MAINE STATE LEGISLATURE

STATE FUNDED RESEARCH

ANNUAL REPORT

FISCAL YEAR ENDING JUNE 30, 2003 (FY03)

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

December 2003
MW50Z(335)

UNIVERSITY OF MAINE SYSTEM

STATE FUNDED RESEARCH ANNUAL REPORT

FISCAL YEAR ENDING JUNE 30, 2003 (FY03)

TABLE OF CONTENTS

The University of Maine System is required to submit in January of each year an annual report on the utilization of state research appropriations for operations, state research capital bonds, and University R&D revenue bonds with debt service funded by a state appropriation. The following is the report for fiscal year 2003 (FY03) that covers the period from July 1, 2002 to June 30, 2003.

University of Maine Summary

The University of Maine continues to grow the R&D enterprise as seeded with the Maine Economic Improvement Fund (MEIF). The Institution continues to use the fund as investment capital across the technology sectors that are important to Maine and across the R&D continuum to continue to leverage Federal dollars as well as create economic opportunities for UM graduates and businesses across the state. In FY03, the University of Maine received $8,080,000 of MEIF to support matching funds for grants and contracts, equipment purchase, capital construction, staff salaries and services to support research, development, technology transfer and economic development in the areas of Advanced Materials and Composites, Advanced Technologies for Forestry and Agriculture, Aquaculture and Marine Sciences, Biotechnology, Information Technology, Environmental Technologies and Technology Transfer, Commercialization and Business Development across all sectors. The $2.8 million invested in direct matching funds alone generated $37.1 million in direct grants and contracts, a return of 13 to 1 for each dollar invested.

Also in FY03, research capital bond revenues were used at the University of Maine to continue the expansion and renovation of Hitchner Hall, (biotech, life sciences and food science labs), begin the construction of the Engineering and Science Research building (which will primarily serve the advanced materials and composites sector, and the IT and computer sector), and begin the construction of the Advanced Manufacturing Center, serving the research and private sector in Maine.

- ***Federal Grants and Contracts***

  The University of Maine continues to leverage the MEIF funds to attract federal awards from the National Science Foundation, the Office of Naval Research, the National Institutes of Health, and the U.S. Department of Agriculture among others. Total extramural funding exceeds $50,000,000 for the third year in a row. Notable projects in each targeted technology sector are detailed in the attached narratives. The University of Maine research administration continues to work closely with the federal delegation and other state research partners in pursuance of large multi-institution, multi-year projects such as the Gulf of Maine Ocean Observation System (GoMOOS) a partnership of the State Planning Office, Bigelow Labs, the University of Maine, and other research organizations. Another example is the $15 million appropriated to date for the National Coldwater Marine Aquaculture Center being developed in partnership with the U.S. Department of Agriculture, Agricultural Research Service. A major public/private partnership between the University of Maine, Hodgdon Yachts of Boothbay, and several other composites companies received an appropriation from the Office of Naval Research for the development of the next generation high-speed patrol boat, currently the Mark V.

Perhaps the most notable project receiving federal funding last year is the National Science Foundation award of $6 million to form the Institute of Molecular Biophysics, a partnership between the University of Maine, the Jackson Laboratory, and the Maine Medical Center Research Institute.

- ***Industrial Research***

Many of the University of Maine researchers work directly with Maine companies, either providing direct research services to the companies or involving them in their federally funded work. In particular, the University of Maine has been quite successful in supporting Maine companies doing R&D leading to product commercialization with support from the Maine Technology Institute. The Maine Technology Institute ("MTI") was established by the Maine Legislature to fund Maine companies developing new products or technology services. The University supports approximately half the 200+ projects, working with companies such as Applied Thermal Sciences in Sanford, Saltwater Marketing in Portland, Biode in Westbrook, Harbor Technologies in Brunswick, Intelligent Spatial Technologies in Orono, and Seabait of Maine in Franklin, to name a few.

In addition the University received two MTI cluster enhancement awards to strengthen industry sector R&D in the area of composites and digital media.

- ***Technology Transfer and Intellectual Property***

An important component commercializing the outputs of R&D is the protection and licensing of intellectual property - most often through patenting. The University of Maine uses a small portion of MEIF funds for technology transfer that includes these patenting and licensing activities. In FY03, the University of Maine filed 8 patent applications in the fields of wood composites, advanced composites, high temperature sensing devices, papermaking and retention. In addition, we commercialize other non-patentable products such as software. Two products developed by our campus computer store are making wide spread impact and are now licensed to 140+ schools and generated $50,000 in licensing revenue. Similarly, the Advanced Wood Composites Center has received a proprietary building code for a wood-composites product that can be licensed to manufacturers. Many of these technologies are under joint development with Maine companies and, if successfully commercialized, will generate jobs in Maine and royalty revenue.

The University of Maine continues to strengthen the commercialization opportunities from R&D. In this effort, we pursue federal grants that support the development of the commercialization infrastructure at the University of Maine and the State. The University of Maine was a partner in Coastal Communities Job Center and Maine Manufacturing Extension Partnership grant from the Department of Labor to "train" Maine technology companies to develop and commercialize new technologies. This program was funded at the very end of FY03 and will be developed over the coming year.

Always looking to capitalize on existing investments by our partners, the University of Maine continues to cost-share the USM patent program attorney Woody Higgins, who now spends several days a week in Orono at the Target Technology Center and serves as in-house patent council and advises on intellectual property matters.

- ***R&D and Technology Transfer Facilities***

While protecting the intellectual property that results from R&D is a necessary step in the commercialization process, it often takes real products to prove technical and commercial feasibility. Many of our research labs have been designed to serve as pilot-plants where first generation products can be made and tested and perhaps test marketed. This year marked the completion of the Hitchner Hall addition that includes our food processing pilot plant. The Department of Food Science works with many companies in developing new food processing technologies and products. Efforts in the past year include the beginning of a program with the Maine Wild Blueberry Commission and the blueberry industry to develop blueberry/soy based food products to move into new value added markets. In addition, the Advanced Manufacturing Center operates in temporary facilities and works directly with UM and private sector partners to develop first generation prototypes and production models. Finally, the University began operating the Shur tissue culture facility in Island Falls at the end of the FY03. The facility, donated to the University of Maine, is a state of the art tissue culture facility that supports the development of new plant varieties and will focus on potato and ornamental horticulture variety development.

- ***Business Incubators***

Technology-Based Business Incubation is a recent effort in Maine to nurture the technology start-up companies in Maine. The Advanced Technology Development Centers Program, run through the Department of Economic and Community Development, helped establish 7+ targeted technology incubators throughout Maine. The University of Maine is directly involved in running three centers. The Target Technology Center was opened in early 2002 and serves as the Information Technology Incubator in the State. Stillwater Scientific Instruments is a spin-off company from the University of Maine Laboratory for Surface Science Technology commercializing technology developed with National Science Foundation funding. They moved into the Target Incubator in the spring of 2002 to get assistance with the business start-up issues that plague many new business owners. Intelligent Spatial Technologies started in the spring of 2003 and is a spinout from our National Center for Geographic Information. FoxTech is a start-up company in computer-aided design that has re-located from Michigan and works closely with the Advanced Manufacturing Center.

In addition, the University of Maine operates the Aquaculture Advanced Technology Center in partnership with the Maine Aquaculture Innovation Center. The Aquaculture Center has business incubation spots available at the Darling Marine Center, the Center for Cooperative Aquaculture Research in Franklin, and the Washington County Community College in Eastport. The Darling Center space was completed in June of 2002 and is now occupied by a spin-off activity of MicroTechnologies, a Richmond-based Fish Biotechnology company.

The University of Maine is a partner in the Composites Technology Center, the incubator for the composites industry, with Sanford Industrial Development Committee and the Piscataquis County Economic Development Council. The first incubator space is in Sanford, the second planned for Greenville, received funding through the June 2003 "Jobs Bond." The University serves as the R&D lab for these companies.

The University of Maine is looking for spin-off technologies suitable for all the incubators, which include environmental technologies, precision manufacturing, advanced technologies for forestry, and agriculture and biotechnology.

- ***Local and Regional Economic Development***

The University of Maine continues to partner with state and regional economic development organizations and local towns and communities to understand the needs of local businesses and the opportunities to use our R&D relationships to spin-off, grow, or attract existing and new businesses. In FY03, we were successful in attracting FoxTech, LLC to Orono, Maine. Partnering with these organizations gives Maine the critical mass to continue to grow.

- ***The Future***

As we move into the next year, we continue to have bright spots that will carry the momentum that the MEIF and state bond funds have initiated.

- The continued development of a Molecular Biophysics Institute in partnership with the National Science Foundation, the Jackson Laboratory, and the Maine Medical Center Research Institute.

- The Completion of the Engineering and Science Research Center and the Advanced Manufacturing Center.

- The expansion of technology-based entrepreneurship programs for graduate and undergraduate students in all disciplines and the construction of the Technology Innovation Center funded by the June 2003 "Jobs Bond".

- The expansion of the Advanced Wood Composites Center, funded by the June 2003 "Jobs Bond"

- The continued development of aquaculture R&D activities in partnership with the USDA, the industry, and the State.

- Growth and expansion of "Homeland Security" R&D, capitalizing on our strong programs and applying to the needs of the State and the nation.

- Continued strong performance in the R&D funding from all sources.

- Additional Maine Economic Improvement Funds, including the reinstatement of the $2 million originally included in the FY03 appropriation, will allow current project commitments, such as the EPSCor project, to be fulfilled and will allow the University to leverage more grants and contracts to stimulate economic growth in Maine

University of Southern Maine Summary

During FY03, USM began to see earlier investments in R&D pay dividends. New grants and contracts related to R&D exceeded $3.6M, up from less than $1M last year, and the equivalent of 26 full-time jobs were created. In addition to those positions directly supported by R&D funds, the equivalent of an additional 25 positions were supported by grants and contracts that are the result of earlier R&D investments at USM. The plan is working.

- **Institutes and Opportunities**

  USM has two research institutes to develop R&D capacity: the Bioscience Research Institute of Southern Maine (BRISM) and the Institute for Research in Information Science (IRIS). Each institute primarily provides a focal point for interdisciplinary research in its targeted technology, bringing together and supporting researchers from different departments and different colleges to address research questions of national interest. Work continues within each institute to facilitate USM participation in the two Ph.D. programs: the Cooperative Ph.D. program in Biosciences, currently enrolling six students, and the University of Maine Computer Science Ph.D. program.

  Bioscience Research Institute of Southern Maine (BRISM)

  During FY03, Dr. John Wise and his team settled in and established a strong research program at USM. Recruited from Yale University during FY02, Dr. Wise has built collaborations within USM and across the research communities of Maine and northern New England. These collaborations form the core of the emerging Center for Integrated and Applied Environmental Toxicology which is expected to be approved by the Board of Trustees early in FY04. In addition to the grants that came from Yale with the Wise laboratory, another $3.2M in proposals was submitted during FY03.

  Another major researcher, Dr. Lew Incze, joined USM from the Bigelow Laboratory. Dr. Incze's work at the intersection of physical oceanography and biological systems is critical to the understanding of the Gulf of Maine. Dr. Incze is already drawing together a number of researchers to form a core group examining aquatic systems.

Institute for Research in Information Science (IRIS)
Work continued by faculty members in Computer Science and Information and Communications Technology on research agendas recently established at USM: the theoretical basis of object-oriented databases, the performability of distributed networks, and web-based tools to facilitate collaboration and information sharing among non-technical users. All three of these submitted proposals to federal and state funding agencies, including two proposals to the Maine Technology Institute.

- **Infrastructure**
  The capital investment in the Research Wing of the Science Building also came to fruition in FY03 with the completion of the basement and first laboratory floor in early June. These research spaces were completely occupied during the first quarter of FY04, with funded research underway and core scientific facilities operational—an animal facility, a nuclear magnetic resonance laboratory, a radioactive isotope laboratory, as well as extensive microscopy space and equipment.

- **Incentives for Research and Development at USM**
  The State R&D appropriation has allowed USM to develop its institutional capacity to leverage extramurally-generated funds more effectively. For example, as part of USM's aggressive effort to build research competitiveness, FY03 marked the first year of the Research Initiatives Incentives program. In this program 10% of all indirect costs recovered by USM through USM grants and contracts ($300,000 in FY03) was utilized to
  1) return funds to Colleges, Schools, and individual researchers to motivate high quality new grant proposals,
  2) deliver proposal development services such as technical and editorial assistance,
  3) initiate an undergraduate research opportunities program for the benefit of USM students.

  The creation of this program, funded entirely by indirect cost recovery on grants and contracts, has allowed an increasing number of USM R&D activities to be sponsored by resources other than the State R&D appropriation, thereby maximizing the impact of the State funds, and broadening the scope of research development at USM.

Conclusion
USM is demonstrating that significant investments in R&D activities, with both direct support of research and the development of human and physical infrastructure, can pay off. The returns are coming in: as new grants and contracts, as additional graduate students and programs, as unprecedented collaborative activity, and as vibrant and meaningful research programs. Patiently and prudently tending these investments will insure further increase in such returns, and benefits to the economic vitality of Maine, especially in our targeted technology areas.

State Research Appropriation for Operations

The University of Maine System received an appropriation of $0.5 million in FY98, an additional $4 million in FY99, an additional $5.55 million in FY00, and an additional $50,000 in FY2001 bringing the total available for research in FY01 to $10.1 million. There was no additional appropriation for FY02; therefore, the FY02 appropriation remained at $10.1 million. In FY03, the initial appropriation for R&D reflected a $2 million increase for a total of $12.1 million; however, during FY03, the additional $2 million was deappropriated resulting in the total FY03 R&D state appropriation remaining level at $10.1 million. The FY03 appropriation of $10.1 million was distributed between the University of Maine (UM - $8,080,000) and the University of Southern Maine (USM - $2,020,000).

Summary of Utilization of FY03 State Research Appropriation for Operations

Of the FY03 allocation of $10.1 million and $0.1 million carried forward from FY02, UM and USM (1) expended a total of $6.8 million, (2) matched external grants & contacts with $2.9 million, and (3) carried forward $0.5 million in unspent funds to FY04.

These state research dollars resulted in the UMS attracting $40.7 million in external grant & contract funding (primarily federal), a ratio of 4 to 1. The $9.7 million of State funds utilized during FY03 resulted in a total of $50.4 million being made available for research & development and supported 521 FTE positions.

The following is a summary of the utilization of the state research appropriation for operations during FY03.

	FY03 Expenditures & Physical Plant Commitments	Used To Match Grants & Contracts	Total Funds Utilized	Funds Carried Forward to FY04
UM	$4,836,949	$2,780,952	$7,617,901	$466,137
USM	1,966,891	124,325	2,091,216	(8,106)
Total R&D Funds	$6,803,840	$2,905,277	$9,709,117	$458,031
Grants & Contracts Generated			40,696,514	
Total Funds			$50,405,631	

The research and development funding provided by the State of Maine was used to support (1) salaries for faculty and staff, (2) direct equipment purchases, (3) matching funds for grants and/or contracts, (4) research space, and (5) research in such areas as computer software & engineering, advanced materials engineering, advanced technologies for forestry & agriculture, aquaculture & marine sciences, biotechnology, technology transfer, information technology, and biosciences.

Legislative History of State Research Appropriation for Operations

The following is a summary of the actions of the 118th, 119th, and 120th Maine Legislatures with regard to appropriating research funds for operations to the University of Maine System.

118TH LEGISLATURE

On March 26, 1997, the Governor signed into law the Economic Improvement Strategy (Chapter 24) that appropriated $.5 million to the University of Maine System for research.

On April 1, 1998, the Governor signed into law the Economic Improvement Strategy (Chapter 643, Part LL, Section S-3) that appropriated $4 million to the University of Maine System for research. These funds were allocated from the FY98 year-end state surplus for use in FY99.

119TH LEGISLATURE

On March 15, 1999, the Governor signed into law the Part I Current Services budget (Chapter 16) that appropriated $4 million in 1999/00 and 2000/01 to the University of Maine System on a "base budget" basis for research. This extends the one-time FY99 $4 million research appropriation that was funded from the FY98 year-end state surplus.

On June 4, 1999, the Governor signed into law the Part II Supplemental Appropriation budget (Chapter 401) that appropriated an additional $5.55 million in 1999/00 and an additional $50,000 in 2000/01 to the University of Maine System on a "base budget" basis for research.

On April 25, 2000, the Governor signed into law the Part II Supplemental Appropriation budget (Chapter 731) that appropriated $0.3 million in 2000/01 to the University of Maine System on a "base budget" basis for the Maine Patent Program.

120TH LEGISLATURE

On June 21, 2001, the Governor signed into law the Part II Supplemental Appropriation budget (Chapter 439) that appropriated an additional $2 million in 2002/2003 to the University of Maine System on a "base budget" basis for research.

On March 25, 2002, the Governor signed into law a deappropriation (Chapter 559) that reduced the FY03 $2 million Supplemental Appropriation by $1 million.

On July 1, 2002, the Governor signed a Financial Order that curtailed the FY03 $2 million Supplemental Appropriation by an additional $1 million. This eliminated the FY03 increase of $2 million for research, bringing the FY03 research & development appropriation back to the FY02 level of $10.1 million. On November 18, 2002, the Governor signed into law a supplemental appropriation budget (Chapter 714) that deappropriated the $1 million curtailment that was signed on July 1, 2002.

Legislative History of State Research Appropriations for Operations

118th Legislature

	FY98 New Appropriation	FY99 New Appropriation	Total New Two-Year Appropriation
UM	$400,000	$3,200,000	$3,600,000
USM	100,000	800,000	900,000
TOTAL	$500,000	$4,000,000	$4,500,000

119th Legislature

	FY00 New Appropriation	FY01 New Appropriation	Total New Two-Year Appropriation
UM	$4,440,000	$40,000	$4,480,000
USM	1,110,000	10,000	1,120,000
TOTAL	$5,550,000	$50,000	$5,600,000

120th Legislature

	FY02 New Appropriation	FY03 New Appropriation	Total New Two-Year Appropriation
UM	$0	$0	$0
USM	0	0	0
TOTAL	$0	$0	$0

Total Yearly Research Appropriation for FY01 - FY03

	FY01 - FY03 Appropriation
UM	$8,080,000
USM	2,020,000
TOTAL	$10,100,000

1/1/04 MW50Z(338)

State Appropriation for the Maine Patent Program

Through a combination of numerous public educational presentations and individual counseling sessions with clients, the Maine Patent Program stimulates and supports both existing and start-up Maine businesses by providing critical information and guidance regarding development, strategic protection, and valuation of their intellectual property assets. The program continues to grow in visibility and utilization by innovation-based businesses in Maine. The Program receives, on average, around ten applications per month for one-on-one counseling with individual inventors and businesses, and, from the time the Program began providing public services in the first quarter of FY02 until today, over 200 inventors, scientists and entrepreneurs have sought individual assistance from the Program. Additionally, over 500 Maine attendees have been recorded at the many seminars, workshops, and conferences on various intellectual property topics hosted by the Program and the Technology Law Center around the state.

The Program works closely in partnership with other Maine economic development institutions, including the Maine Small Business Development Centers, the Maine MEP, and the Maine Technology Institute ("MTI"). In FY03, well over 20 Program clients received seed or development grant awards from MTI and several of these awards were for the purpose of pursuing patents. The Program estimates that since its inception, between fifteen and twenty-five new clients have filed or soon will file patent applications with the Program's assistance, and several clients who had pending applications now hold issued patents.

To accomplish the Program's state-wide outreach to provide a key component in Maine's forward-thinking initiative to foster economic growth and development for innovation-based and high tech businesses, the University of Maine System received an appropriation of $300,000 in FY03. The Program provides ever-increasing numbers of Maine businesses and entrepreneurs with tools, information, education, counseling and assistance with intellectual property issues that are crucial to the success of such technology-based businesses, including patent, trademark, copyright and trade secret protection, commercialization and licensing. In FY02, the Program expended $197,145, carrying forward to FY03 $265,774. During FY03, the Program expended $288,703, and $273,322 was carried forward to FY04. The unused funds have been or will be distributed to the Program for future use, particularly as the economic growth initiative continues, creating more Maine businesses requiring intellectual property advice and services to fully compete in the marketplace.

State Funding for Research Capital Projects

On November 3, 1998, the voters of Maine approved a $20 million bond issue to improve the Maine economy by supporting innovative research and development. The University of Maine System received $13.5 million from this bond issue to be used for capital improvements and equipment purchases to support research and development. The bond proceeds were distributed between the University of Maine ($10.8 million) and the University of Southern Maine ($2.7 million).

On June 4, 1999, the Governor signed into law the Part II Supplemental Appropriation budget (Chapter 401) that appropriated $2.5 million in 2000/01 to the University of Maine System on a "base budget" basis to pay the debt service on a $25 million university research & development revenue bond. The University issued the revenue bond on August 15, 2000 that provides $20 million for University of Maine Engineering & Science Research Facility and $5 million for the University of Southern Maine Portland Science Building Lab Renovation.

On April 25, 2000, the Governor signed into law a one-time supplemental appropriation (Chapter 731) that appropriated $9 million for the renovation of teaching laboratories and classrooms in Aubert Hall at the University of Maine.

On June 11, 2002, the voters of Maine approved a $35 million bond issue to be used in part to stimulate job growth. The University of Maine System received $9 million with the bond proceeds being distributed to the University of Maine ($5 million) for the Advanced Manufacturing Center and to the University of Southern Maine ($4 million) for the Mitchell Center.

On June 10, 2003, the voters of Maine approved a $60 million bond issue to be used in part to stimulate economic growth and job creation. The University of Maine and the University of Southern Maine will receive a combined total of $15 million to support their research efforts.

Summary of Utilization of FY2003 Research Capital Funds

	Bond Allocation	Other Funds Provided To Date	Total Project Budget	Expenditures to Date	Funds Carried Forward To FY2004
FY1999 State Bonds					
UM	$10,800,000	$1,168,622	$11,968,622	$11,370,720	$597,902
USM	2,700,000	155,000	2,855,000	2,708,656	146,344
Total	$13,500,000	$1,323,622	$14,823,622	$14,079,376	$744,246
FY2001 University Revenue Bonds					
UM	$20,000,000	$600,000	$20,600,000	$9,059,902	$11,540,098
USM	5,000,000	4,161,599	9,161,599	8,389,101	772,498
Total	$25,000,000	$4,761,599	$29,761,599	$17,449,003	$12,312,596
FY2002 State Bonds					
UM	$5,000,000	$0	$5,000,000	$481,063	$4,518,937
USM	4,000,000	0	4,000,000	205,701	3,794,299
Total	$9,000,000	$0	$9,000,000	$686,764	$8,313,236
FY2001 One-time Appropriation					
UM	$9,000,000	$2,496,353	$11,496,353	$9,120,079	$2,376,274

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION NARRATIVE BY MAJOR RESEARCH AREA

UM

The information below regarding the "Purpose of Research Area and Description of How Funds Were Spent" as well as the "Description of Grants & Contracts Generated" is applicable to **all** major research areas at the University of Maine.

Purpose of Research Area and Description of How Funds Were Spent:

The University of Maine uses the Maine Economic Improvement Funds (MEIF) for the specific purpose of leveraging investments for:

A. Increasing the attraction of external funds through, grants, contracts, and gifts to support the growth of research and development of new science and technology relevant to Maine and the world.
B. Increasing the institutional capacity (facilities, equipment, staff, scientists) to immediately support Maine's students, the citizens, communities, and the private sector in Maine.
C. Developing new research, science, publications, technologies, information, and start-up companies that have the potential to positively impact Maine's economy.

Funds are spent on:

A. Basic infrastructure and key operating expenses which cannot be supported on direct costs on grants.
B. Research personnel who work directly on these project areas.
C. Start-up funds for new faculty, which typically support lab fit out and equipment, grad-student and technician support, and basic start-up materials for a fixed period of time, typically three years or less. Direct and indirect matching funds on grants and contracts. Direct cash match when required by the sponsor, often in the form of personnel time.
D. When not required by sponsor, match may be provided for a critical need (i.e. equipment, technician) that the sponsor won't provide but is necessary to complete the project.

Description of All Grant & Contract Funds Generated (includes MEIF & Non-MEIF):

Sector	Awards #	Award Amount	Cost-share Amount
Advanced Materials and Composites	27	$4,198,802	$755,302
Aquaculture and Marine Sciences	81	$9,296,028	$1,514,311
Biotechnology	25	$4,612,183	$1,193,630
Forestry and Agriculture	61	$4,590,982	$779,802
Environmental Technologies	72	$5,598,700	$891,980
Information Science and Technologies	18	$3,490,697	$82,725
Sub-total Sectors	***284***	***$31,787,392***	***$5,217,750***
Other non-sector	107	$12,755,566	$2,933,103
UM Totals	***391***	***$44,542,958***	***$8,150,853***
Other Formula, Gift, Ind. - ***not categorized****	n/a	$6,430,486	n/a
Extramural Total		***$50,973,444***	

(*Note: UM is developing mechanics to categorize the balance of these funds by sector)

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

The previous table summarizes the new grant and contract awards received during the FY03 time period. It includes extramural grant and contract funds, and formula funds and gift/endowment funds, which are not tracked by technology sector at this time.

Also please note that a project is often within several sectors. The above sorting is meant to be general by the nature of the project. However, for example, a *"...marine composites project using resin treated wood composites to prevent marine borer damage..."* could easily be classified as forestry, composites, marine science and environmental (as it replaces chemically treated wood). In this case it is listed as a composite.

Ongoing Cost-share Commitments:

The Cost-sharing listed in the previous table represents the amount required at the time of the award. All cost sharing does not come from MEIF but often includes departmental resources and the time of personnel committed to the project. The University has the following outstanding commitments for the next 5 fiscal years against Maine Economic Improvement Funds. With the reinstatement of the $2 million of Maine Economic Improvement Funds originally included in the FY03 appropriation, the University can leverage more grants and contracts, and current commitments to research projects that require matching funds, such as the NSF EPSCoR project, would not be jeopardized. Additional commitments will be made as new grants are awarded during each fiscal year.

OUTSTANDING MEIF COMMITMENTS	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**
Advanced Materials and Composites	$1,899,496	$1,722,222	$1,202,486	$1,109,516	$1,017,904
Biotechnology	2,432,054	1,667,880	1,403,546	425,546	425,546
Aquaculture and Marine Sciences	1,393,586	1,075,815	1,009,168	953,760	374,000
Forestry and Agriculture	2,291,114	1,681,552	1,613,642	1,361,735	1,266,734
Information Technology	1,568,256	1,717,872	1,469,357	1,406,054	1,090,254
Environmental Technologies	1,536,869	1,318,731	963,195	974,210	613,543
Cross Sectors	708,334	600,000	600,000	600,000	600,000
Totals	***$11,829,709***	***$9,784,072***	***$8,261,394***	***$6,830,821***	***$5,387,981***

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Aquaculture and Marine Science*

Purpose of Research Area

At UM, Aquaculture and Marine Sciences includes science and technology related to rearing food and non-food species such as finfish (salmon, cod, halibut, marine tropicals, rainbow smelt) shellfish (oysters, clams, scallops, mussels), seaweed, and other organisms such as seaworms. Marine Science includes marine monitoring technologies such as the Gulf of Maine Ocean Observation System (GoMoos), Gulf of Maine biological and physical oceanography research, understanding the biological, physical and chemical patterns that effect fisheries and the environment, advanced materials which can survive in the hostile marine environment for waterfront infrastructure and marine vessels, and new value-added food products.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. Spin-off Companies

Saltwater Marketing, LLC, of Portland has formed to commercialize and market UM, Lobster Institute technology to freeze seafood, particularly lobsters. This method of freezing seafood enhances the flavor and improves shelf life so that seafood can be stored under commercial conditions. The technology is patented in the United States and Canada.

B. Aquaculture Incubator

Aquaculture Business Incubators at University Facilities in Franklin and Walpole
Three years ago, the University of Maine and the Washington County Technical College partnered with the Maine Aquaculture Innovation Center (MAIC) to establish an aquaculture business incubator program. Using state funds provided by DECD, MAIC and the University of Maine secured $750,000 - $250,000 for construction of incubator space at the Darling Marine Center in Walpole, and $250,000 for incubator space at the Center for Cooperative Aquaculture Research in Franklin and $250,000 for space at the Marine Trades Center at the Washington County Community College in Eastport.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Aquaculture and Marine Science (Continued)*

State Need

Maine's aquaculture industry (salmon, mussels and oysters) in 2001 directly employed over 1,000 Maine citizens. A significant portion of this employment is located in eastern Hancock County and in Washington County, both economically depressed areas. In 2002, problems encountered by the Atlantic salmon aquaculture industry lead to significant lay-offs in the industry and in other sectors that support fish farming. During the same period, citizens interested in marine aquaculture have been applying in record numbers for the permits necessary to farm shellfish (oysters, mussels, and scallops) and echinoderms (urchins). The aquaculture business incubator program responds to the public's strong interest in aquaculture industry growth, and in the need to develop high value new finfish species such as Atlantic halibut, haddock, and codfish.

Program Objectives

Two marine labs were constructed with incubator program support at the Darling Marine Center in FY03. In the spring of 2003, Micro Technologies Inc. of Richmond Maine was chosen to be the first business incubator tenant at Walpole. MicroTechnologies Inc. provides pathology services to the aquaculture industry and is developing a vaccine to combat infectious salmon anemia virus, a pathogen that has resulted in significant production declines and economic losses over the past two years.

At CCAR in Franklin, the first incubator tenant is Seabait of Maine, a new farm that produces marine polychaete worms, used by anglers as bait, and by fish farmers as a feed supplement for broodstock. CCAR staff helped Seabait of Maine secure a $485,000 "Development Award" by the Maine Technology Institute. The funds will in part be used by Sea Bait to locate within the incubator at CCAR.

Also at CCAR, the University is working with another new company that wants to explore the profitability of farming marine species (such as halibut and cod) on land, in tanks using recirculation aquaculture systems. The University's partnership with this start-up company will develop as soon as a $2.3 million marine hatchery facility is completed. Ground breaking for hatchery is scheduled for late October 2003. The business incubator program is providing funds for construction, University R&D monies, and a $1.2 million grant from the Economic Development Administration (EDA) of the U.S. Department of Commerce.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Aquaculture and Marine Science (Continued)*

C. Student Researcher Start-up Companies

Sea and Reef Aquaculture, LLC, was formed in FY03 by two Ph.D. students in the School of Marines Sciences. Funded by the NSF their research involves the captive rearing of marine tropical fish. In parallel, Chad Callan and Soren Hansen have started a company to grow, market, and sell tropical fish for the aquarium market. Currently, these fish are harvested from the wild, so this technology will be environmentally friendly and produce a better product. The company has received a Maine Technology Institute Grant and are being assisted by the UM business Incubators.

Maine Coral Aquaculture, LLC, has been formed by SMS graduate student Craig Seavis. Craig has created a new company based on his research in UM's marine science program to grow coral using aquaculture techniques. He envisions commercial development of a viable ornamental coral aquaculture facility in Maine to target reef aquarium enthusiasts. Maine Coral has received a grant from the Maine Technology Institute to commercialize this research.

D. Faculty Innovations

Many faculty in the sector have innovative ideas that are directly related to the Maine Economy. They range from "marine borer resistant composite pilings", "composite-to metal joining technology" for marine vessels, artificial lobster baits, and filter materials made from waste crab and lobster shells. Below are current examples that have made significant progress in the last few years.

Juvenile Oyster Disease

Maine's Damariscotta River estuary is an ideal place to grow oysters. In the summer, they thrive in the algae rich broth created by the mixing of a warm river with upwelling seawater. However, for oysters and oyster farmers, there is trouble in paradise. An organism that causes juvenile oyster disease (JOD) also finds the estuary to its liking. With a touch of irony, it makes infected oysters starve in the midst of plenty. It has been the target of a concerted University of Maine research effort for more than a decade, one that is paying off.

Through much of the 1990s, researchers worked to identify a cause. Former UM shellfish pathologist Bruce Barber and his graduate student turned oyster farmer Chris Davis led that work. They showed that oyster growers could cut their losses by selecting for fast growing stock.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Aquaculture and Marine Science (Continued)***

In 1999, Kathy Boettcher, Barber and John Singer, all of the Dept. of Biochemistry, Microbiology and Molecular Biology and School of Marine Sciences, reported a milestone in the search for the cause of JOD. They demonstrated that the disease could be treated with antibiotics and thus must have a bacterial origin. Then, they used new laboratory culture techniques and DNA analysis to discover the presence of a previously unknown species of bacteria on oysters that were sick. The bacteria were not found on healthy oysters. Additional studies with the bacteria, tentatively named *Roseimarina crassostreae*, have confirmed its primary role in JOD.

Boettcher's efforts to understand both the disease and what oyster farmers can do to minimize losses have earned praise from the industry. "Her work has given the industry an understanding of what causes JOD and what we can do to prevent it. She has shown a real determination to work with people in the oyster industry, and we appreciate it," says Dick Clime, one of the state's pioneer oyster farmers on the Damariscotta.

First recognized as a significant problem in Maine in 1988 and subsequently in New York and Massachusetts, JOD can kill more than 90 percent of the cultured young oysters in a farmer's stock. That's a tough loss in an industry just getting on its feet. Maine growers raise high quality American oysters, *Crassostrea virginica*, for what they call the white table cloth market. In 2002, market size oysters brought in revenues of about $850,000.

The Maine Aquaculture Innovation Center (MAIC), a state supported organization located at UM, is leading efforts to establish new oyster farms, but JOD is a significant barrier. "JOD is the one thing that has kept oyster culture in Maine from expanding," says Clime, MAIC board chair and a UM graduate.

Not a threat to people, the disease continues to affect oysters in other parts of the Northeast. In 2003, it was reported for the first time at Martha's Vineyard where a major producer lost about half of his juvenile stock.

As its name implies, the disease kills young oysters. It generally strikes between July and October after they've been placed in open water to grow to adult size. The Damariscotta is both the heart of Maine's commercial oyster industry and the location of most JOD outbreaks in the state.

Boettcher has identified several possible methods for detection and treatment that may have commercial value in supporting the Maine industry and commercialization. The University is currently investigating the commercialization potential.

In addition, with Funding through the Maine Technology Institute, the aquaculture industry and MAIC, the University has begun a selective breeding program to develop a JOD resistant brood-stock for future generations of oysters.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Aquaculture and Marine Science (Continued)*

UM WOOD COMPOSITES CENTER TO DEVELOP NEW PIER MATERIALS FOR THE U.S. COAST GUARD

New building products being developed at the University of Maine Advanced Engineered Wood Composites (AEWC) Center could help the U.S. Coast Guard with renovations at its aging marine facilities. The Coast Guard and the AEWC have entered into a three-year $500,000 contract to develop and test wood composite components for decks, walkways and retaining walls.

The service is hoping to develop components that will last longer, minimize environmental impact, and be made from recycled materials. The need for repairs at existing Coast Guard facilities in the Northeast alone is estimated to cost about $120 million.

Engineers at the AEWC will design, develop, install and monitor wood composite materials for slip resistant pier decks and retaining walls. Materials will be manufactured on AEWC's Davis Standard Woodtruder machine using 60% wood fiber and 40% polyolefin plastic.

Plans call for the installation of extruded decking at a pier in New Haven, Connecticut to see how well the decking performs under working conditions. AEWC engineers will also design and test a 100-foot by 25-foot retaining wall and compare the performance of four kinds of deck planks on the walkway at the Owl's Head lighthouse near Rockland, Maine.

Gulf of Maine Ocean Observation System (GoMOOS)

Traditionally, people who depend on the ocean for a living have managed with little or no up-to-date information about currents, winds and waves. When they needed to know the location of fog banks or the wind direction in the Gulf of Maine, mariners had only weather reports and their own hard won experience. But now, there's a new source of information in the form of a 24-hour watchdog known as the Gulf of Maine Ocean Observing System, or GoMOOS.

In the past year, 10 GoMOOS monitoring buoys have been sited offshore from Boston to Saint John, New Brunswick and as far east as the waters off Nova Scotia. Using the latest monitoring technology, the buoys measure air and water temperatures, visibility, and wave heights. In addition, two land-based facilities constantly sweep most of the Gulf for current speed and direction. Most of the information is available via the Internet at www.gomoos.org or http://gyre.umeoce.maine.edu/gomoos.php.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Aquaculture and Marine Science (Continued)*

The University of Maine is one of 31 member organizations for the system, which is owned and managed by a nonprofit corporation in Portland, GoMOOS Inc. Neal Pettigrew, UM physical oceanographer and an associate professor in the School of Marine Sciences, is one of the system founders and its chief scientist.

Buoys are maintained in a new ocean operations facility by the Physical Oceanography Group at the University of Maine.

"We are a prototype for a national federation of regional ocean observing systems that will go up one coast and down the other. This is the first one.", says Pettigrew.

The system was built with federal funding but is envisioned to operate as a utility by leasing buoy space for research and providing other information services.

E. Partnerships

The University of Maine continues to maintain strong partnerships within the Maine marine science and aquaculture community. Major initiatives over the last year include the creation of the *National Coldwater Marine Aquaculture Center* with the USDA Agriculture Research Service. To date UM has worked with the Maine delegation to leverage over $13 million dollars to construct facilities at Orono and Franklin and collaborate with UM scientists. USDA ARS Research Leader, Dr. Bill Wolters is now housed at UM and has begun a salmon breeding program at existing UM facilities at Franklin.

Another blossoming partnership is between the UM School of Marine Sciences and the Gulf of Maine Research Institute (formerly the Gulf of Maine Aquarium) in Portland. UM is exploring co-locating several scientists at the GMRI as it becomes available.

Ongoing Maine partnerships include the GoMOOS organization, the Maine Aquaculture Association, Washington County Community College, Maine Maritime Academy, Bigelow Labs, MDIBL, University of Southern Maine, the Maine Department of Marine Resources, and many other public and private sector community organizations. Maine Seagrant and UM Cooperative Extension are particularly involved with local businesses and communities through its Marine Extension Program.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Biotechnology*

Purpose of Research Area:

At UM Biotechnology generally includes life science research that is related to humans, animals, and plants. Much of the biotechnology is related to understanding the environment in Maine including the plants we grow for crops (trees, potatoes, blueberries, etc.) and the animals we catch or raise (fish, shellfish, lobsters). We study how they grow and live, what impacts they have on the environment and what impacts them, and how to make them healthier and sustainable. In addition, we look at the health benefits from natural bio-products and how they may treat human disease.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. UM Technology Spinouts

None

B. Biotechnology Incubator

The Thomas Teague Center is the State's ADTC for Biotechnology. While UM is watching for start-up companies that may logically locate in this center, there are none at this time. UM did support the center on its National Science Foundation grant proposal to the *Partnerships for Innovation* program to increase the likelihood of biotechnology commercialization in Maine.

C. Student Researcher Start-up Companies

None

D. Faculty Innovation

Juvenile Oyster Disease – Kathleen Boetcher – See Aquaculture

E. Partnerships

The University of Maine has entered into significant biotechnology partnerships during the past fiscal year. The awarding of the National Science Foundation EPSCoR cooperative agreement brings $6 million to the state over three years to create the *Institute for Molecular Biophysics* in partnership with the Jackson Laboratory and the Maine Medical Center Research Institute. Formation of the IMB will lead to additional funding from NIH and NSF and international partnerships with institutions such as the University of Heidelberg.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Biotechnology (Continued)***

Additional collaborations with the Maine Biomedical Coalition include partnerships with the Foundation for Blood Research, the University of New England, and the Mount Desert Biological and Laboratory. Funding includes NSF and NIH.

A final example of partnerships is the research being done in collaboration with Eastern Maine Medical Center to evaluate the medical properties of extracts from blueberries.

F. Additional Highlights

NSF IGERT

With a $2.6 million five-year grant from the National Science Foundation (NSF), three Maine research organizations are poised to take a major step in genomics research and graduate education. The grant will allow the University of Maine, The Jackson Laboratory (TJL) and Maine Medical Center Research Institute (MMCRI) to establish an interdisciplinary Ph.D. program in functional genomics.

The program, which is offered under UM's Interdisciplinary Ph.D. umbrella, introduces a new graduate education paradigm that will prepare students for fundamental changes in the approach to the biological/biomedical sciences. The structure of the program also increases the level of interaction and cross-disciplinary collaboration among faculty members in the three institutions.

The study of functional genomics focuses on the interplay between genes and the biological machinery that enables an organism to live and reproduce. It involves further refinement of our understanding of genome "language" and of how that information is organized and used.

The initiative is funded under an NSF program known as Integrative Graduate Education and Research Traineeship, or IGERT. The grant, which has been awarded to UM, is led by Barbara Knowles, associate director of TJL and director of research. Participating faculty come from UM, TJL, and MMCRI.

"This grant and a possible companion program now under consideration by the Deutsche Forschungs Gemeinschaft of the German government, to support German graduate students in this international program, will combine to make a unique program of study," says Knowles. "I envision that students from the U.S. or Germany will be able to study with internationally recognized scientists in either country. They will receive cross-disciplinary training so that they can use the tools of physics, engineering, chemistry, genetics and genomics, as well as the computational sciences, to unravel the functions of individual genes and the interactions between them to influence complex traits. This is a whole new way to think about training graduate students, and we in Maine are really excited to be at the crest of this wave."

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Biotechnology (Continued)*

Students will move through a core curriculum in the biological, computational, and physical sciences. They will develop a research project drawn from the many possibilities at the three institutions. Instead of being closely guided by a single faculty member, as is done is in traditional graduate programs, students will work with a pair of scientists representing different disciplines. The students' thesis research will likewise encompass experimental approaches from more than one discipline.

This award serves as the foundation for a 'Research Triangle' between the three institutions and uses graduate education to reinforce the stability of the Triangle," says Tom Maciag, director of the Center for Molecular Medicine at MMCRI and co-principal investigator on the IGERT application. "Furthermore, this award may also enable the development of new and exciting research collaborations within the 'Research Triangle' that may facilitate the submission of additional competitive research applications to funding agencies other than the NSF."

Questions in functional genomics cannot be answered by the biological sciences alone, says Hutchison. Students will develop skills in the physical and computational sciences and work to understand the relationship between genes and development. The benefits may apply widely in medicine, agriculture, the environment and other fields.

BIOTECHNOLOGY INDUSTRY BECOMING A MAJOR ECONOMIC FORCE IN MAINE

Biotechnology businesses are becoming a major force in Maine's economy according to a new University of Maine report. The industry generated nearly $432 million in sales and employed about 3,690 people in 2002. Because money spent by companies generates additional economic activity throughout the economy, the report estimates the industry's total economic contribution at $685 million in Maine with direct and indirect support for 7,135 jobs.

Todd Gabe and Tom Allen, assistant professor and associate scientist, respectively, in the Dept. of Resource Economics and Policy, wrote the report. They received support from the Maine Technology Institute, the Biotechnology Association of Maine, and the Maine Center for Innovation in Biotechnology and the Maine Agriculture and Forest Experiment Station. "The reason we did this study was to establish benchmarks for the size and vitality of this industry. The data will be useful in tracking the industry's performance in the future," says Gabe.

The report is the first part of a larger study that will focus on the business climate for biotechnology in Maine. Surveys will be conducted this winter to gather information about factors affecting the growth of the industry. Gabe and Allen did not collect any new data for the report. They based their analysis on government statistics, industry directories, and other sources. To select businesses, they used a definition that characterizes

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Biotechnology (Continued)*

biotechnology as "any technique that uses living organisms or parts of organisms to make or modify products...". They excluded medical services, pharmaceutical sales and marketing companies, and medical instrument manufacturers. Also excluded were traditional farm, forest, and fishing companies. Aquaculture firms, other than those that harvest seaweed to extract useful compounds, were not included.

Although there are 80 separate companies and non-profit organizations in the Maine industry, 10 of them accounted for the bulk of sales and employment. About half of the companies and almost 60 percent of biotech jobs are located in York and Cumberland counties. Other companies are located in mid-Maine and across the state, with more than 1,000 employees working at The Jackson Laboratory in Bar Harbor.

Maine's biotechnology companies produce medicinal, pharmaceutical, diagnostic and biological substances such as reagents, immunoassays, sensors and antibodies used in research and health monitoring.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials*

Purpose of Research Area:

At UM, Advanced Materials and Composite Technologies include many platform technologies that crossover into other sectors. For example "wood-composites", often a combination of wood and synthetic fibers and resins, are developed to take into consideration modern and sustainable harvesting technologies, environmental impact, and use precision manufacturing technologies such as extrusion, radio-frequency curing, and advanced IT models for design and engineering.

In addition UM's sensor program is highly dependant on the design and engineering of new composites and advanced materials, metals coated with polymers and filters made of natural products such as chitosan from crab shells.

Finally, truly high-tech composite structures are being researched and developed for applications in space for NASA or in combat for the Navy and the Army. High temperature, blast resistance, and survivability are the key characteristics.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. UM Technology Spinouts

Engineered Materials of Maine started in October 2002 based on a wood composite product, AEL, developed at the Advanced Engineered Wood Composites Center. This product is a laminated beam using low-grade hardwoods with applications in construction and transportation. EMM is operating in a 40,000 square foot facility in Bangor.

B. Composites Technology Incubator

The Composites Technology Center Incubator (CTC) is one of the State's Advanced Technology Development Centers (ATDC) and was formed as a partnership between the Sanford Industrial Development Authority, the Piscataquis County Economic Development Corporation, and the University of Maine. The CTC has a 20,000-sqft facility in Sanford (which is focused on synthetic composites) and is currently designing a new facility in Greenville to focus on wood composites start-up companies. Currently, several technologies under development at the Advanced Wood Composites Center are targets for the Greenville facility.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

C. Student Researcher Start-up Companies

UM Student Start-ups
Pell Innovations, LLC was formed by Jacob Pellitier, an undergraduate Mechanical Engineering student developing a composite archery bow as his first project. Pell, assisted by the Target Technology Incubator, has received a $10,000 seed grant from the Maine Technology Institute. Jacob will start the Fall 2003 semester as a graduate student in mechanical engineering supported by a NASA fellowship working on advanced materials. He is also assisting the Maine Patent Program (UM Law School) as an intern and is working with program director Woody Higgins.

D. Faculty Innovation

Patents Issued
One new U.S. patent was issued in FY03 for a building construction method using fiber reinforced oriented strand board panels that would make a structure stronger and more durable and, therefore, more resistant to natural disasters like hurricanes. The inventor was Dr. Habib Dagher, director of the AWEC.

Code Reports
The University of Maine AEWC received a proprietary ICBO building code report on the Advance Engineered Lumber product. The Code Report is optioned for license to Engineered Materials of Maine, of Bangor.

New Patents Filed this FY03
5 composites/advanced material patent applications were filed in FY03.

Inventors	Department	Application
Dagher, Fiutak, McDougal	AEWC, DIC	(1) Composite
Dagher, et al	AEWC, Wood Science	(1) OSB
Goodell. Lopez	AEWC, Wood Science	(1) COMPRIS
Da Cuhna	Electrical Computer Engineering	(2) Sensor Materials

New Licenses and License Options
Technology related to Advanced Engineered Lumber (code report, technical data, and patent application) was optioned for licensed to Engineered Materials of Maine.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

E. Partnerships

The University of Maine Advanced Materials and Composite Technologies groups continue to have strong partnerships locally and nationally with both public and private groups including:

The Maine Composites Alliance, the Maine Department of Transportation, the Maine Department of Economic and Community Development, The U.S. Department of Defense (Navy and Army), U.S. Department of Agriculture Forest Products Laboratory, Federal Highway Administration, and the U.S. Coast Guard. Private Maine companies such as Bath Iron Works, Applied Thermal Sciences, Hodgdon Yachts, Custom Composites, Kenway Corporation, and Correct Deck continue to collaborate on projects. National Companies such as JM Huber, BP America, DuPont, Pacific WoodTek, and Louisiana Pacific continue to partner in these programs as well.

Perhaps the two of the most significant partnerships evolving over the past year are a partnership between the Laboratory for Surface Science and Technology and the microelectronics/semiconductor industry around the development of new MEMS R&D capabilities and facilities in the new Engineering and Science Building. The group has received considerable attention and equipment donations from equipment manufacturers.

The second is the R&D capability to meet the Department of Defense's needs for infrastructure through a joint program with the Advanced Wood Composites Center. Nurtured by Chancellor Westphal, this emerging relationship shows strong promise for Department of Defense support for research and technology development.

F. Additional Highlights

Modular Advanced Composite Hullforms
The U.S. Navy is exploring the technology to build a new generation of high-speed support ships with the help of the University of Maine and companies in Maine, Hawaii, and England. These vessels would combine traditional steel infrastructure with underwater bodies or hulls made of composite materials. The resulting hybrid could lead to ships that meet the Navy's needs for faster and lighter mid-size vessels, says mechanical engineering professor Vince Caccese, UM's project coordinator. The technology could also have civilian applications.

This Modular Advanced Composite Hull Form project, known as MACH, has attracted more than $4.5 million in federal funding, as well as support from U.S. Navy research labs. Partners in the project include Pacific Marine in Honolulu; Applied Thermal Sciences, an engineering consulting firm in Sanford, Maine; and Nigel Gee and Associates, a naval architecture firm in Southampton, United Kingdom; as well as U.S. Navy labs in Maryland and Rhode Island.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

At the University of Maine, students are collaborating with faculty and professional engineers to design, build, and test hybrid hulls that can withstand underwater speeds of 50 knots or more. The challenge is to increase structure strength through the manner in which the composite panels are fastened to the internal steel frame. Moreover, the hull must be easily manufactured and maintained — all at a cost the Navy can afford.

In addition to UM mechanical engineers, electrical and computer engineering professor Bruce Segee is leading a team that is developing a computing and data management system to monitor structural stresses in the hull and relay information to the ship's crew. Their approach uses sensors that are built into the panels. The idea is to give the crew an immediate view of the hull structure. "Our focus is computing power and networking so that multiple sensors can be placed inside the panel, but the number of wires going to the panel remains small and independent of the number of sensors. All you need for the electronics is power, ground, and a network connection," says Segee.

Many of the experimental composite parts are being designed and made from scratch. Working with engineers Keith Berube and Rangy Bragg, students use a process known as resin transfer molding to make panels of different shapes. As many as 16 sheets of woven fiberglass fabric may go into a single panel. Liquid resin the color and consistency of maple syrup is pumped through the fabric layers. One panel can be made in about a day.

Once they dry, the panels are studied in UM's mechanical engineering structural testing laboratory in Boardman Hall. The composite panels are bolted to steel I-beams; then the joints are stressed to determine just how much pressure they can withstand without bending or breaking.

The tests have produced some interesting results. In one case, applying a high force bent the three-quarter-inch-thick steel structure, demonstrating the strength of the undamaged composite. In others, the location of cracks in the panels helped the engineers determine how stress is distributed in the bolted hybrid connections. Before they are done, the UM engineers will have studied dozens of panel and I-beam joints.

MACH offers UM engineers and their partners the chance to push shipbuilding into uncharted waters. It will be a long-term effort, says Caccese, with the potential for transforming the nation's maritime industries.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

UM ENGINEERING LAB MAY HOLD CLUE IN SPACE SHUTTLE COLUMBIA ACCIDENT INVESTIGATION

Researchers in a University of Maine mechanical engineering laboratory have characterized the high temperature degradation of carbon-carbon composites, the same type of material that is a current focus of attention by the board investigating the space shuttle Columbia accident.

With grants totaling more than $700,000 from the Missile Defense Agency through the Office of Naval Research over the past three years, UM researchers are developing a sensor that can monitor the integrity of these materials in structures such as a missile or an aircraft wing.

The Columbia Accident Investigation Board is looking at the possibility that pinholes could have led to a weakening of leading edge wing panels made of carbon-carbon composite. The panels could have been susceptible to damage by foam debris that hit the shuttle's left wing after liftoff. "NASA has taken some criticism for not monitoring the integrity of the shuttle wing structures, but it's not fair. Non-destructive testing techniques that can be applied to these types of materials are just being developed," says Mick Peterson, associate professor of mechanical engineering who leads the UM research effort.

In laboratory tests, Peterson's team has been able to use ultrasound to monitor the degradation of carbon-carbon composite material at temperatures of more than 1,000 degrees Centigrade. "The degradation that carbon-carbon composites are susceptible to are not detectable at an early stage by traditional non-destructive testing techniques. Once significant damage has occurred to the material, fracture toughness may have decreased dramatically. We are now beginning to develop methods that can help us to understand the degradation mechanisms by using in-situ sensors. No one yet knows how to do the kind of detailed material monitoring that is required," says Peterson.

Carbon-carbon composites are constructed of carbon fibers embedded in a carbon matrix. They were developed in the 1960s for the space program because they retain their strength under high temperatures. The theoretical useful life of carbon-carbon material is calculated by knowing how quickly it oxidizes, says Peterson. In the presence of oxygen and heat, the carbon slowly burns away. "But that useful life can change. If something comes in and gets hotter than it's supposed to or if there's some contamination, we don't know what the impact is on its lifetime. We could have accelerated these oxidation processes in the carbon, and those accelerated oxidation processes can lead to premature failure," says Peterson. "The oxidation can be localized because of contamination. Then because of density variations in the carbon, it can essentially tunnel through these areas, and once that tunneling has occurred, you've got a porous interior and a hard exterior. Ultrasound is able to see through that top layer and identify the

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

characteristics of that material under the surface. Our technique enables us to quantify the degradation mechanisms and the effect of contamination without requiring that an unreasonable number of tests be performed."

The high temperature sensor under development in Peterson's lab uses ultrasound to indicate the integrity of a carbon-carbon material in place in a structure. In Peterson's laboratory, special precautions are taken to protect parts of the monitoring system that are sensitive to heat. The sensor generates an ultrasound signal at room temperature and uses fused quartz wave guides — clear rods about a half inch thick — to transmit that signal to the heated material in a furnace.

The research team has recently published results of the work in Acoustics Research Letters On-Line and previously presented the work at the Review of Progress in Quantitative Non-Destructive Evaluation. It has also submitted a paper, "In-Situ High-Temperature Monitoring if Carbon-Carbon Oxidation Using Time Reversal Mirrors," to the International Conference on Composite Materials scheduled for July 2003. Peterson expects to have a prototype sensor system completed in 2003.

UM WOOD COMPOSITES JOB CREATION EFFORTS GET BOOST FROM NATIONAL SCIENCE FOUNDATION

Ongoing efforts at the University of Maine to create jobs through the commercialization of wood composites technology received a boost from a $575,543 National Science Foundation grant. The money will support marketing and business development activities in the UM Advanced Engineered Wood Composites Center (AEWC). AEWC engineers and scientists specialize in research and development of products made with wood and fiber-reinforced polymers or FRPs.

UM was selected as one of 12 universities in the nation to receive the grant through the NSF Partnerships for Innovation program. Efforts will focus on working with businesses to develop wood composite beams using low-grade hardwood, disaster-resistant housing using FRP-reinforced OSB sheathing panels and long-strand-composite lumber (LSCL) beams and columns produced by mechanically crushing low-value logs.

Other organizations have pledged to work with AEWC on business development. They include the Maine Technology Institute, Eastern Maine Development Corp., Maine Department of Economic and Community Development, The Manufacturing Extension Partnership, Maine Department of Transportation, Louisiana Pacific, Dow Chemical, State Farm Insurance, Henderson and Bodwell, The Kenway Corp., Market Development Alliance of the FRP Composites Industry, APA the Engineered Wood Association, National Institutes of Standards and Technology, USDA Forest Products Laboratory.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Composites and Advanced Materials (Continued)*

NSF expects institutions to act as catalysts in helping their surrounding communities transform research-based knowledge into innovations that create opportunities for new wealth and a broader economic base that benefit communities and the nation at large.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Environmental Technologies***

Purpose of Research Area:

The State of Maine recognizes seven technology sectors for which programs such as the Maine Technology Institute and the State Incubator Programs support. The original Maine Economic Improvement Fund legislation recognizes five sectors. Many of the R&D projects at UM are easily co-listed between Environmental and Forestry and Agriculture, Aquaculture, and Marine Science. UM has chosen to break out separate categories for ease of comparison.

At UM, research and development related to the environment is involved in nearly every discipline. As a natural resource based state and economy, all aspects of our state rely on understanding and maintaining a healthy and sustainable environment. Research and development at UM extends from understanding the basic mechanisms of nature which effect our environment, mechanisms, and technologies to monitor our environment, predictive models to use the data collected, and technologies to prevent damage or repair or clean-up existing damage.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. UM Technology Spinouts

None at this time.

B. Incubator

The Center for Environmental Enterprises in South Portland serves as the State Incubator for the environmental technologies sector. The University of Maine is assisting two tenants of the incubator, Benric Technologies and New England Classics.

C. UM Student Start-ups

None at this time.

D. Faculty Innovation

Patents Issued

A US patent was issued for "... attracting and repelling substances for the Colorado potato beetle", a pest harmful to potato agriculture. Dr. Randall Alford was the co-inventor along with Joseph Dickens of the USDA Agricultural Research Service.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Environmental Technologies (Continued)***

New Patents Filed
The University of Maine converted a provisional patent application to a full application for the bioremediation of industrial wastes, invented by Drs. Barry Goodell and Jody Jellison.

Three new patent applications were filed on papermaking technology for retention. These are listed in the Forestry Agriculture Section.

New Licenses and License Options
Papermaking "retention" technology has been non-exclusively licensed to SAPPI Fine Paper and is working in the Somerset Maine mill. In addition, the University granted an exclusive license option to Tate and Lyle Corporation for North America and Europe. AE Staley (the U.S. division) is currently running trials at 2 U.S. mills. The technology increases the amount of fillers and fibers retained in the paper web, thus reducing the waste stream. This technology is also listed in the Forestry Agriculture Section.

E. Partnerships

The University of Maine has longstanding partnerships in the Environmental, Forestry, and Agriculture sectors including State Agencies such as the Maine Department of Environmental Protection, the Maine Department of Agriculture, the Maine Forest Service, the Department of Conservation and the Department of Economic and Community Development. Private sector partners include the Agricultural Council of Maine, the Biotechnology Association of Maine, the Maine Beef Association, the Maine Dairy Industry Association, the Maine Deer and Elk Association, the Maine Farm Bureau, the Maine Forest Products Council, the Maine Golf Course Superintendents, Maine Greenhouse and Flower Growers Association, Maine Harness Racing Association, Maine Landscape and Nursery Association, Maine Organic Farmers and Gardeners Association, Maine Pomological Association, the Maine Potato Board, Maine Sheep breeders Association, Maine Small Fruit and Vegetables Growers, Maine Wild Blueberry Commission, the Small Woodlot Association of Maine and the Maine Wood Products Association. In addition, faculty participate in the associated national associations and also work directly with individual companies, many who are members of these associations.

In addition, the University has many partnerships with the paper industry, most related to assisting with increasing productivity through eliminating waste, reducing chemical and energy use. Such partnerships are often funded by the industry, U.S. Department of Energy, EPA, and the Maine Department of Environmental Protection.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Environmental Technologies (Continued)***

F. Additional Highlights

Abrupt climate change

In the last decade, ongoing research has overturned some long held beliefs about the Earth's climate. Until 1992, prevailing scientific opinion considered climate to be a lethargic beast. Change came slowly, it was thought - over eons. Moreover, the oceans and the atmosphere, two of the most important parts of the climate system, were considered to be largely independent of each other. Not any more.

Eleven years ago the results of ice core analysis from the Greenland Ice Sheet Project (GISP2) surprised scientists with a glimpse of a more temperamental climate system. Since then, evidence in ocean sediments and ice cores from Antarctica and high mountain glaciers tell similar stories. In the past, average temperatures, storm frequency, precipitation patterns, and even ocean currents have changed substantially in less than a decade.

"There's no longer any doubt that the climate system in the past has changed relatively quickly from one state to another," says Paul Mayewski, director of the Climate Change Institute at UM and the leader of GISP2. "It's unlikely that there's a single cause, although in my opinion, changes in the amount of energy output from the sun could play an important role."

The new evidence is more than academic. Climate changes are considered to be a major factor in human history. The fate of ancient civilizations as far apart as Peru and the Middle East appear to have been influenced by changes in the frequency and severity of flood and drought.

About 600 years ago, a smaller climate shift opened a period that scientists call the Little Ice Age. Sea ice expanded at the poles, and average temperatures dropped. Harsh winters influenced human activity, leading, for example, to the abandonment of Norwegian colonies in Greenland.

If scientists could get to the bottom of climate shifts, says Mayewski, they might be able to predict future climate with more reliability. Such knowledge could have major implications for energy, agriculture, and even political stability.

Mayewski and his colleague George Denton, UM Libra Professor of Geological Sciences, are working with U.S. Senator Susan Collins to develop a federal $60 million research program on abrupt climate change. As currently envisioned, says Mayewski, UM would lead a consortium including the University of New Hampshire, the University of Washington, Penn State, and the Lamont-Doherty Laboratory at Columbia University. Collins has introduced the Abrupt Climate Change Research Act of 2003 for U.S. Senate consideration.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Environmental Technologies (Continued)***

New Sensor Technology for Waterborne Pathogens

Scientific advances don't stem only from new discoveries. Sometimes they occur when existing knowledge is combined in new ways. At UM, electrical engineers and molecular biologists have joined forces in an effort to develop a new sensor that can rapidly detect pathogens in water. The potential use: water supplies that need constant monitoring to make sure they are safe.

Their device uses technology that has already been developed — langasite crystals that vibrate when a voltage is applied, and nucleic acids or proteins that can recognize and bind to a possible contaminant such as e.coli or vibrio cholera.

Working in the College of Engineering and the Laboratory for Surface Science and Technology, Mauricio Pereira da Cunha and Paul Millard have received a $79,968 National Science Foundation grant to explore their ideas. Current detection approaches, says Pereira da Cunha, work but take too long. "If you take water to a lab and there is a risk of contaminating a population, by the time the lab comes back with the results, and says, 'yes, this water is contaminated,' half the population could be dead," he adds.

NEW U.S. WEATHER STATION LOCATED AT UM

A new U.S. weather station located at the University of Maine's Rogers Farm in Old Town is part of a system that will provide national climate data for the 21st century. The automated facility is part of the Climate Reference Network being developed by the National Oceanic and Atmospheric Administration (NOAA).

The UM site is one of over 100 similar stations being erected to monitor the weather across the country. The only other network station in Maine has been located in the Aroostook Wildlife Refuge at Limestone. NOAA expects the complete network to have 250 stations altogether.

"We are the custodian of the new weather station at Rogers Farm," says Steve Reiling, director of the Maine Agricultural Center who oversees UM's research farms. UM officials have signed an agreement with NOAA to host the facility and make inspections if problems occur. NOAA will arrange for regular maintenance.

According to Greg Zielinski, Maine State Climatologist and a research associate professor in the UM Institute for Quaternary and Climate Studies, the goal is to provide data for climate trend analysis with a minimum of adjustments for changes in monitoring conditions. NOAA contacted UM last spring to make arrangements for the station, which was built in September.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Environmental Technologies (Continued)***

Zielinski and Reiling assisted with the search for suitable sites on the UM campus. "They were looking for sites that are unlikely to be developed in the future. University owned land on a research farm is suitable because it's likely to stay undeveloped for the long term," says Zielinski.

Scientists who analyze currently available weather data over large geographic areas must account for local changes in land use around each station, Zielinski notes. One such problem is known as the urban heat island effect. It occurs because urban development has resulted in warmer local conditions around many stations. Scientists who analyze national or global climate trends make adjustments to remove the urban heat island effect. Nevertheless, original unadjusted data is preferable because it is more likely to reflect the true climate at a station, Zielinski adds.

The facility includes three temperature sensors as well as equipment to monitor wind speed, relative humidity, solar radiation, and precipitation. Data from the UM station is transmitted by satellite to the Oak Ridge National Laboratory in Tennessee where it is made available to researchers and the public. More information about the Climate Reference Network and data from the UM station can be seen at http://lwf.ncdc.noaa.gov/servlets/crnall.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Information Technology*

Purpose of Research Area:

At UM, Information Technology (IT) takes many forms and again crosses over many disciplines. It includes both hardware and software development and applications that help solve problems in other fields. Over the past three years, the University of Maine has expanded its IT capability considerably by becoming an Internet 2 institution and developing super-computing capacity. Crossing over into the creative economy, the New Media program offers IT related technology development outside the traditional hard-sciences. The creation of a digital time-based media lab in late FY03 is bringing the latest IT tools to that segment of the Maine economy.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. UM Technology Spinouts

Intelligent Spatial Technologies, LLC, Chris Frank, is a graduate student in UM's spatial information science and engineering program. Earlier this year, he formed his own company, Intelligent Spatial Technologies, based on departmental research. Its first product, SmartMap, is a mobile mapping system that tells users not only where they are but what they are looking at.

The company is now located in the Target Technology Incubator where he has already added an employee and received funding from the Maine Technology Institute and the National Science Foundation SBIR program. The company is also a subcontractor on a UM research project.

B. Target Technology Incubator

The Target Technology Incubator is a partnership between the Bangor Target Development Corporation and the University of Maine and is one of the States Advanced Technology Development Centers. It focuses on IT sector companies but also serves tech-based business in the region. The goal is to provide information technology companies with the expertise, tools, resources, and networks necessary to make their ventures a success, within an environment that fosters information technology development, commercialization, and successful business management practices.

Companies can benefit from the services of the Incubator as Tenants, Affiliate Members or seminar participants.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Information Technology (Continued)*

GOALS:

- Develop emerging technologies into viable companies.
- Create an environment of entrepreneurship to foster economic development in the region.
- Develop successful management practices to ensure continued success of companies.
- Expand resources in the region to support technology related enterprises.
- Encourage students/youth to consider self-employment/new company formation a viable career option.

Current Tenants:

Stillwater Scientific Instruments

Stillwater Scientific Instruments (SSI) is developing a device that dramatically decreases the time it takes to analyze chemical compounds in the laboratory. This device, a component of mass spectrometers, will be sold to laboratory equipment manufacturers. Mass spectrometers are sold primarily in the biomedical and pharmaceutical industries as well as environmental fields in which complex chemical mixtures must be accurately identified.

This device was developed through research at the University of Maine, and Stillwater Scientific Instruments was founded to commercialize this technology. The project has received funding from the National Science Foundation and the Maine Technology Institute.

The Incubator has provided Stillwater support in the areas of commercialization, negotiating agreements, management structure/policies, market research, fund raising, financial management and marketing.

Foxtech, Inc.

Foxtech Design, Inc. recently relocated to Maine from Michigan. Foxtech was formed in November 1997 to provide CAD (Computer Aided Design) and reverse engineering services to parts manufacturers and their suppliers. Highly detailed, accurate, and stylized 3D computer models are created for product and tooling designs of prototype and production parts. The types of parts include plastic injected, sheet metal stampings, hydraforming, and castings. Foxtech's customer base is primarily automotive, but also includes aerospace, medical, sports, and consumer products. Foxtech's services are needed when its customers cannot keep a design project in-house because of timing, experience, or equipment.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Information Technology (Continued)***

The Incubator has provided Foxtech with assistance in successfully relocating the company to Maine, access to University resources, identification of new markets through market research and industry contacts, marketing strategies, and opportunities. Ultimately the company hopes to expand their market base and create new jobs.

IST (Intelligent Spatial Technologies)

IST is a University of Maine Spin-off Company formed to commercialize the technology developed by the NCGIA. IST Founder Chris Frank is a graduate student from NCGIA and is continuing the commercial development of his thesis topic.

IST provides a full-range of integrated navigation, way finding, traveling, and information services that give the user control of when, where, and what kind of information is provided. The company has a strong background in spatial information research combined with over five years of experience in software design and development, and maintains strong links with the University of Maine.

IST is currently in the research and development phase of its first product - the SmartMap - a mobile mapping system that has an enhanced location and orientation capability. By knowing where someone is and what direction they are facing, a map is being developed that automatically aligns itself to the user and instantly provides relevant information about nearby geographic objects.

The Incubator has provided IST assistance in business planning, business structure, personnel/management, MTI SEED grant preparation, identification of markets, marketing opportunities, and commercialization strategies.

AFFILIATES PROGRAM: Target's Affiliates Program allows new and emerging companies the opportunity to benefit from the services of the Target Incubator without being physically located in the building. Affiliate members are potential future tenants.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Information Technology (Continued)*

Current Affiliates:

- Pell Innovations, LLC Technologies (Jacob Pelletier): UM grad student and faculty researchers commercializing solar energy products and developing products using advanced composite materials.

- Milcord: Advisors to technology companies regarding accessing Federal funding.

- Christian Gagnon: Entrepreneur engaged in new technology development.

- Mainely Sensors: Sensor technology developed in LASST for use in environmental applications. (UM Faculty and grad students)

- Sea and Reef Aquaculture: UM Ph.D. students researching aquaculture of marine tropical fish for the retail market.

- Survey Magik: UM student developing software program that creates web based surveys.

- VersionZero: New media development company founded by UM grad student who is also working as a grad assistant at the Target Incubator.

- Good Leads: Lead generation specialists serving technology companies. This established company is located in New Hampshire and expanding to Maine

- Sephone Internet: A web hosting, design development company located in Bangor, Maine.

- JMAC Multimedia: A newly formed division of Maine Family Broadcasting, Inc., specializing in multi-media marketing tools/presentations for business.

- Spill Free Oil Drainage Products, LLC: Developers of innovative products that solve environmental problems as well as promote efficiency and safety associated with the maintenance and delivery of fluids in the workplace.

C. UM Student Start-ups

Sea and Reef Aquaculture, LLC, was formed in FY03 by two Ph.D. students in the School of Marines Sciences. Funded by the NSF, their research involves the captive rearing of Marine tropical fish. In parallel, Chad Callan and Soren Hansen have started a company to grow, market, and sell tropical fish for the aquarium market. Currently, these fish are harvested from the wild so this technology will be environmentally friendly and produce a better product. The company has received a Maine Technology Institute Grant and are being assisted by the UM Target Technology Incubator in part because the sales strategy includes marketing for internet sales.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Information Technology (Continued)*

versionZero, LLC, was formed by new media graduate student Nathan Hankla in FY03. Nathan is a former intern at the Target Technology Incubator. During his internship, he created web sites for the Incubator, the MaineTech 2003 show, and ORED. His company not only creates web sites, but also other forms of digital media. His clients include other Target Center tenants and the East-West Highway.

D. Faculty Innovation

Patents Issued
None

New Patents Filed
UM, in partnership with Stillwater Scientific, converted two provisional patent applications related to the Time of Flight Spectroscopy which includes intensive statistical analysis via hardware/software techniques

New Licenses and License Options
BSA/BMA inventory management software for University computer stores, developed by Doug Marchio of the University Computer Connection is now in use and licensed by over 140 universities, colleges, and schools. UM continues to market this software and is looking to spin-off the software to a start-up company.

E. Partnerships

The University of Maine has strong partnerships in the IT world. The University has supported the State's Laptop Initiative through the Department of Computer Science, College of Education, the Computer Connection, and Offices of Sponsored Programs. Computer Science has help with training teachers, the College of Education with evaluating the use of the laptops, Computer Connection with acquiring technology for the program and Sponsored Programs with identifying research results that can support teaching objectives through the laptop vehicle.

Private Sector partnerships are strong with smaller companies like Applied Thermal Sciences of Sanford, Trefoil of Orono, and large companies like Apple which donated over $200,000 of software to help initiate the TimeLab project. UM NCGIA 's partnership with Intelligent Spatial Technologies will result in new commercial products from their research.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Information Technology (Continued)***

F. Additional Highlights

E-business software – Doug Marchio

Rapid turnover in computers and other high tech gear gives retailers a headache. What is hot one day can be out of date the next. Keeping track of product updates and availability, not to mention price changes, has had high tech sellers reaching for the aspirin.

Now comes a cure in the form of software developed by University of Maine students working with Doug Marchio, manager of the Computer Connection, UM's on-campus computer store. Known as the Buyers and Sales Assistant, or BSA, the new system has proven so successful that universities across the country are using it to manage their technology purchasing.

"The computer industry changes so fast. It's the hardest industry for sourcing products. For example, prices for memory sometimes change multiple times a day. It's a monster, and we've had to develop a monster tamer," says Marchio.

Through a contract with the Campus Computer Resellers Alliance, a higher education non-profit organization of over 600 colleges and universities, Marchio has seen a "lite" version of BSA solve technology procurement problems for some of the country's largest universities, including Stanford, the University of Illinois, the University of Southern California, and Colorado State. Separate contracts for full versions of BSA are currently being established with other large universities including NYU, University of Colorado, Old Dominion University and University of Rochester.

The approach was developed by Benjamin Scott, a 2000 UM computer science graduate, in conjunction with Marchio. It starts by importing computer supplier databases on a nightly basis (up-to-the-minute or real time is optional). The system retrieves, sorts, and filters the data to produce its own up-to-date searchable database. That information is then placed on a Web site and tailored to specific groups of users. Computer store buyers, for example, can use it to locate equipment rapidly that customer's request and to get them the best prices or "best" vendor terms. Suppliers benefit, says Marchio, by having their own information and vendor advantages show up within the BSA database about specific products. Campus retailers save money and time for their customers by finding the best "available" deals on everything from high-end PCs to printer ink cartridges. End user consumers will soon be able shop for themselves at an eStore (web page) that uses the same BSA database.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Information Technology (Continued)*

Scott, who developed the original computer code for BSA as a student, continues to work on the system from his home in Portland, Maine. "We've visited other universities and their computer stores," says Scott. "This system is unique. I'm excited that UM has supported it." Scott, who currently works with support from the UM Department of Industrial Cooperation, would like to see the system applied to the purchasing needs of other industries.

NEW SCIENTIFIC INSTRUMENT COMPANY IS BASED ON UM RESEARCH

A new business that is evolving from University of Maine research is moving into the Target Technology Center in Orono. Stillwater Scientific Instruments is developing a new device that dramatically speeds up the analysis of chemical compounds. The device is based on work by a research team led by Brian Frederick of Orono, a chemistry professor and member of the Laboratory for Surface Science and Technology (LASST) at UM. Frederick came to Maine in 1998. The new company will commercialize technology developed in his research group to increase the rate at which data from a chemical sample can be gathered.

"The best existing laboratory technology uses only about ten percent of the ions that are generated from a compound," says Frederick. "With the approach that we've developed, we use about 50 percent of the ions, so that the measurement can be made five times faster. In addition, we can achieve the same level of sensitivity."

The technology is based on modifications to a standard analytical technique known as mass spectrometry. Frederick estimates that about 20,000 mass spectrometers are sold annually, primarily in the biomedical and pharmaceutical industries. Other applications include environmental fields in which complex chemical mixtures must be accurately identified. The company will produce components for mass spectrometers that will be sold to other firms that manufacture laboratory equipment, representing a $1 billion market. "We want to create well paying, high tech jobs for Maine," says Frederick, who grew up in Williamsport, Pennsylvania but whose family has roots in Greenville, Maine.

Other members of the LASST research team who joined the new company include physicists Bob Jackson and Peter Kleban; a materials scientist, Jay LeGore; and electronics engineer, Bronson Crothers.

Frederick's efforts have received funding from the National Science Foundation, which supports both research and teaching. Funding to develop commercial prototypes has come partly from the Maine Technology Institute (MTI).

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Information Technology (Continued)***

Splendor in Seagrass through Intelligent Systems

Marine biologists from Maine to Australia are working with engineers at the University of Maine to monitor an ecosystem in retreat. Seagrass meadows provide critical habitat for commercially important fish species and occupy roughly ten percent of world's coastal seas. Unlike seaweeds, these rooted underwater plants put forth flowers and drop their leaves, as do their land-based cousins.

Researchers already know that reduced light transmittance through the water is a major factor. The problem usually starts at the deeper edges of the beds, where the light reaching the plants is only marginal, and progresses towards the shallower regions as conditions deteriorate. Reduced light is often related to murky water conditions that result from erosion on surrounding lands.

To understand this problem and even predict seagrass stress before more beds are lost, biologist Suzanne Fyfe at the University of Wollongong in Australia is using light reflected from seagrass leaves to develop an early warning system. "At present, satellite or aircraft remote sensing techniques can only detect deterioration in seagrass health after large scale dieback has already occurred," she explains.

To turn measurements of reflected light into a predictive tool, Fyfe has turned to UM Assistant Professor Habtom Ressom who leads a research team in the Intelligent Systems Laboratory (INTSYS) of the Department of Electrical and Computer Engineering. Ressom specializes in a computer software system known as an artificial neural network, or neural net.

The team at INTSYS consists of three faculty members, a research associate, and more than a dozen graduate and undergraduate students. The seagrass project is one of several active studies in the lab. Others focus on DNA analysis, gene expression, and industrial process control.

The common thread running through all of the lab's work is the use of computational intelligence techniques to extract knowledge from data. Neural nets have been around for more than 40 years and today are widely used in industry and business. They improve voice transmission over telephone lines, teach machines to talk, recognize patterns, and analyze mortgage risks and financial markets. Consisting of sets of mathematical equations, they are nevertheless inspired by nature. Individual parts of a neural net are viewed as nerve cells and the connections between them as the junctions that link one cell to another.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Information Technology (Continued)***

To the casual observer, the neural net seems to perform statistical magic. It doesn't depend on knowledge of a specific system, but it does require reasonably good quality data. Moreover, its ability to learn and adjust gives the neural net an advantage over conventional modeling approaches, especially in dealing with complex systems.

A seagrass ecosystem fits that mold. A case in point is Fyfe's effort to predict seagrass stress on the basis of reflected light. Fyfe uses a device known as a spectroradiometer to identify the changes in the light reflected from seagrass leaves. "What Ressom's neural network does is to transform this database of information into a mathematical tool. That tool can then be directly applied to remote sensing data to predict stress levels in the seagrass meadows before dieback occurs."

The problem is that seagrass needs sunlight, but water that becomes cloudy with silt or algae can act more like a curtain than a window. Thus, poor water quality can cause seagrass beds to shrink. If Fyfe is successful, scientists could, in a sense, peer behind that curtain to determine whether or not seagrasses are threatened. "She liked the model, and now she is in the field taking measurements in seagrass beds along the coast," Ressom says.

"Neural networks try to correlate difficult-to-measure variables with easy-to-measure variables," says Ressom. "The advantage is that no prior information is necessary. That's why we are able to jump into these subjects. Our background is in electrical and computer engineering. I personally have no knowledge of the biological relationships."

In addition to their seagrass work, Ressom and his team are working with the National Aeronautics and Space Administration (NASA) to apply a neural net to ocean data from satellites. Their goal is to estimate chlorophyll concentrations, an indication of algal growth and ocean vitality.

CHILD LANGUAGE PROJECT – Alan Cobo-Lewis
University of Maine researchers are offering parents a chance to get a glimpse of their own child's development by participating in the Early Language Project, a joint project of UM and the Trefoil Corporation of Orono. Alan Cobo-Lewis, associate professor of psychology, is conducting the project to evaluate a computerized version of the MacArthur Communicative Development Inventories, or CDI, a nationally used child language development test.

The CDI is based on parents' observations of what their child says and understands. It provides an estimate of how a child's language skills compare to what's expected for a child of a given age. A significant lag in language skills can indicate a developmental delay that can affect a child's social interactions and performance in school.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Information Technology (Continued)***

The CDI is normally completed by pencil on paper forms, but Cobo-Lewis has created a computer adaptation with assistance from Curtis Meadow and George Markowsky at Trefoil and members of an international CDI advisory board. Meadow is also a part-time instructor in computer science at UM, and Markowsky is chair of the UM computer science and math departments.

"The idea of computerized adaptive testing is first of all, to make the tests shorter. By focusing on questions that are relevant to one child, the computer doesn't have to administer all of the items on the test," says Cobo-Lewis. Whereas the paper-and-pencil test requires parents to review 493 words for infants (8 to 16 months) and 797 for toddlers (15 to 30 months), the computerized test can usually be completed with only 15 to 24 words for infants and 30 to 40 for toddlers. The difference, Cobo-Lewis explains, stems from the ability of the computer program to calculate a child's language level on the basis of each successive word. That calculation is done with reference to a standardized database of test results from about 1,600 children. "I have figured out how likely a (parent's) response to a word on the test is to indicate the child's language age. As children get older, they get more and more likely to understand a word or say a word. Each word is different. Some are difficult in the sense that a child has to be older to understand it."

Trefoil, an Orono based software development company, is a partner in the project and is evaluating the commercialization of the final product. This work has been funded by the National Institutes of Health through their SBIR/STTR program.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Advanced Technologies for Forestry and Agriculture*

Purpose of Research Area:

At UM, research and development related to forestry and agriculture is at the heart of the institution. As a Land Grant University, serving the forestry and agriculture community is party of our original charter. For more than one hundred and fifteen years, the Maine Agricultural and Forest Experiment Station has been undertaking research for Maine and its people. Originally devoted to research for Maine's farm community, the Experiment Station is now Maine's most important center for research in agriculture, forest resources, aquaculture, and rural economic development. The Station maintains its offices and principal research laboratories at Orono. Additional research facilities include Aroostook Farm at Presque Isle, Highmoor Farm in Monmouth, Blueberry Hill Farm in Jonesboro, Rogers Farm/Witter Teaching and Research Center in Old Town, and various forests throughout the state, including the Demeritt Forest in Orono and the Penobscot Experimental Forest in Bradley. Research extends from basic science to practical applications, development of new plant varieties, and new harvesting and processing technologies.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

A. UM Technology Spinouts

Engineered Materials of Maine started in October 2002 based on a wood composite product AEL developed at the Advanced Engineered Wood Composites Center. This product is a laminated beam using low-grade hardwoods with applications in construction and transportation. EMM is operating in a 40,000 square foot facility in Bangor renovated by the City of Bangor and leased to the company. (This technology spin-out is also listed under composites.)

B. Incubator

The Composites Technology Center in Sanford/Greenville serves the forest products industry. In addition the Loring Development Center at the Loring Commerce Center serves as the State's forestry and agriculture incubator. Currently there are no University related start-up companies located at the Loring Center.

C. UM Student Start-ups

None

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: *Advanced Technologies for Forestry and Agriculture (Continued)*

D. Faculty Innovation

Patents Issued

A US patent was issued for "... attracting and repelling substances for the Colorado potato beetle", a pest harmful to potato agriculture. Dr. Randall Alford was the co-inventor along with Joseph Dickens of the USDA Agricultural Research Service.

Plant Variety Protection

The University applied for a Plant Variety Protection on a new variety of potatoes developed by the late Alvin Reeves. The variety is under development and trials under license to McCain's in Presque Isle.

New Patents Filed

The University of Maine Department of Chemical and Biological Engineering and the Pulp and Paper Development Center continue to innovate new technologies that reduce the cost of paper making while reducing environmental impacts and energy costs. Three new patents have been filed on retention technology which advances the state of the art beyond work begun by DuPont and donated to the University of Maine in 2001.

Inventors	Department	Application
Neivandt, Genco, Paradis	*Chemical Biological Engineering*	*(3) Retention*

Several other wood composites related patents were filed and are listed under composites.

New Licenses and License Options

Technology related to Advanced Engineered Lumber (code report, technical data and patent application) was licensed to Engineered Materials of Maine.

Potato Variety licensed to McCain's in Presque Isle.

Paper making "retention" technology has been non-exclusively licensed to SAPPI Fine Paper and working in the Somerset Maine mill. In addition, the University granted and exclusive license option to Tate and Lyle Corporation for North America and Europe. AE Staley the US division is currently running trials at 2 U.S. mills.

E. Partnerships

The University of Maine has longstanding partnerships in the Forestry and Agriculture sectors including State Agencies such as the Maine Department of Agriculture, the Maine Forest Service, the Department of Conservation, and the Department of Economic and Community Development. Private sector partners include the Agricultural Council of Maine, the Biotechnology Association of Maine, the Maine Beef Association, the Maine Dairy Industry Association, the Maine Deer and Elk Association, the Maine Farm Bureau, the Maine Forest Products Council, the Maine Golf Course Superintendents, Maine Greenhouse and Flower Growers Association, Maine Harness Racing Association, Maine

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Advanced Technologies for Forestry and Agriculture (Continued)***

Landscape and Nursery Association, Maine Organic Farmers and Gardeners Association, Maine Pomological Association, the Maine Potato Board, Maine Sheep breeders Association, Maine Small Fruit and Vegetables Growers, Maine Wild Blueberry Commission, the Small Woodlot Association of Maine, and the Maine Wood Products Association. In addition, faculty participate in the associated national associations and also work directly with individual companies many who are members of these associations.

F. Additional Highlights

Island Falls Tissue Culture Research, Demonstration and Development Facility
The gift of an agricultural research facility in Island Falls, Maine, to the University of Maine will provide a scientific growth spurt for researchers working with the state's potato and horticultural industries. Island Falls potato grower Arthur Shur donated the facility to UM in honor of his father, Jacob. It will be known as the Jacob Shur Research Facility.

The research station consists of a building and three greenhouses. It will enable scientists to use advanced tissue culture techniques in developing plant varieties for Maine's climate and soil conditions, says Steve Reiling, director of the Maine Agricultural Center at UM.

"The size of this facility enables us to accommodate a much larger research effort in this area than we can do on campus," says Reiling. "When breeders identify a plant with desirable characteristics, the best method to reproduce them in large quantities for research purposes is through tissue culture. The building has room for up to one million plants."

Plants propagated through tissue culture rather than seed retain the exact genetic composition of the parent plant.

UM research projects already underway at the facility include horticultural work on garden plants with commercial potential and on disease resistant white pine trees. "We're considering moving our potato breeding program there as well," says Reiling.

WILD BLUEBERRIES MAY HELP PROTECT ARTERIES, REDUCE RISKS FROM CARDIOVASCULAR DISEASE

A University of Maine nutritionist has found evidence that consumption of wild blueberries can help arteries relax and reduce risks associated with cardiovascular disease. The project is the first using rats fed blueberry diets to demonstrate a relationship between consumption of whole wild blueberries and processes that can lead to high blood pressure. The study was published earlier this year in the FASEB Journal, published by the American Societies for Experimental Biology.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Advanced Technologies for Forestry and Agriculture (Continued)***

Cardiovascular disease is the leading cause of death in the United States. Previous studies with cell cultures have shown that antioxidants such as anthocyanines contained in wild blueberries may help protect cells. Wild blueberry consumption in laboratory rats has also been linked to improvements in memory and motor skills.

At UM, Dorothy Klimis-Zacas, professor in the Dept. of Food Science and Human Nutrition, led a team of graduate and undergraduate students in a two-year research project that was supported by the Maine Agriculture and Forestry Experiment Station, the Maine Wild Blueberry Commission, the U.S. Dept. of Agriculture, and the Wild Blueberry Association of North America. "Our experiments focused on the effect of whole wild blueberries on the biomechanical properties of arteries as related to cardiovascular disease," says Klimis-Zacas. "This is the first in-vivo study to examine this relationship."

Researchers found that arteries of Sprague-Dawley laboratory rats fed a diet enriched with wild blueberries generated less force in response to phenylephrine, a stress hormone, than did arteries in rats fed the same diet without blueberries. "Those arteries (in rats fed the blueberry enriched diet) were more relaxed. When they were challenged with the stress hormone, they didn't develop as much force. We know now that blueberries affect the contractile machinery of the artery," says Klimis-Zacas.

The finding is important because the force with which an artery responds to stress can directly affect blood pressure. Norton and Klimis-Zacas presented the results of the study at the 2003 annual conference of the Federation of American Societies for Experimental Biology in San Diego, California and to the Wild Blueberry Association of North America in Bar Harbor, Maine.

The apparent benefit of the blueberry enriched diet carried over to older rats, which received blueberries later in the study. The implication is that the addition of wild blueberries to the diet later in life may still have a protective effect on arteries.

The study has not been replicated in humans, and the researchers did not identify the compounds in wild blueberries that affect arteries. However, it is likely that high concentrations of antioxidants and trace minerals such as manganese that are high in blueberries could explain the beneficial effect, says Klimis-Zacas.

During the project, three groups of rats containing ten animals per group were fed the same diets with the exception of ground, whole wild blueberries. One group received the blueberry addition for the entire time while another group had the same diet without blueberries. To test the addition of blueberries to the diet later in life, the third group received a diet without blueberries for 14 weeks followed by a blueberry-enriched diet for eight weeks. The amount of blueberries given to the rats per day corresponded to between one and two cups of blueberries per day for humans.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Advanced Technologies for Forestry and Agriculture (Continued)***

Researchers then surgically removed the aortas from each rat. They cut four ring sections from each aorta and tested the force generated by each section in response to the presence of hormones that stimulate arteries to relax or contract. During the tests, the arterial ring sections were hung in a tissue bath under conditions that mimicked the body's internal chemical environment.

In a second round of experiments, researchers wanted to find out what layers in the artery are affected by blueberries. They focused on the inside surface of the artery, a layer of cells known as the endothelium. "Increasing vascular resistance may lead to an elevation of blood pressure which may in turn damage the delicate endothelial layer," says Klimis-Zacas. "This layer is affected by many things in the blood. By removing the endothelium, we are left with the smooth muscle layer of the artery, and we can localize the effect of wild blueberries in response to stress hormones. "

In these tests, researchers purposely damaged a portion of the endothelium and then exposed the arteries to the hormones. "We found that when we remove the endothelium, the artery cannot relax, and the contractile force it exerts in response to the stress hormone is about three times what it was with the intact arterial rings," says Klimis-Zacas.

The endothelial layer is known to be an important source of nitric oxide that helps to relax the arteries. "You can imagine what happens with arteriosclerosis. Your endothelium gets damaged. There are many different relaxation factors in the endothelium, but nitric oxide is a major one. We think that blueberries may function by preserving the bioavailability of nitric oxide," says Klimis-Zacas.

"We know that nitric oxide concentration decreases at the onset of cardiovascular disease. By preserving nitric oxide bioavailabilty, blueberries may aid in maintaining arterial relaxation and thus prevent elevation of blood pressure that damages the endothelium and contributes to cardiovascular disease," says Klimis-Zacas.

Future research is planned with rats that have high blood pressure, she says, to see if blueberries will lower blood pressure. A key will be the role of antioxidants in endothelium function.

UM ENTERS LICENSING AGREEMENT WITH THE A. E. STALEY MANUFACTURING COMPANY ON PAPERMAKING TECHNOLOGY

The University of Maine and the A. E. Staley Manufacturing Company of Decatur, IL. signed a licensing agreement during June 2003 to commercialize new UM papermaking technology. A.E. Staley is a worldwide leader in the processing and marketing of corn and wheat based sweeteners and starches.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

UM

MAJOR RESEARCH AREA: ***Advanced Technologies for Forestry and Agriculture (Continued)***

Ongoing work by UM researchers in Orono indicates that the technology can increase efficiency and improve environmental performance in the papermaking process. By making the technology widely available, UM will contribute to a fundamental step forward in the industry, says Joseph Genco, director of the Pulp and Paper Process Development Center at UM and a faculty member in the Department of Chemical and Biological Engineering. A. E. Staley has a starch manufacturing plant in Houlton, Maine. The technology is based on a process that was patented by the DuPont Corporation and donated to UM in 2001. In the early stages of papermaking, chemicals and water are added to raw pulp. Water that drains away at a later stage can take short fibers and chemicals out of the paper. The new technology created by DuPont and developed further at UM allows the paper to retain more of the fibers and chemicals and thus produces a savings in both paper production and wastewater treatment.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Lewiston-Auburn R&D*

Purpose of Research Area and Description of How Funds Were Spent:

This account was designated in FY02 to provide funds for research infrastructure supporting the Natural and Applied Sciences program at USM's Lewiston-Auburn College. True of all work at Lewiston-Auburn, the research projects supported there by R&D funds are tightly integrated with student learning. Dr. David Harris, Dr. Ira Levine, and Dr. Blake Whitaker are LAC faculty whose research programs are augmented with R&D funds.

Funds were used to send two professors and one student to conferences to present papers, to provide summer salary and student research assistant support for research projects undertaken at Lewiston-Auburn College, and to purchase equipment and supplies for those laboratories and projects. Funds were also used to partially fund a grants developer to support efforts at LAC to increase externally funded grants and contract activity.

- Dr. Harris is using GIS technology in the study harbor seal stranding. During FY03 this work was funded through the Marine Animal Lifeline. Dr. Harris is also using GIS and statistical extraction techniques in the assessment of community clinic programs reducing incidence of complications for heart patients and patients with diabetes.
- Dr. Levine's research is on the physiological ecology of commercial red algae, the development of marine agronomy, the conversion of selected cultivars to fresh water cultivation systems, and the development of valuable algal-based natural products. These are the most commercially important algaes in the world. Presently, he and his collaborators (Northeastern University) are developing marine and fresh water integrated finfish:seaweed polyculture systems for the bioremediation of aquacultural wastes and the production of valuable bioproducts.
- Dr. Whitaker is studying local species–smallmouth bass, loon, osprey, eagle, mink, seal–as sentinels of anthropogenic chemical-induced genotoxicity. Molecular biology assays (comet assay, AFLP) are now functional in the L-A laboratories. The work focused on chemotoxicity in the Androscoggin River was presented by a student, Kim Chamberland, at a national meeting.

Description of Grant & Contract Funds Generated:

David Harris obtained a grant through the Marine Mammal Lifeline–*Development and Use of a Geographic Information System (GIS) for Analysis of Harp, Hooded and Harbor Seal Sighting/Stranding Locations*,

Blake Whitaker obtained a grant from the Maine Department of Environmental Protection–*DNA Damage Assessment in Suckers using the Comet Assay.*

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Lewiston-Auburn R&D (Continued)*

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

During FY03, the three faculty members who utilized funds from this account submitted six proposals requesting just less than $1M. To date two have been funded (beginning in FY04). Four R&D grants were active during FY03, with approximately $16,500 of expenditures during this year. All three Lewiston-Auburn faculty are actively collaborating with local industry, other USM researchers, and researchers at other Maine institutions. One example of this is Dr. Levine's project *Development, Assembly, and Production of a Northeast Region Aquaculture Research Facilities Directory*, funded by the regional USDA.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Library Research Materials*

Purpose of Research Area and Description of How Funds Were Spent:

This account supports the acquisition of new research materials in scientific areas of importance to USM's R&D efforts. Acquisitions have been primarily scientific databases and electronic journals. These resources significantly augment the existing collection in order to bring USM's research resources up to a level that supports competitive research in the areas of biosciences, biotechnology and the information sciences. Additionally, we have preserved subscriptions to some scientific journals that would have been eliminated because of the difficult combination of funding cuts and the rising costs of serials.

Description of Grant & Contract Funds Generated:

None

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

Provides needed information infrastructure for R&D at USM.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***Wise Lab (Environmental Toxicology)***

Purpose of Research Area and Description of How Funds Were Spent:

This account was activated for the purpose of tracking the R&D funds expended to start up the laboratories and activities of the John Wise Laboratory (Environmental Toxicology).

Description of Grant & Contract Funds Generated:

None yet.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

None yet.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***John Roberts Road***

Purpose of Research Area and Description of How Funds Were Spent:

During FY03, USM rented research facilities in South Portland (formerly occupied by the Maine Medical Center Research Institute) so that bioscience and information science research can be conducted for which there is no space on campus. Thus we advance USM's research activity while the new research wing is built on the Portland campus. These funds cover rent, utilities, renovations and other operational expenses.

As of June 2002 the facility contained

- the USM animal facility, with BL2 tissue culture and procedure rooms, plus an office for the animal manager
- shared molecular biology equipment (microscopes, flow cytometer, sequencer)
- the autoimmune laboratory (Dr. Pelsue)
- the psychopharmacology laboratory (Dr. Markowski)
- the Bioethics Project (Dr. Murphy)
- one of three GIS research computers (Dr. Bampton)
- the eCollaboratory/IRIS irregulars (Dr. Wilson)
- primary offices for the director, the operations director and an administrative assistant
- primary space for the proposal development office and the undergraduate research opportunities program
- a conference room suitable for research seminars, workshops and technical presentations

During the summer and fall of 2002, renovations were accomplished to accommodate Dr. Lew Incze and his biological oceanography research program. Dr. Incze's program, including his own salary and that of one research associate, is fully funded by external sources. This adds another major researcher to the USM research faculty.

By the end of FY03, all of the laboratory occupants of John Roberts Road were in the process of moving, or scheduled to move during the summer, to the new Research Wing of the Science Building. By the middle of FY04, John Roberts Road will no longer house any R&D activities; all those will be housed on the three USM campuses.

Description of Grant & Contract Funds Generated:

None directly.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***John Roberts Road (Continued)***

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

At John Roberts Road, USM does research that could not occur on campus. Without this facility, USM would not have been able to respond to the opportunity when Dr. Incze expressed interest in moving his research program to an academic institution.

At John Roberts Road, USM stimulates USM research productivity by hosting research seminars, visits from federal agency personnel, technical presentations by researchers "from away", and other opportunities for southern Maine researchers to congregate, collaborate, and share their work.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Bioscience Research Institute of Southern Maine (BRISM)*

Purpose of Research Area and Description of How Funds Were Spent:

The purpose of this account is to support research and development of biological sciences research at USM, and to develop and operate the Bioscience Research Institute of Southern Maine (BRISM). The purposes of the institute are:

- To serve as the focal point for attracting external funding for R&D in the biosciences by fostering small group collaborations as well as individual research, and
- To facilitate the participation of USM and affiliated faculty in delivering the University of Maine collaborative Ph.D. program with emphasis in carcinogenesis and environmental toxicology.

Funds were used for the salaries of two Applied Medical Sciences faculty (hired earlier using Department of Energy EPSCoR funds), partial salaries for senior researchers, laboratory assistants in three different laboratories, and administrative staff support for the Wise Laboratory. Additional funds were used for graduate student stipends, equipment, and operations of the institute and its faculty.

Description of Grant & Contract Funds Generated:

Nineteen grants totaling more than $3.3M were awarded to eleven different BRISM researchers during FY03. The larger projects include the following:

- Toxicology of Particulate Cr(VI) in Human Lung Cells (NIEHS, $291,190 Wise)
- Metal Toxicity in Stellar Sea Lion Tissues and Cell Lines (NOAA/NMFS, $707,109 Wise)
- Chronic Disease and Maternal and Child Health Epidemiology Capacity Building (Maine DHS, $893,313 Thompson)
- Vertical Distribution of Lobster Larvae and Postlarvae and its Impact on Transport (Maine Sea Grant, Davis Family Foundation, $150,146 Incze)
- Creation of the Imaginal Eye Disk in *Manduca* (NSF, $372,000 Champlin)
- A Maine ScienceCorps Promoting Excellence and Equity in High School Biological Science Education (NSF, $390,940 Duboise)
- Acquisition of a Shared Microscopy Resource Center for the University of Southern Maine (NSF, $170,010 Markowski)

BRISM work is growing. Strong scientific centers in toxicology, aquatic systems and neural development are beginning to take shape. In addition to the basic scientific work, BRISM researchers are actively seeking grants that add significant core equipment to our facilities and grants that allow research to be done by and shared with more college students, school teachers, and K-12 students.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Bioscience Research Institute of Southern Maine (BRISM)*

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

In July 2002, a researcher came to USM from Yale University, along with his team of three assistants and a Ph.D. student. He brought $2M in research funding. A post-doctoral student was recruited.

In December 2002, a second senior researcher came to USM from Bigelow Laboratory, along with a research assistant. In addition to his own research program, he serves as Chief Scientist for the Census of Marine Life (Gulf of Maine Area Program) project funded by the Sloan Foundation and directed by Evan Richert.

During 2002/03 BRISM organized researchers around two major proposals. A proposal submitted to NIH to establish a Center for Biomedical Research Excellence (COBRE) brings together 14 faculty at USM and 24 researchers at affiliated institutions in Maine and elsewhere around the theme of environmental toxicology. It provides for the recruitment of 6 additional faculty over five years. Another NIH proposal is to fit out the third of three levels of the Research Wing of the Science Building in Portland, which has a total area of about 27,000 square feet, and officially opened on June 2, 2003.

During 2002/2003 the implementation of the collaborative Ph.D. program was achieved.

During 2002/2003 25 grants were active among the BRISM researchers. Total externally funded expenditures approached $1.5M, generating nearly $300K in indirect funds.

Proposal activity during 2002/2003 set records at USM. BRISM-related proposals came to $31.9M of the $41.7M of R&D-designated proposals submitted during this very busy proposal year.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Research Development*

Purpose of Research Area and Description of How Funds Were Spent:

This account provides support for increasing USM's capability to generate and manage funded research. Specific investments include the following:

- salaries of the Director, the Associate Director, and the Director of Operations of Research Initiatives, as well as one full-time and one half-time administrative assistant
- the Office of Proposal Development, which assists faculty members in developing successful grant proposals and fundable research agendas. This office also produced the 2nd annual celebration of Student Research and Creative Activity, aka Poster Day.
- partial support for additional staff in the Office of Sponsored Programs, providing additional pre-award resources in the Office of Sponsored Programs.
- partial support for additional staff in the Office of Graduate Studies, focusing especially on the needs of graduate students in the programs related to the targeted technology areas.

Description of Grant & Contract Funds Generated:

None directly. These investments enhance USM's ability to obtain and manage external grants and contracts, and to attract and support the graduate students involved in those projects.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

For the second year in a row, proposal development within the R&D targeted technologies increased substantially. In FY2001, 20 proposals were submitted for a total dollar value of $2,795,400. In FY2002, 42 proposals were submitted for a total dollar value of $13,277,439. In FY2003, 53 R&D proposals were submitted from USM, for a total dollar value of $41,731,910. Not only is the number of proposals increasing, the magnitude and the complexity of the proposals are dramatically greater.

Increased support for the Office of Proposal Development and that Office of Sponsored Programs has led to improved pre- and post-award services to researchers and their administrative staff.

Continuing the investments in these research support areas will result in further increases in research productivity at USM, especially in Maine's targeted technology areas.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *College of Arts and Sciences R&D*

Purpose of Research Area and Description of How Funds Were Spent:

This account supports preliminary research and feasibility studies by R&D faculty in the College of Arts and Sciences, the university's largest college. During FY03, CAS investigators used the funds for purchase of biological and chemical supplies and equipment, travel to research sites, and upgrades of research instrumentation. Ten faculty members utilized the funds for student research assistance in generating preliminary data for proposals.

Description of Grant & Contract Funds Generated:

None here. (See related entries for Opportunity Programs, IRIS, and BRISM)

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

Of the 13 CAS faculty members who received funding from this account, eight investigators submitted proposals to major funding agencies during FY03. The R&D funds have enhanced the capacity of CAS faculty to form research collaborations, resulting in FY03 proposals submitted in partnership with external organizations that include the City of Portland, University of Florida's Whitney Laboratory, and the Gulf of Maine Research Institute. New partnerships have resulted in an expansion of the College's funding base to previously untapped federal agencies, including the U.S. Environmental Protection Agency. During FY03, fourteen CAS proposals in the R&D areas requested more than $4.8M. CAS presently has eleven active R&D grants with nearly $800K in expenditures in FY03.

- Dr. Langley-Turnbaugh is studying sources of air toxics in Portland's Bayside Neighborhood, with a focus on fine particulate matter from soils. Her research includes evaluation of novel remediation technologies for lead-contaminated soils.
- Dr. Knight continues research on increased growth in plants consequent to altered metabolism, with possible applications to carbon management through carbon sequestration in the terrestrial biosphere. This work will be funded in FY04 by Los Alamos National Laboratory.
- Dr. Prudente is exploring chemical precursors and pathways to b-amino acid derivatives. Beta-Amino acids are the structural backbone to the b-lactam antibiotics (i.e. penicillin and related compounds) as well as the new generations of antibiotics that are attempting to thwart resistant strains of bacteria.
- Dr. Moore studies marine cyanobacteria. She will begin a new study in FY04 in partnership with the Massachusetts Institute of Technology on the diversity microbial communities in Hawaiian ponds.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Opportunity Programs*

Purpose of Research Area and Description of How Funds Were Spent:

The purpose of this account is to invest funds to help USM faculty become more competitive in receiving external funding for R&D. One mechanism is internal competitions for funding to do pilot research, purchase essential but expensive equipment, and to create opportunities for collaboration locally and nationally. A second mechanism is providing matching funds to enhance proposals and increase their competitiveness for external funding.

During FY03 the R&D funding remained flat. Consequently no new opportunity programs were initiated at USM; funds were used to complete commitments that were made earlier for projects that continued into this year.

The second major area of expenditures is as match for funded external grants. During FY03 funding was provided for match involving five grants.

Description of Grant & Contract Funds Generated:

Four grant awards were made during FY03, related to earlier investments made through opportunity programs:

- Julien Murphy, *Institutional Considerations for Tissue Donation to Commercial Tissue Repositories*, The Greenwall Foundation, $121k
- Irwin Novak, *Maine Space Grant Consortium - Travel Grant*, Maine Space Grant Consortium
- Steven Pollack, *X-Ray Diffraction at the University of Southern Maine*, National Science Foundation, $68k
- Caryn Prudente, *Intermolecular & Intramolecular Radical Reactions of B-Amino Radicals Generated from Aziridinium Ions,* The Petroleum Research Fund, American Chemical Society, $35k

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

Several researchers who have been supported through Opportunity Programs in earlier years continue their own projects and others have incorporated their work into the Bioscience Research Institute.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Inst for Research in Info Sciences (IRIS)*

Purpose of Research Area and Description of How Funds Were Spent:

The purpose is to support research and development of information science and technology research at USM and to develop and operate the Southern Maine Institute for Research in Information Science (IRIS). The purposes of the institute are:

- to serve as a focal point for attracting external funding for R&D in the information sciences and
- to facilitate the participation by USM and affiliated faculty in delivering the University of Maine Computer Science Ph.D. program.

Funds were used for partial salaries of one research faculty member in the Information and Communications Technology program and two Computer Science faculty members. All the supported faculty are Institute members, and they have substantial (50% or greater) research commitment. Additional funds were used for graduate student stipends, a corps of undergraduate serving as technical assistants to all researchers in both BRISM and IRIS, and the operations of the institute and its faculty.

The areas of research include:

- theoretical interactions of Java technologies with object-oriented database systems
- the performability of highly redundant, highly parallel networks
- improved access, visualization and presentation of research data and research resources for USM research areas
- high-precision digital mapping of geological and geographical features

This account also funds a university-wide site license for the ESRI suite of GIS tools and the servers on which the software is provided. In partnership with the GIS lab on the Gorham campus, IRIS encourages the use of GIS software to enhance research, and the presentation of research results, by investigators in all areas of the University of Southern Maine.

Description of Grant & Contract Funds Generated:

Three small projects were awarded grants in the areas of performability predictions (Fiorini, MSGC, $20k), the use of GIS technologies (Bampton, UNE $2.5k; and Harris, Marine Animal Lifeline, $16k), and one large project in earth science access for students and faculty with disabilities (Locke, NSF, $100k). Additionally three proposals in the areas of Java technologies and object-oriented databases were submitted; total requests to the Dept of Defense and to the NSF exceeded $1.3M.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***Inst for Research in Info Sciences (IRIS Continued)***

Description of Outcomes/Economic Benefits Including Progress Made on Projects:

Two projects were continued with support from the Maine Space Grant Consortium (Fiorini, *Assessing the Performability of Parallel Computing Systems with Power-Tail Distributed Task Execution Time*), and from the National Science Foundation (Swanson, *Digital Mapping & Strain Analysis of Deformed Veins & Intrusions*).

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: *Maine Patent Program*

Purpose of Program Area and Description of How Funds Were Spent:
The Maine Patent Program provides a key component in supporting economic growth in Maine by assisting inventors, research scientists, entrepreneurs and businesses with understanding, protecting and exploiting their intellectual property. Through a combination of public educational functions and individual counseling sessions with clients, the Program stimulates and supports both existing and start-up Maine businesses by providing critical information and guidance regarding the various means available for businesses to protect and develop their intellectual property assets. The Program educates Maine's citizens and business leaders on U.S. patent, copyright and trademark laws and issues and general strategies pertinent to technology-driven businesses through numerous statewide, in-depth educational seminars, courses and workshops. The Program also provides individual counseling and advice to inventors, scientists and entrepreneurs at all stages of product development and sophistication. Such counseling typically includes assessment of the patentability of their inventions and development of intellectual property strategies tailored to their particular businesses. Maine's investment in research and development in science and technology is greatly enhanced and advanced by the Program's no-cost education and outreach services, which have reached hundreds of Maine innovators

Due to the high demand for Program services, a full-time position for a Patent Program Fellow was created, and a patent attorney with experience in biotechnology was hired for this position. Overall, Program funds were invested primarily in staff salaries, supporting the full-time patent attorney who serves as Director of the Program, the Patent Program Fellow, and two-thirds of the salary of the Director of the Technology Law Center, an intellectual property lawyer and educator who oversees the Program's budget and staff, and directs its public education mission. The Program also has one full-time office and communications manager. The Program and its clients benefit from the contributions of two unpaid law student externs each semester. Program funds have also been spent to lease real estate for the Program's offices, purchase computers and related equipment to furnish the new office, sponsor and deliver seminars and workshops (such as site fees and handout materials), cover travel and professional education expenses, maintain the attorneys' professional licenses and memberships, and develop and maintain the Program's website.

In response to high public demand for the Program's patent services, the Program has continued to develop the need for additional professional staff each year. Additionally, the Program maintains an office in Orono to serve clients in the area, staffed by the Program Director, and it will be adding a half-time administrative assistant for that office in addition to a graduate student research assistant at one-quarter time. The Program's annual expenditures for the current fiscal year and future years will therefore likely exceed that of fiscal year 2003, and significantly exceed that of fiscal years 2001 and 2002. Accordingly, the Program's annual budget should be maintained at current FY04 levels ($300,000) and unspent funds from prior years should remain in the Program Fund for expected near-term use on Program staff, educational outreach and entrepreneurship-enhancing activities.

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***Maine Patent Program (Continued)***

Description of Grant & Contract Funds Generated:
The Program did not generate grant or contract funds in fiscal year 2003. In its initial years, the Program made cash awards to select inventors and businesses to assist them with aspects of the patent application process that are within the Program's mission but that the Program is not staffed or legally prepared to perform. Those grants are to be repaid upon successful commercialization of the patented product. To date, none of the award contracts has matured to repayment. The Program has discontinued the award process because this function is adequately met by the Maine Technology Institute. The Program did receive revenue of $40.00 in fiscal year 2003 for admission fees charged to recoup expenses for a public education program.

Description of Outcomes/Economic Benefits Including Progress Made on Projects:
The Program is impacting numerous individuals and businesses throughout the state. In this, the second full year of its operation, the Program and the Technology Law Center presented 24 seminars, workshops or conferences, with over 500 attendees recorded. Locations of these seminars ranged from Portland to Lincoln and East Millinocket to Limestone. The Program continues to receive, on average, around ten applications per month for one-on-one counseling with individual inventors and businesses, and, from the time the Program became operational and began providing public services in the first quarter of FY 2002 until today, over 200 inventors, scientists and entrepreneurs have sought individual assistance from the Program. Additionally, each month, approximately 20-40 innovators gather at monthly meetings of the Maine Inventors Forum in Portland and Orono to hear speakers invited by Program staff and discuss issues related to invention-based businesses. Furthermore, at MaineTech2003 in Augusta, a representative group of start-up Program clients demonstrated their innovative products.

The Program works closely in partnership with other Maine economic development institutions, including the Maine Small Business Development Centers, the Maine MEP, and the Maine Technology Institute ("MTI"). In fiscal year 2003, well over 20 Program clients received seed or development grant awards from MTI and several of these awards were for the purpose of pursuing patents. The Program estimates that since its inception, between fifteen and twenty-five new clients have filed or soon will file patent applications with the Program's assistance, and several clients who had pending applications now hold issued patents.

The Program also works closely with existing companies who, while highly innovative, have in the past not fully recognized the potential value of intellectual property they are creating. The Program has counseled several such companies, aiding them in identifying and protecting such valuable intellectual property. Further, after helping these companies raise awareness and set up internal processes for innovation disclosure and patent protection, the Program has helped them build relationships with outside counsel or patent agents to perform their

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION
NARRATIVE BY MAJOR RESEARCH AREA

USM

MAJOR RESEARCH AREA: ***Maine Patent Program (Continued)***

future patent work. The Program also has a positive economic impact by discouraging inventors from spending their money on risky patent pursuits or fraudulent invention protection schemes.

The Maine Patent Program and Technology Law Center are unique in this nation, and fine examples of Maine's creative and multi-disciplinary approach to economic development. As the Program grows to meet the public's increasing needs in the months and years ahead, its services will become even more effective and valuable to the state's economic development initiative. The Technology Law Center, moreover, is working on collaborative relationships with other USM departments toward fulfilling the state's mission to improve technology commercialization and entrepreneurship education.

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION

ACCOUNTING PERIOD: 7/1/2002 - 6/30/2003

UM/USM COMBINED

	Source of R&D Funds			Utilization of R&D Funds						
University	FY03 R&D Base Budget	Total Unused R&D Funds from Prior Years	Total R&D Funds Available	FY03 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Commitments to Physical Plant Projects	Total R&D Funds Utilized	Funds Carried Forward To FY04 [1]	New Grants & Contracts Generated [2]	Total FTE Positions Supported By All R&D Funds [3]
UM	8,080,000	4,038	8,084,038	4,667,764	2,780,952	159,185	7,617,901	466,137	37,052,062	495
USM	1,987,369	95,741	2,083,110	1,897,259	124,325	69,632	2,091,216	(8,106)	3,644,452	26
TOTAL	$10,067,369	$99,779	$10,167,148	$6,565,023	$2,905,277	$228,817	$9,709,117	$458,031	$40,696,514	521

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).

[2] Dollar value of new grants & contracts that resulted from FY03 State R&D funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

1/8/04 MW50Z(339)

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION

ACCOUNTING PERIOD: 7/1/2002 - 6/30/2003

UM

	Source of R&D Funds			Utilization of R&D Funds						
Major Research Area	FY03 R&D Base Budget (a)	Total Unused R&D Funds from Prior Years (b)	Total R&D Funds Available (a)+(b)	FY03 R&D Actual Expenditures (c)	Transferred To Match Grants & Contracts (d)	Commitments to Physical Plant Projects (e)	Total R&D Funds Utilized (c)+(d)+(e)	Funds Carried Forward To FY04 [1]	New Grants & Contracts Generated [2]	Total FTE Positions Supported By All R&D Funds [3]
Advanced Materials Engineering	2,630,695	0	2,630,695	1,851,472	500,317	162,532	2,514,321	116,374	4,104,787	76
Adv. Technologies Forestry & Agriculture	2,212,801	0	2,212,801	781,296	1,345,174	0	2,126,470	86,331	9,330,860	119
Aquaculture & Marine Science	1,106,929	0	1,106,929	372,845	665,762	(11,047)	1,027,560	79,369	9,023,029	92
Biotechnology	133,163	0	133,163	31,102	20,294	0	51,396	81,767	5,013,367	42
Computer Software & Engineering	588,748	0	588,748	457,589	117,887	(78)	575,398	13,350	4,581,568	101
Technology Transfer	1,407,664	4,038	1,411,702	1,173,460	131,518	17,776	1,322,756	88,946	4,998,451	65
Total	$8,080,000	$4,038	$8,084,038	$4,667,764	$2,780,952	$169,185	$7,617,901	$466,137	$37,052,062	495

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).
[2] Dollar value of new grants & contracts that resulted from FY03 State R&D funds.
[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

1/8/04 MW50Z(339)

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY03 OPERATING RESEARCH APPROPRIATION

ACCOUNTING PERIOD: 7/1/2002 - 6/30/2003

USM

	Source of R&D Funds			Utilization of R&D Funds						
Major Research Area	FY03 R&D Base Budget (a)	Total Unused R&D Funds from Prior Years (b)	Total R&D Funds Available (a)+(b)	FY03 R&D Actual Expenditures (c)	Transferred To Match Grants & Contracts (d)	Commitments to Physical Plant Projects (e)	Total R&D Funds Utilized (c)+(d)+(e)	Funds Carried Forward To FY04 [1]	New Grants & Contracts Generated [2]	Total FTE Positions Supported By All R&D Funds [3]
Lewiston-Auburn R&D	40,000	0	40,000	30,310	0	0	30,310	9,690	0	1
Library Research	95,000	0	95,000	91,506	0	0	91,506	3,494	0	0
J Wise Lab	400,000	0	400,000	369,520	0	0	369,520	30,480	0	4
John Roberts Road	0	69,632	69,632	274,724	0	69,632	344,356	(274,724)	0	0
Research Development	338,098	0	338,098	337,107	0	0	337,107	991	0	5
College of Arts & Sciences	75,000	0	75,000	65,217	0	0	65,217	9,783	0	1
Opportunity Programs	215,569	11,109	226,678	51,819	71,419	0	123,238	103,440	223,910	0
Inst for Research in Info Sciences (IRIS)	290,059	15,000	305,059	299,579	25,268	0	324,847	(19,788)	160,881	7
Bioscience Research Institute (BRISM)	533,643	0	533,643	377,477	27,638	0	405,115	128,528	3,259,661	8
Total	$1,987,369	$95,741	$2,083,110	$1,897,259	$124,325	$69,632	$2,091,216	($8,106)	$3,644,452	26

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).

[2] Dollar value of new grants & contracts that resulted from FY03 State R&D funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

1/8/04 MW50Z(339)

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY03 MAINE PATENT PROGRAM APPROPRIATION

ACCOUNTING PERIOD: 7/1/2002 - 6/30/2003

USM

Major Program Area	Source of Patent Program Funds: FY03 Patent Program Base Budget (a)	Source of Patent Program Funds: Total Unused Funds from Prior Years (b)	Source of Patent Program Funds: Total Patent Program Funds Available (a)+(b)	Utilization of R&D Funds: FY03 Patent Program Actual Expenditures (c)	Utilization of R&D Funds: Transferred To Match Grants & Contracts (d)	Utilization of R&D Funds: Commitments to Physical Plant Projects (e)	Utilization of R&D Funds: Total Patent Program Funds Utilized (c)+(d)+(e)	Funds Carried Forward To FY04 [1]	New Grants & Contracts Generated [2]	Total FTE Positions Supported By All Patent Funds [3]
Maine Patent Program	296,251	265,774	562,025	288,703	0	0	288,703	273,322	0	4

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).

[2] Dollar value of new grants & contracts that resulted from FY03 Maine Patent Program funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on Maine Patent Program projects.

1/8/04 MW50Z(339)

UNIVERSITY OF MAINE SYSTEM

FY2003 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS

UM/USM COMBINED

Project Name	Referendum Bond Portion	Other Funds Provided To Date	Total Project Budget	Expenditures to Date	Funds Carried Forward To FY2004
FY1999 State Bond Issue (approved by voters 11/3/1998)					
UM	$10,800,000	$1,168,622	$11,968,622	$11,370,720	$597,902
USM	2,700,000	155,000	2,855,000	2,708,656	146,344
TOTAL	$13,500,000	$1,323,622	$14,823,622	$14,079,376	$744,246
FY2001 University R&D Revenue Bonds (Debt Service Paid by $2,500,000 State Appropriation - Issued 8/15/2000)					
UM	$20,000,000	$600,000	$20,600,000	$9,059,902	$11,540,098
USM	5,000,000	4,161,599	9,161,599	8,389,101	772,498
TOTAL	$25,000,000	$4,761,599	$29,761,599	$17,449,003	$12,312,596
FY2001 One-Time State Appropriation (signed by Governor 4/25/2000)					
UM	$9,000,000	$2,496,353	$11,496,353	$9,120,079	$2,376,274
FY2002 State Bond Issue (approved by voters 6/11/2002)					
UM	$5,000,000	$0	$5,000,000	$481,063	$4,518,937
USM	4,000,000	0	4,000,000	205,701	3,794,299
TOTAL	$9,000,000	$0	$9,000,000	$686,764	$8,313,236

OFT: 01/12/2004 MW50Z(339) Source: Z65(38)

UNIVERSITY OF MAINE SYSTEM

FY2003 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS

UM

Project Name	Referendum Bond Portion	Other Funds Provided To Date	Total Project Budget	Expenditures to Date	Funds Carried Forward To FY2004	Estimated Completion Date
FY1999 State Bond Issue (approved by voters 11/3/1998)						
Hitchner Expansion & Renovation and Food Science Building	$9,400,000	$544,220	$9,944,220	$9,459,399	$484,821	9/30/03
Hitchner FY2001 Revenue Bond Interest	0	438,860	438,860	325,779	113,081	9/30/03
Aquaculture Renovation & Expansion	200,000	0	200,000	200,000	0	10/31/01
CRW Lab Related Work	250,000	64	250,064	250,064	0	6/15/99
Boardman Hall Basement Renovation	0	159,398	159,398	159,398	0	2/01/02
Barrows Lab Renovation	74,015	1,080	75,095	75,095	0	5/10/01
Software Eng & Adv Materials Labs	875,985	25,000	900,985	900,985	0	10/25/00
	$10,800,000	$1,168,622	$11,968,622	$11,370,720	$597,902	
FY2001 University R&D Revenue Bonds (Debt Service Paid by $2,500,000 State Appropriation - Issued 8/15/2000)						
Engineering & Science Research Facility	$14,400,000	$500,000	$14,900,000	$5,997,107	$8,902,893	12/31/04
Machine Tool Lab Addition	400,000	0	400,000	186,832	213,168	12/31/03
Advanced Manufacturing Center	2,460,000	0	2,460,000	362,532	2,097,468	3/31/04
Hitchner Addition	2,000,000	0	2,000,000	2,000,000	0	12/31/02
Boardman Hall Renovation	500,000	0	500,000	500,000	0	2/01/02
Underground Steam Distribution Upgrade	240,000	100,000	340,000	13,431	326,569	12/31/04
	$20,000,000	$600,000	$20,600,000	$9,059,902	$11,540,098	

OFT: 01/12/2004 MW50Z(339) Source: Z65(38)

UNIVERSITY OF MAINE SYSTEM

FY2003 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS

UM

Project Name	Referendum Bond Portion	Other Funds Provided To Date	Total Project Budget	Expenditures to Date	Funds Carried Forward To FY2004	Estimated Completion Date
FY2001 One-Time State Appropriation (signed by Governor 4/25/2000)						
Aubert Hall - Phase 1	$9,000,000	$496,353	$9,496,353	$9,120,079	$376,274	3/31/04
Aubert Hall - Phase 2	0	2,000,000	2,000,000	0	2,000,000	9/30/04
	$9,000,000	$2,496,353	$11,496,353	$9,120,079	$2,376,274	
FY2002 State Bond Issue (approved by voters 6/11/2002)						
Advanced Manufacturing Center	$4,000,000	$0	$4,000,000	$0	$4,000,000	3/31/04
CAM Tools Advanced Materials Center	1,000,000	0	1,000,000	481,063	518,937	3/31/04
	$5,000,000	$0	$5,000,000	$481,063	$4,518,937	

OFT: 01/12/2004 MW50Z(339) Source: Z65(38)

UNIVERSITY OF MAINE SYSTEM

FY2003 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS

USM

Project Name	Referendum Bond Portion	Other Funds Provided To Date	Total Project Budget	Expenditures to Date	Funds Carried Forward To FY2004	Estimated Completion Date
FY1999 State Bond Issue (approved by voters 11/3/1998)						
Portland Science Building Lab Renovation	$2,254,890	$30,000	$2,284,890	$2,138,546	$146,344	7/01/03
Portland R&D Parking	57,966	0	57,966	57,966	0	7/01/03
Mitchell Center R&D Renovations	387,144	125,000	512,144	512,144	0	11/30/00
	$2,700,000	$155,000	$2,855,000	$2,708,656	$146,344	
FY2001 University R&D Revenue Bonds (Debt Service Paid by $2,500,000 State Appropriation - Issued 8/15/2000)						
Portland Science Building Lab Renovation	$5,000,000	$4,161,599	$9,161,599	$8,389,101	$772,498	10/31/03
FY2002 State Bond Issue (approved by voters 6/11/2002)						
Mitchell Center Expansion	$4,000,000	$0	$4,000,000	$205,701	$3,794,299	12/15/04

OFT: 01/12/2004 MW50Z(339) Source: Z65(38)