 for any one business as of the date of issuance of a tax credit certificate.

D. The investment with respect to which any individual is applying for a tax credit certificate may not be more than an aggregate of ~~$100,000~~ $200,000 in any one business in any 3 consecutive calendar years, except that this paragraph does not limit other investment by any applicant for which that applicant is not applying for a tax credit certificate.

E. The business receiving the investment must have annual gross sales of ~~$2,000,000~~ $3,000,000 or less and the operation of the business must be the full-time professional activity of the principal owner, as determined by the authority. The principal owner and the principal owner's spouse are not eligible for a credit for investment in that business. A tax credit certificate may not be issued to a parent, brother, sister or child of a principal owner if the parent, brother, sister or child has any existing ownership interest in the business.

F. The investment must be expended on plant, equipment, research and development, or working capital for the business or such other business activity as may be approved by the authority.

G. The authority shall establish limits on repayment of the investment. The investment must be at risk in the business.

H. The investors qualifying for the credit must collectively own less than 1/2 of the business.

Sec. 2. 10 MRSA §1100-T, sub-§4 is amended to read:

4. Total of credits authorized. The authority may issue tax credit certificates to investors eligible pursuant to subsection 2 in an aggregate amount not to exceed $2,000,000 up to and including calendar year 1996, $3,000,000 up to and including calendar year 1997, ~~$4,000,000~~ $5,500,000 up to and including calendar year 1998, ~~$5,000,000 up to and including calendar year 1999, $6,000,000 up to and including calendar year 2000,~~ and not to exceed $7,000,000 thereafter. In addition, the authority may issue tax credit certificates to investors eligible pursuant to subsection 2-A in an aggregate amount not to exceed $1,000,000.

SUMMARY

This bill amends the Maine Seed Capital Tax Credit Program by increasing the limits on qualifying investments in eligible businesses to $1,000,000 per business and $200,000 per investor in any one business in any 3 consecutive calendar years. The bill also expands the field of eligible businesses by requiring that the business receiving the investment have annual gross sales of $3,000,000 or less.

The bill also increases the amount of tax credit certificates that may be issued in calendar years 1998, 1999 and 2000 by the Finance Authority of Maine. Under current law, tax certificates may be issued in an amount not exceeding $4,000,000 up to and including calendar year 1998 and $5,000,000 up to and including calendar year 1999, and the amount increases until it reaches $7,000,000 after calendar year 2000. This bill accelerates the pace of the increase so that the authority may issue tax credits in an amount not exceeding $5,500,000 up to and including calendar year 1998 and $7,000,000 up to and including calendar year 1999 and thereafter.

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APPENDIX I

Charts of proposed recommendations and funding levels prepared for the Joint Select Committee on Research and Development, December 1997

UNIVERSITY OF MAINE SYSTEM
Software Engineering and Development

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
SOFTWARE E & D	$1,020,000 annual appropriation	• Hire new research faculty and technical support • Provide a pool of matching funds for equipment purchases • Provide operating funds including student assistantships and information resources needed to expand the research program	Establish a university-based center of excellence in Software Engineering and Development dedicated to research and education for the advancement of Maine's software development and software intensive industries	Computer Software industry Manufacturing industry Biotechnology (designer drug and genetics) industry Information intensive companies	**Within 5 years**: **Federal**: Increase annual funding from $1M to $10M **Private**: Increase annual funding from $15,000 to $1M (from 1.4% to 10% of total)	**Within 5 years**: • 15 new disclosures of invention • 5 patent and/or copyright applications • 3 licensing agreements • Spin off of at least 1 new computer software company • Double rate of UMS B.S., M.S, and Ph.D. degrees conferred in computer science and engineering from 56 to 112, from 28 to 56, and from 5 to 10, respectively • Collaboratively establish the State's first Ph.D program in Computer Science at UM and USM	This project will help implement the Maine Science & Technology Plan by addressing the calls for: • Research and Development Capacity Relevant to Maine's Industries, and • An Educated and Technically Skilled Workforce
	$800,000 bond	• Renovate approx. 6,000 sq. ft. in Boardman Hall and Barrows Hall at UM • Renovate and equip information technologies laboratory at USM	These facilities will house the R&D activities in computer software engineering, including manufacturing control, geographic information systems and user-interface design development. The renovated laboratories will improve research efficiency, provide appropriate space for new research equipment, and help attract new personnel				

Chart prepared by the University of Maine System
December, 1997
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UNIVERSITY OF MAINE SYSTEM
Advanced Materials Engineering and Development

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
ADVANCED MATERIALS E & D	$3,270,000 annual appropriation	• Hire new research faculty and technical support • Provide a pool of matching funds for equipment purchases • Provide operating funds including student assistantships and information resources needed to expand the research program	Develop a university-based center of excellence in Advanced Materials Engineering focused on emerging opportunities for Maine's composites, wood products, and semiconductor manufacturing industries.	Composites industry Wood Products industry Semiconductor Manufacturing industry	**Within 5 years**: **Federal**: Increase annual funding from $2.7M to $15M **Private**: Increase annual funding from $350,000 to $1.8M (maintain at 12% of total)	**Within 5 years**: • 20 new disclosures of invention • 7 patent and/or copyright applications • 3 licensing agreements • Stimulation of the development or recruitment of at least 1 new wood composite manufacturing company in Maine. • Collaboration with industry and CMTC for research, education, and training activities • Strong collaboration with two world-class semiconductor companies- Fairchild and National Semiconductor in South Portland.	This project will help implement the Maine Science & Technology Plan by addressing the calls for: • Research and Development Capacity Relevant to Maine's Industries, and • An Educated and Technically Skilled Workforce
	$2,750,000 bond	• Renovate approx. 22,000 sq. ft. in Boardman Hall, Barrows Hall and the Crosby Laboratory at UM, and the microelectronics laboratory at USM.	These facilities will house the R&D activities in composite materials and semiconducting materials engineering. The renovated laboratories will improve research safety and efficiency, provide appropriate space for new research equipment, help attract new personnel and stimulate productive statewide research and training projects.		Approx. $10M in private and federal funds will be raised over the next 5 to 10 years to enhance the UM Engineering Complex and provide additional space for semiconducting materials manufacturing		

Chart prepared by the University of Maine System
December, 1997
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UNIVERSITY OF MAINE SYSTEM
Marine Biotechnology ($18 million bonding level)

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
MARINE BIOTECH-NOLOGY	$1,370,000 annual appropriation	• Hire new research faculty and technical support • Provide a pool of matching funds for equipment purchases • Provide operating funds including student assistantships and information resources needed to expand the research program	Develop a university-based center of excellence in Marine Biotechnology research focused on Maine's marine aquaculture, commercial fishing, and emerging marine products industries.	Aquaculture industry Commercial Fishing industry Marine Products industry	**Within 5 years**: **Federal**: Increase annual funding from $1.15M to $10M **Private**: Increase annual funding from less than 1% to 5% ($500,000) of total	**Within 5 years**: • 15 new disclosures of invention • 5 patent and/or copyright applications • 2 licensing agreements • Stimulation of the commercial production of at least 1 new cultured marine product in Maine • Protection of Maine's aquaculture industry from significant disease-related losses • Collaboration with Maine industry and non-profit research institutions on research projects	This project will help implement the Maine Science & Technology Plan by addressing the calls for: • Research and Development Capacity Relevant to Maine's Industries, and • An Educated and Technically Skilled Workforce
	$10,000,000 bond	• Renovate and expand Murray Hall at UM • Renovate the Aquaculture Research Center building at UM • Add laboratory space to the aquaculture research facility at the Darling Marine Center in Walpole.	These facilities will house some of the R&D activities in marine biotechnology (physiology, genetics, pathology, biochemistry, molecular biology, etc.) and their application to cultured species. They will be a significant step toward our goals of increasing visibility of the marine science program, increasing collaborations among marine scientists, improving research safety and efficiency, and providing appropriate space for new researchers and equipment.		**Within 5 to 10 years**: Approx. $15M in private and federal funds to further expand Murray Hall into a BioScience Complex that houses the School of Marine Science and other biologists who rely on the same core research facilities		

Chart prepared by the University of Maine System
December, 1997
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	$2,500,000 bond	• Renovate 20,000 sq. ft. of laboratory space in Hitchner Hall, which will become available as marine researchers are moved to the addition on Murray Hall at UM. • Currently used but inadequate laboratories in Deering Hall can then be converted to office and classroom space.	These facilities will include a food processing pilot plant, experimental greenhouses and other laboratories needed to support R&D activities in biotechnology, environmental chemistry, and remote sensing for forestry and agriculture. The renovated facilitates will greatly improve research safety, efficiency, and capacity. They will make a significant impact on our ability to take advantage of new sources of federal funding.		$500,000 in federal funds has already been raised for the food processing pilot plant. $500,000 of the State funds will be used to "match" those federal funds.		

UNIVERSITY OF MAINE SYSTEM
Biotechnology

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
MEDICAL BIO TECH-NOLOGY	$1,420,000 annual appropriation	• Hire 5 new research faculty and facilitate joint appointments with UMaine, Foundation for Blood Research, Maine medical Center and provide technical staff for laboratories. • Provide a pool of matching funds for equipment purchases • Provide operating funds including student assistantships and information resources needed to expand the research program	Establish a university-based center of excellence in Medical Biotechnology dedicated to the advancement of Maine's biotechnology industry Further develop existing partnerships with Maine Medical Center, the Foundation for Blood Research and local Biotech industries and the industry's Center for Innovation in Biomedical Technology.	Biotechnology Environmental Science Food Industry Health Care Veterinary Medicine	**Within 5 years**: **Federal**: Increase annual funding from $250,000 to $1M **Private**: Increase annual funding from $5,000 to $100,000 (10% of total)	**Within 5 years**: • Provision of Maine Biotechnology industry with an increasing number of highly trained personnel with solid research skills at the undergraduate and graduate levels. • Attraction and retention of new biotechnology firms and industry-based senior scientists to Maine • Collaboration with Maine industry and non-profits on research, education and training projects including delivery of University of Maine doctoral program. • Improve graduate and biotechnology/biomedical science education at USM • 5 new disclosures of invention • 1 patent and/or copyright • 1 licensing agreement	This initiative will especially enhance the development of the sunrise biotechnology industry in Maine. This project will help implement the Maine Science & Technology Plan by addressing the calls for: • Research and Development Capacity Relevant to Maine's Industries, and • An Educated and Technically Skilled Workforce

	$2,000,000 bond	• Renovate 12,000 sq. ft. of laboratory space at USM including animal room, dark room, cold room and high level biosafety (BL-3) lab.	These laboratories will support R&D activities in biotechnology, including molecular biology and immunology research. The renovated facilitates will greatly enhance our ability to attract new students, research faculty, and federal funding, and to interact effectively with the private sector.				

UNIVERSITY OF MAINE SYSTEM
Marine Biotechnology ($15 million bonding level)

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
MARINE BIOTECH-NOLOGY	$1,370,000 annual appropriation Hire new research faculty and technical support Provide a pool of matching funds for equipment purchases Provide operating funds including student assistantships and information resources needed to expand the research program	Develop a university-based center of excellence in Marine Biotechnology research focused on Maine's marine aquaculture, commercial fishing, and emerging marine products industries.	Aquaculture industry Commercial Fishing industry Marine Products industry	**Within 5 years**: **Federal**: Increase annual funding from $1.15M to $10M **Private**: Increase annual funding from less than 1% to 5% ($500,000) of total	**Within 5 years**: 15 new disclosures of invention 5 patent and/or copyright applications 2 licensing agreements Stimulation of the commercial production of at least 1 new cultured marine product in Maine Protection of Maine's aquaculture industry from significant disease-related losses Collaboration with Maine industry and non-profit research institutions on research projects	This project will help implement the Maine Science & Technology Plan by addressing the calls for: Research and Development Capacity Relevant to Maine's Industries, and An Educated and Technically Skilled Workforce
	$7,000,000 bond Renovate Murray Hall at UM Renovate the Aquaculture Research Center building at UM Add laboratory space to the aquaculture research facility at the Darling Marine Center in Walpole.	These facilities will house some of the R&D activities in marine biotechnology (physiology, genetics, pathology, biochemistry, molecular biology, etc.) and their application to cultured species. They will be a significant step toward our goals of increasing visibility of the marine science program, increasing collaborations among marine scientists, improving research safety and efficiency, and providing appropriate space for new researchers and equipment.		**Within 8 to 10 years**: Approx. $18M in private and federal funds to further expand Murray Hall into a BioScience Complex that houses the School of Marine Science and other biologists who rely on the same core research facilities		

UNIVERSITY OF MAINE SYSTEM

Marine Biotechnology ($10 million bonding level)

Project	State Investment	Description	Relevance to R&D Capacity	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	Relationship to Economic Development Plans
MARINE BIOTECH-NOLOGY	$1,370,000 annual priation	• Hire new research faculty and technical support • Provide a pool of matching funds for equipment purchases • Provide operating funds including student assistantships and information resources needed to expand the research program	Develop a university-based center of excellence in Marine Biotechnology research focused on Maine's marine aquaculture, commercial fishing, and emerging marine products industries.	Aquaculture industry Commercial Fishing industry Marine Products industry	**Within 5 years**: **Federal**: Increase annual funding from $1.15M to $10M **Private**: Increase annual funding from less than 1% to 5% ($500,000) of total	**Within 5 years**: • 15 new disclosures of invention • 5 patent and/or copyright applications • 2 licensing agreements • Stimulation of the commercial production of at least 1 new cultured marine product in Maine • Protection of Maine's aquaculture industry from significant disease-related losses • Collaboration with Maine industry and non-profits on research projects	This project will help implement the Maine Science & Technology Plan by addressing the calls for: • Research and Development Capacity Relevant to Maine's Industries, and • An Educated and Technically Skilled Workforce
	$2,000,000 bond	• Renovate the Aquaculture Research Center building at UM • Add laboratory space to the aquaculture research facility at the Darling Marine Center in Walpole.	Ffacilities will house some of the R&D activities in marine biotechnology (physiology, genetics, pathology, biochemistry, molecular biology, etc.) and their application to cultured species. A significant step toward goals of increasing visibility of the marine science program, increasing collaborations among marine scientists, improving research safety and efficiency, and providing appropriate space for new researchers and equipment.		**Within 10 years**: Approx. $23M in private and federal funds to further expand Murray Hall into a BioScience Complex that houses the School of Marine Science and other biologists who rely on the same core research facilities		

Chart prepared by the University of Maine system

GULF OF MAINE AQUARIUM RESEARCH LABORATORY

Project	State Investment	Description	Relevance to R&D Capacity, "Synergies"	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	History of Project: Relationship to Economic Development Plan
APPLIED FISHERY & MARINE BIOTECHNOLOGY RESEARCH LABORATORY	$2,000,000 G.O. Bond	State funds will be matched at least 1:1 with private and/or federal funds (for combined total of $4,000,000) to: • Design and build Phase I (20,0000 sq. ft.) of a collaborative public/ non-profit/private sector research laboratory • Fit out common laboratory equipment. • Design and build public exhibit lobby featuring research underway by research collaborators on and off site. • Leverage $4,000,000 additional private and/or federal funds to build 20,000 sq. ft. Phase II expansion to provide 40,000 sq. ft. total lab and exhibit space).	This collaborative research facility will provide: <u>Applied Fishery Research</u>: • Infrastructure to attract and support soft-money fishery scientists to Maine. • Information on critical commercial fish species via Internet. • Neutral forum for conflicting fishery interests to develop and implement research strategies. <u>Marine Biotechnology</u>: • Infrastructure to attract leaders in marine biotechnology industry to locate or stay in Maine. • Proximity to Maine's biotechnology industry and medical research centers. • Convenient access to University of Maine, downeast aquaculture operations and Boston research institutions .	<u>Applied Fishery Research</u>: Increase Maine's Marine Science capabilities in the area of applied research to support Maine's fresh and saltwater fishery management needs. <u>Marine Biotechnology</u>: Support evolution of Marine Biotechnology industry in Maine from dream to reality.	<u>Phase I</u>: $2,000,000 private contribution to match State contribution for Phase I (20,000 sq. ft.). <u>Phase II</u>: $4,000,000 additional funding through mix of federal science agency funding, debt financing and private contributions for Phase II (20,000 sq. ft. for total of 40,000 sq. ft.)	<u>Phase I</u>: Provide laboratory for 16 non-profit and public research scientists (average salary in excess of $45,000). Attract 2 marine biotechnology companies with total of at least 20 employees (average salary in excess of $45,000) to locate in facility. <u>Phase II</u>: Create 35 new marine science positions (public, private and non-profit) at average salary of at least $45,000. Engage 716,000 annual Gulf of Maine Aquarium visitors with Maine's various public, private and non-profit aquatic research and technology efforts.	Advances *Maine's Science & Technology Action Plan* Call for R&D Facilities, Call for Commercialization and Call for Science & Technology Input in Policymaking. Advances *Charting Maine's Economic Future* goal to emerge as world class center for marine science, technology and industry by increasing outside R&D funding and creating an onsite cluster of research and industrial marine technology activities. Advances *The Course for 1995 & Beyond* goal to develop a collaborative plan to benefit from marine biotechnology opportunities. Advances *State of Maine 1996 Economic Development Strategy Outline* objective to cultivate marine science and biotechnology industries.

Chart prepared by Don Perkins, Gulf of Maine Development Corporation

MARINE TECHNOLOGY FUND

Project	State Investment	Description	Relevance to R&D Capacity, "Synergies"	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	History of Project; Relationship to Economic Development Plans
Interconnectivity Expansion of Capacity	$3 million bond FY 99 ($1 million for inter-connectivity; $2 million for capacity) (followed in later years by state appropriations to permit funding of non-capital costs)	• Provide funds to applicants to upgrade Internet connections between the 14 public and private educational institutions and not-for-profit marine labs and to provide related services • Provide funds to academic and not-for-profit applicants to acquire equipment and associated instrumentation to enhance marine research and education capabilities and to increase collaboration and productivity and to improve and renovate lab and research facilities • Selection of fund recipients to be made by the Research Capacity Committee of the MSTF • Applicants required to provide 1:1 cash match	• Improves ability of academic and not-for-profit researchers to collaborate on projects and to share information • Improves capacity	Aquaculture and marine technology Marine biotechnology Assists academic institutions and not-for-profits	Federal: $6 million federal investment Private: $4 million total ($1 million from private foundations and $3 million from matching funds from recipients of assistance)	By 2005 (assuming ongoing appropriations): • Interconnection of the 14 public and private academic and not-for-profit marine research labs • 50% increase in collaboration in research efforts among the 14 labs over 1997 levels • Leveraging of federal marine research funds 3 to 4 times in excess of 1996 levels ($50 million) • Agreement among industries and resource managers that they have significantly improved information and that Maine in making better science-based management decisions about marine resources	This project is relevant to the State S&T plan Call for: Increased R&D Capacity Relevant to Maine's Industries Marine technology is a focus area in the S&T implementation plan program for Research Challenge grants The Fund was identified as an action item in the Jobs from the Sea Initiative

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Chart prepared by the Office of Policy & Legal Analysis from information provided by the Maine Science and Technology Foundation
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RESEARCH CHALLENGE PROGRAM

Project	State Investment	Description	Relevance to R&D Capacity, "Synergies"	Primary Impact Area	Federal & Private Dollars Expected	Expected Outcomes	History of Project; Relationship to Economic Development Plans
RESEARCH CHALLENGE PROGRAM	$3 million bond FY 99 (followed in later years by state appropriations to permit funding of non-capital costs)	• Bonds would provide funds for physical infrastructure for businesses, public and private academic institutions, non-profit institutions and centers for innovation • Eligible projects include equipment and instrumentation that increase R&D capacity and improve productivity; facilities improvements and renovations that enhance research capacity; telecommunications infrastructure that promotes efficiencies among research institutions • Selection process overseen by the MSTF's Research Capacity Committee; academic & not-for-profit institutions would be required to partner with a business to be eligible for funding; communities would be eligible as co-applicants; collaboration with out-of-state partners is encouraged as long as infrastructure investments remain in the State • Applicants would be required to provide 1:1 cash match	• Building capacity is the primary reason for the challenge program; program is designed to enhance long-term relationships by promoting collaboration between the business community and institutions within the State and outside of Maine • Encourages communities to co-invest in building the R&D assets of their communities • Leverage significant federal funds	All 5 priority target areas	Federal: $8 million Private/Other: additional $1 million from the MSTF Maine Technology Fund (Research Capacity sub-fund) ; $4 million from applicants' 1:1 match; $250,000 from communities	By 2005 (assuming ongoing appropriations): • 50-75% increase over 1996 levels ($80 million) in the amount of federal R&D funds awarded to Maine researchers and businesses • Leverage same amount from applicants, participating communities and private foundations as from federal sources • Triple the number of partnerships between businesses, academia and the non-profit community • Annually create/retain 50-75 science and technology jobs and set the stage for cluster growth in technology areas	This project implements the State Science & Tech. Plan call for: • Increased R&D Capacity Relevant to Maine's Industries This program is listed in the implementation plan for the State S&T Plan

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