

# MAINE STATE LEGISLATURE

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# MAINE ECONOMIC IMPROVEMENT FUND



UNIVERSITY OF MAINE SYSTEM

Annual Report FY16 • Presented to Maine State Legislature



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## Memo from the Chancellor

The Maine Economic Improvement Fund (MEIF) represents Maine's ongoing commitment between the state and our public universities, working together to advance research and economic development for the benefit of all Maine people. In July 2014, the University of Maine System Board of Trustees (UMS BOT) established Strategic Outcomes and metrics to measure the performance of the University of Maine System and its campuses. Included in these Strategic Outcomes are specific goals for research, economic development and workforce development. The UMS BOT has applied these overall Strategic Outcomes to research and development, and has established specific goals and metrics for the Maine Economic Improvement Fund to help achieve these Strategic Outcomes. These metrics were approved at the end of FY14, and are applied to all FY16 MEIF activity and included in this annual report. By statute, MEIF-funded activity is restricted to Maine's seven statutorily established R&D sectors.

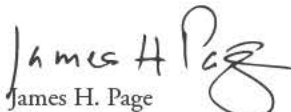
- In FY16, the state's \$17.35 million MEIF investment was leveraged at a rate of 3:1 by our UMS campuses for an additional \$50.3 million in federal and private-sector grants and contracts in the seven sectors.
- MEIF funds and the external grants and contracts they leverage funded the work of over 400 researchers and technicians, and more than 800 graduate and undergraduate students.
- These grants and contracts provided more than \$2 million to purchase major equipment to upgrade and outfit university labs.

Maine's public universities secured new patents, worked on development projects with large and small businesses and startups, and provided R&D support to over 500 companies and individuals.

As required in the statute that created MEIF 19 years ago, included with this FY16 MEIF report are financial and informational details.

If you have questions about MEIF projects, this report or other University of Maine System research and economic development programs, please contact me.

Sincerely,

  
James H. Page  
Chancellor  
University of Maine System

University of Maine System Maine Economic Improvement Fund Fiscal Year 2016

## MEIF Background

The Maine Economic Improvement Fund (MEIF) represents the ongoing commitment between the state, the private sector and our public universities, working together to advance research and economic development for the benefit of all Maine people.

Since its establishment by the Maine Legislature in 1997, MEIF has positioned the University of Maine System (UMS) at the center of statewide efforts to leverage economic development through targeted investment in university-based R&D. MEIF continues to be funded through an annual state appropriation to UMS.

These funds provided through state appropriation to the University of Maine System are dollars specifically provided to support university-based research, development and commercialization in the state's legislatively designated seven strategic technology areas:

- Advanced Technologies for Forestry and Agriculture
- Aquaculture and Marine Sciences
- Biotechnology
- Composites and Advanced Materials Technologies
- Environmental Technologies
- Information Technologies
- Precision Manufacturing

The University of Maine and the University of Southern Maine have well-established research, development and commercialization activities accounting for 97 percent of the MEIF activity. In 2009, the University of Maine System established the Small Campus Initiative Fund to promote seven-sector research and development activity at the other five UMS campuses and, as of 2013, Maine Maritime Academy (MMA).

## Role of MEIF

The role of MEIF is to provide researchers at Maine's public universities with the investment necessary to:

- Attain external grants and contracts to support R&D activities in Maine's seven sectors
- Attract and retain world-class researchers
- Provide support for modern laboratories and state-of-the-art equipment
- Create new products, patents, technologies, companies and exciting job opportunities in Maine
- Create and sustain economic development and innovation

MEIF funds often provide the required match to acquire these federal or private sector grants. This investment in Maine's public university R&D helps faculty and students successfully leverage tens of millions of dollars in grants and contracts annually.

MEIF money also supports equipment purchases or facilities renovations to make the universities more competitive for federal grants.

MEIF increasingly fosters university partnerships with business and industry through economic development collaborations, entrepreneur training programs, business incubators, business research and other programs. These efforts lead to new Maine-based products, technologies, patents and spin-off businesses.

The University of Maine and University of Southern Maine are the two universities with established research and graduate programs in all of the seven targeted research sectors and have received MEIF funds, with 77.6 percent to the University of Maine, 19.4 percent to the University of Southern Maine, and 3 percent to the other campuses and Maine Maritime Academy.

Indicators of success show that Maine's MEIF investment is paying dividends by:

- Creating businesses and jobs, including the jobs of more than 400 faculty and staff, and over 800 students working on MEIF-funded projects
- Boosting Maine's economy by leveraging MEIF funds to bring federal and private-sector grants and contracts to Maine
- Building capacity and expertise to help Maine companies solve problems and commercialize innovation
- Helping commercialize patents, innovations and intellectual property
- Capitalizing on natural resources and core strengths by focusing R&D efforts on economic sectors where Maine can make real gains. University research personnel use MEIF resources to support the staff, equipment and facilities they need to successfully pursue and develop research projects

# Strategic Outcomes, Goals and Metrics

In July 2014, UMS BOT developed and approved Strategic Outcomes to measure the performance of the University of Maine System and its campuses. In October 2014, UMS BOT approved the use these newly developed Strategic Outcomes to create MEIF-specific goals and metrics. Several of the UMS Strategic Outcomes are performance targets for all R&D and economic development activity. The MEIF goals recognize that MEIF activity is restricted to Maine's legislatively selected seven R&D sectors and are, therefore, MEIF goals and metrics, and a subset of the overall UMS goals. The UMS Strategic Outcomes that apply to R&D activity are:

- Target 1 – Increase Research Capacity and Activity
- Target 2 – Support New Technologies, Licensing and Commercialization
- Target 4 – Increase Economic Development Partnerships
- Overall Goal – Support R&D Workforce Development

This report addresses those goals. In addition, the University of Maine System reports R&D outcomes annually through the statutorily required survey of Maine R&D activity administered by the Maine Department of Economic and Community Development.

The R&D Strategic Outcomes and related MEIF goals are:

## MEIF Target 1

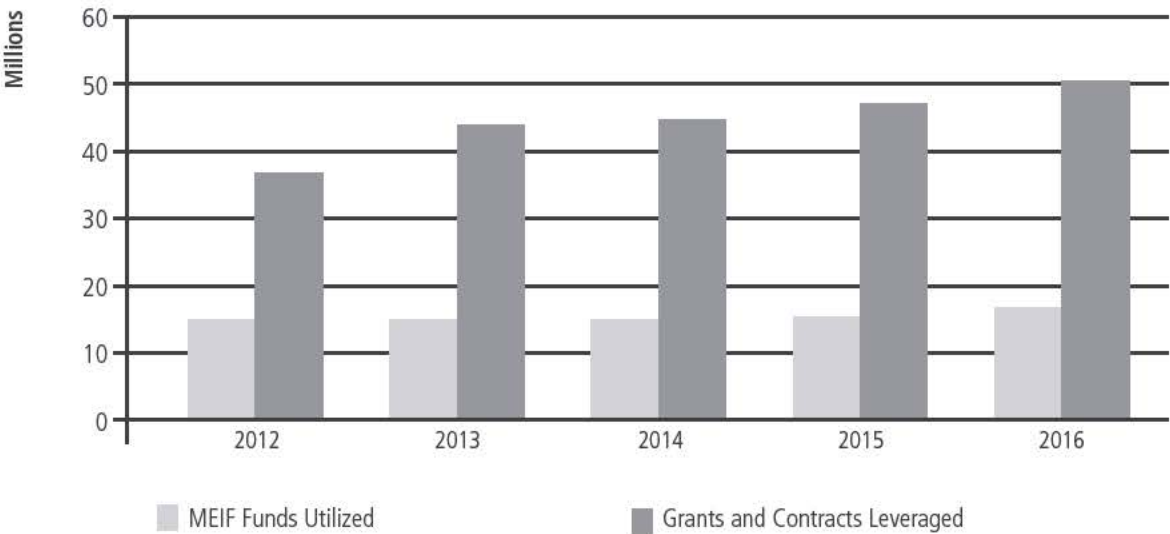
*Derived from UMS BOT Research and Economic Development Target 1*

UMS maintains a sponsored programs grant and contracts effort growing greater than 3 percent annually on a three-year rolling average from a 2013 baseline of \$45 million and NSF-defined total research expenditures of \$45 million in the MEIF sectors. Activity from the seven MEIF sectors will account for 50 percent of the total R&D grants and contracts, with a 3 percent annual growth on a three-year rolling average. The FY13 baseline was a calculated percentage of total activity. Table 1 below shows the actual FY13 baseline at slightly less at \$43.5 million.

Table 1

FY16 Total Grants and Contracts		Number of Awards		Total Award Value	
Total Proposals Submitted		1,141		\$172,061,414	
Total Proposals Awarded		946		\$76,823,194	
Grants and Contracts Awarded in MEIF Sectors	FY13 MEIF Awards	FY14 MEIF Awards	FY15 MEIF Awards	FY16 MEIF Awards	
Forestry and Agriculture	\$8,642,424	\$7,654,060	\$14,194,009	\$10,317,799	
Aquaculture and Marine	7,045,322	9,153,389	15,187,566	12,631,690	
Biotechnology	1,985,295	6,353,450	1,524,204	2,399,487	
Composites	9,230,715	5,135,033	5,247,712	6,974,264	
Environmental	5,781,658	7,959,264	4,349,651	5,045,536	
Information Tech	7,422,675	2,520,521	4,473,781	11,497,199	
Precision Manufacturing	1,130,746	1,414,700	780,694	1,009,921	
Cross Sector	2,290,129	4,681,209	1,018,132	507,842	
Total	\$43,528,964	\$44,871,626	\$46,775,749	\$50,383,738	
				FY16 Dollar Increase	\$3,607,989
				FY16 Percentage Increase	7.71%

**Figure 1 MEIF Return on Investment (UMS)**  
Tens of Millions Leveraged in Grants and Contracts  
(Five-Year Snapshot)



In summary, the MEIF Target 1 for increasing external grants and contracts leveraged through MEIF investments saw an increase of 4.4 percent over the previous fiscal year. This favorable trend continues in a positive direction after decreases from FY10 through FY12. This is largely related to changes in the economy, and the federal and private-sector partners that are beginning to slowly increase post-recession funding for R&D. Recognizing the lead-time for proposal preparation, sponsor review and selection, and contract activity to begin, there can be a one- to two-year lag in output. Proposal preparation and submissions remain steady. For the purpose of this report, a private-sector contract is counted as a single proposal submission.

**MEIF Target 2**

*Derived from UMS BOT Research and Economic Development Target 2*

UMS annual revenue from commercialization, including intellectual property licensing, increases at least 20 percent annually on a three-year rolling average from a baseline of \$150,000 from the MEIF sectors.

Table 2

MEIF Target 2 — Commercialization Activity	FY13	FY14	FY15	FY16
Revenue from Commercialization	\$121,250	\$96,726	\$150,094	\$127,949
Number of Patents Filed	15	32	22	35
Number of Patents Issued	16	12	9	8
Number of License Agreements and License Options	6	6	16	8
			FY15–FY16 change	-15%

In summary, revenue from the commercialization of intellectual property has decreased over the last several years, but grew again in FY15. FY16 saw a drop from FY15. Commercialization in Maine often relies on companies licensing UMS intellectual property to secure private investment to advance technology, products and services into markets. General trends in venture capital and private equity investments are slowly rebounding in Maine, and companies are starting to see new equity investments. Patents take four to five years from application to issuance. Newly issued UMS patents reported in Table 2 and detailed in Appendix 1 were filed four to five years ago. In addition, UMS technologies generally fall into categories, such as transportation infrastructure, pulp and paper, sensors and biotechnology. These sectors have been slower to rebound post-recession and timelines from lab to market can take five to 10 years. UMS is focusing additional effort to accelerate the commercialization with private-sector partners and other investment programs, such as the Maine Technology Institute and Maine Venture Fund.

## MEIF Target 3

*Derived from UMS Research and Economic Development Target 4*

The UMS annual revenue from activities with business and industrial partners in the MEIF sectors increases from an FY13 baseline of \$3.15 million to \$6.75 million by FY17, and the number of business and industry contracts in the MEIF sectors will increase from a baseline of 400 in FY13 to 450 in FY17.

In summary, many MEIF investments not only leverage external grants and contracts, but through a combination of MEIF funds, and grant and contract funds, have helped UMS campuses build capacity to work directly with industry partners. Some industry partners will be companies licensing and commercializing UMS intellectual property, while many companies are working with UMS campuses to get assistance with solving their problems or perfecting their inventions and innovations. UMS projects with business and industry continue to grow, and activity is meeting the goals and metrics of this Target. Figure 2 demonstrates the statewide nature of these partnerships for those contracts that are currently tracked. Many additional companies, inventors and entrepreneurs receive advice and guidance, but do not result in formal contracts.

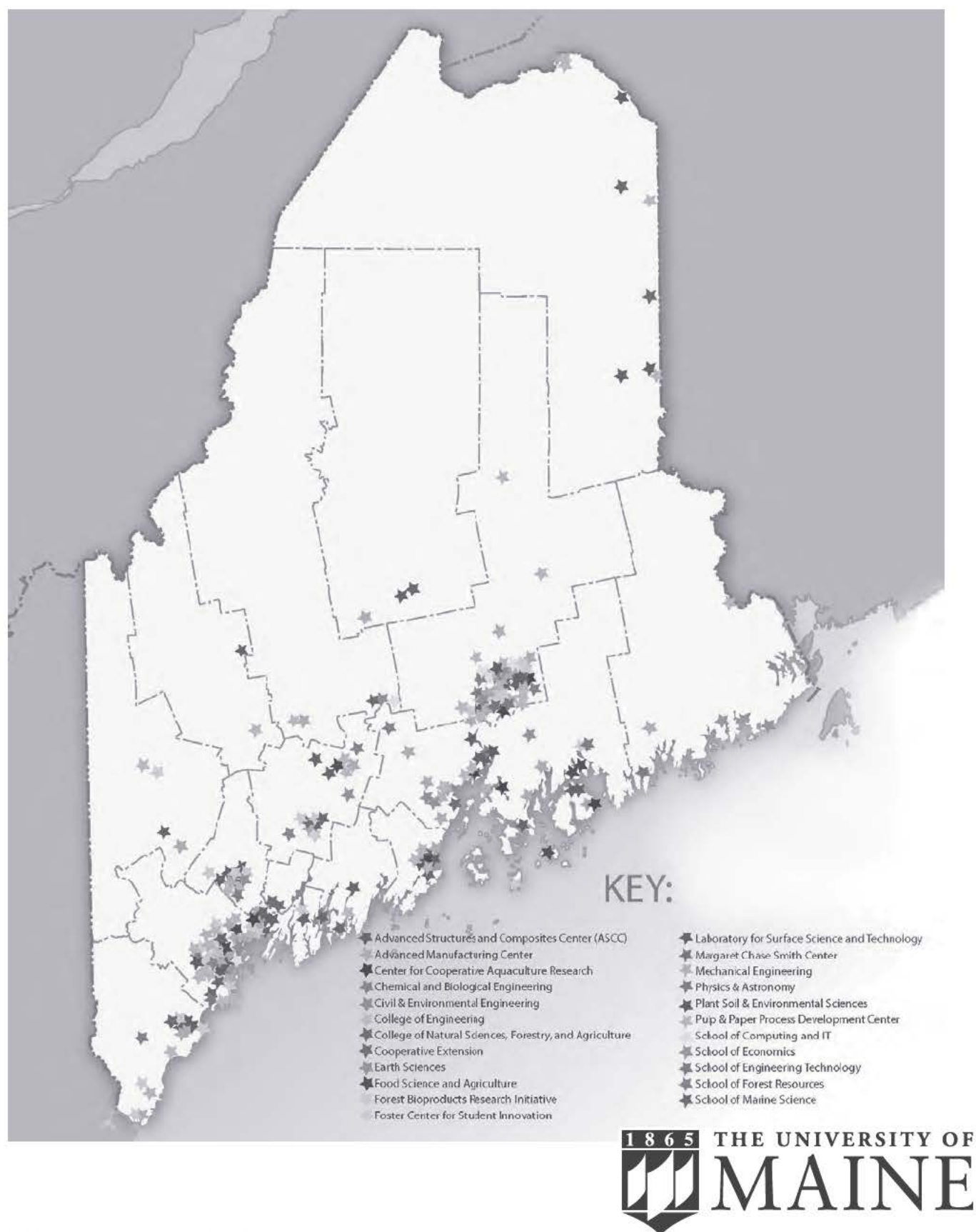
Table 3

<b>MEIF TARGET 3 — Business and Industry Contracts</b>	<b>FY13</b>	<b>FY14</b>	<b>FY15</b>	<b>FY16</b>
Revenue from Business and Industrial Contracts	\$4,156,184	\$4,371,999	\$5,759,572	\$4,836,138
Number of Business and Industrial Contracts	407	500	624	519



## Strategic Outcomes, Goals and Metrics

Figure 2 UMS Industry Partnerships



## MEIF Target 4

### *Support R&D Workforce Development*

UMS shall maintain a concerted effort to involve faculty, staff and students participating in research, development and commercialization, and shall report annually the number of employees directly supported by MEIF funds and by grants and contracts in MEIF sectors. As external funding is hard to predict, there is no specific numerical goal for employee count, but UMS shall report the annual number of faculty, staff and students to indicate trends and identify opportunities for growth.

In summary, state economic analysis predicts economic growth in Maine based on an available trained and educated workforce. Growth in the seven MEIF sectors is especially dependent on the available workforce. MEIF seven-sector projects at UMS rely on regular faculty and staff, as well as many “soft money” employees — those hired to work on specific grants and contracts, and paid by those grant and contract funds. UMS employees and students gain valuable on-the-job training and experience, and may then contribute to the employment base within these sectors after completion of the grants or graduation. Grant and contract revenue is a strong contribution to this workforce development. UMS counts employees involved in this activity, and will continue to pursue the growth in employment numbers related to growth in grant and contract activity. Nonstudent employees are tracked as full-time equivalents (FTEs) based on a 40-hour/52-week work year. Student employees, tracked by head count, generally work less than 20 hours per week during the academic year.

Grant and contract revenue also is an important source of funding for students’ salary, tuition and other types of support, allowing many research-active students to offset their cost of education while getting valuable skills and on-the-job experience.

### **Success and Strategic Impact**

By leveraging MEIF funds, UMS has attracted more than \$225 million since 2012 in federal and private-sector grants and contracts related to the seven strategic research areas. This funding directly results in Maine products and technologies, such as biofuels, pulp and paper products, new potato varieties, aquaculture technologies and software, which lead to improvements in Maine’s industries.

### **Return on Investment**

Each year, the state’s MEIF appropriation is matched by tens of millions of dollars in federal and private funds for important research and development. The University of Maine as the state’s land grant institution utilizes its long-established research capacity and infrastructure to attract the majority of these matching funds. Other UMS schools continue to build and partner within federal and private-sector grants and contracts.

### **Developing Workforce and Creating Jobs**

More than 400 full-time equivalent jobs are funded annually in Maine through the funds leveraged and expended related to MEIF. These positions include faculty, technicians and research staff. Over 800 graduate and undergraduate students are funded for their involvement in research, development and commercialization. This activity is better than most internships and gives students great real-world experience as well as life-long networks and connections.

Table 4

MEIF Target 4 — Workforce Development	Wages Paid from MEIF	Wages Paid from Grants/Contracts	Totals	
Number of Faculty Staff Supported (FTE = Full-Time Equivalent)	123	310	433	
Number of Graduate Students Supported (Headcount)	49	285	334	
Number of Undergraduate Students Supported (Headcount)	78	459	537	
Student Costs from Grants and Contracts	FY13	FY14	FY15	FY16
Student Salaries and Wages from Grants and Contracts	\$5,001,942	\$4,877,650	\$4,603,696	\$5,255,861
Student Tuition Paid by Grants and Contracts	952,553	857,781	835,961	956,963
Student Fellowships Paid by Grants and Contracts	236,553	199,400	552,944	197,744
Student Health Insurance Paid by Grants and Contracts	167,893	282,848	62,967	247,960
<b>Total Soft Money Student Support</b>	<b>\$6,358,941</b>	<b>\$6,217,679</b>	<b>\$6,055,568</b>	<b>\$6,658,528</b>

# MEIF Success Stories

## ■ USM'S C2 Lab

The University of Southern Maine's Ci2 Lab empowers undergraduate students to be innovators and creative thinkers as they work in multidisciplinary teams to launch real-world entrepreneurial projects in partnership with the nonprofit, business or government sectors. Over the past year, a student team that formed an informal company called TimeShock Games has built over eight games and published three, with more in the pipeline. Their efforts have attracted the attention of Amazon, which is partnering with Microsoft to develop virtual reality games. Amazon and Microsoft will conduct an in-depth evaluation of the team's most recent game, "Chicken Mafia," with the objective of potentially buying and distributing it. Amazon has now recognized Ci2 as a "concept lab," and is initiating discussions about future internship and partnership potential. Additionally, after a visit to the Ci2 lab, Susan Gordon Messer of Massachusetts Institute of Technology's GameLab is now working with Ci2 game development students to develop future partnerships and potential internships for Ci2 students at the MIT GameLab.

In another example of innovation and entrepreneurship, a USM engineering student is working on revolutionary imaging technology that harmlessly employs radar and microwave "wave" frequencies to image material substrates at the microscopic level. The student is exploring a commercial application for this technology through both a research partnership with the University of Massachusetts Lowell and SAPPI paper company. This student will seek patent application for the process and plans to start a company in Maine to deploy the technology.

## ■ Health Informatics Research Cluster

The USM Health Informatics (HI) Research Cluster, an interdisciplinary team of faculty and staff researchers, focuses on supporting the development of health informatics through strategic partnerships with health care, public health and health data organizations that build Maine's capacity to provide efficient, high-quality clinical and population health services. In the past year, HI Research Cluster has broadened partnerships with the Maine Health Data Organization (MHDO) and Community Health Options, expanding the cluster's research focus to include telehealth applications, and how they support health care access for rural and other underserved populations.

HI Research Cluster has worked with multiple partners to receive several research funding awards totaling more than \$9 million, with approximately \$7 million allocated to Maine-based organizations. These new projects will focus on

developing a new data resource for cancer research, a lung cancer prevention/screening/treatment initiative, and a 50-state, baseline inventory of telehealth services provided to Medicaid enrollees in rural and urban settings. Funders include the U.S. Department of Justice, Maine Cancer Foundation, Bristol-Myers Squibb Foundation, and U.S. Health Services and Resources Administration. Finally, student involvement in project work has expanded in the areas of statistical analysis, R-programming, data mining and working with health care data.

## ■ Waterfront Entrepreneur Project

The Waterfront Entrepreneur Project at USM's School of Business engages students with local community entrepreneurs and businesses in the seafood industry and transportation/logistic sectors so that students gain workplace-ready skills through global-applied, industry-oriented learning experiences that can lead to potential new industry products and services.

Building on knowledge gained through Maine's collaborative relationships with Icelandic and Northern Atlantic academic institutions, the project launched with three teams of MBA students who worked with entrepreneurs in the New England Ocean Cluster and Woodard & Curran to examine market feasibility, conduct market opportunity analyses, and develop market plans for three new seafood industry products: new lobster consumer food products, the reprocessing of waste lobster shells into Chitosan, and the promotion and distribution of a sustainable cod liver oil product. These three team proposals were judged by a group of 40 local area entrepreneurs in late April 2016; the winning MBA team won a trip to visit the Iceland Ocean Cluster House and Reykjavik University. All three Waterfront MBA collaborative projects continue to be under active consideration for development and launch as potential businesses in Maine. Business School faculty members John Voyer and Bob Heiser have begun discussions with Reykjavik University to explore joint USM-RU courses and programs.

## ■ High-Sensitivity Reaction Calorimeter (uRC)

The acquisition of a high-sensitivity reaction calorimeter has allowed USM faculty and students to study the chemical reactions, interactions and physical transformations of different chemical systems. The equipment has significantly enhanced the current education and research capabilities at USM and has initiated new preliminary research in areas of new materials for art conservation, as well as the study of thermal regulation/metabolic activity in deer ticks.



## ■ QC<sup>2</sup> "Collaboratory"

In recent years, the number of craft breweries in Maine has exploded. Small homebrewers are scaling up their operations as they gain exposure and recognition, but are challenged by the costs of implementing QA/QC processes. USM's new community lab, the Quality Control Collaboratory (QC<sup>2</sup>), helps brewers with their processes, while giving undergraduates valuable hands-on experience using laboratory instrumentation to support this growing industry. In its first six months, QC<sup>2</sup> engaged local breweries and the Maine Brewers' Guild, and faculty and students to set up the lab and begin research projects with Rising Tide and Allagash breweries. Five more breweries were slated to be part of the first brewers' class. April 2016 saw the first New England Brew Summit, with participation from brewers, community members, Sen. Angus King, U.S. Rep. Chellie Pingree, and Dick Cantwell, the Brewers Association quality ambassador. The New Belgium Brewing Co. presented QC<sup>2</sup> with \$5,000 for its collaborative work with Allagash Brewery.

## ■ Phage Hunters

There is a long list of learning objectives for the phage genomics course at UMaine in which first-year undergraduates conduct hands-on research. Students learn how to purify and isolate novel bacteriophages — viruses that infect bacterial hosts — from soil samples. They learn how to characterize their individual phages, which can only be viewed using an electron microscope. They learn essential laboratory techniques used to analyze and design unique experiments. But most important, the first-year students learn how to be researchers and acquire skills early in their academic career that will allow them to excel in the sciences.



In the classroom, students figure out how their isolated virus is related to many of the others that have been isolated across the United States. The procedures students learn to analyze phages closely resemble those used to understand more complex genomes, such as the human genome. By comparing their phage with others that infect the same host, students develop an understanding of the evolution of genomes.

[umainetoday.umaine.edu/archives/spring-summer-2016/phage-hunters/](http://umainetoday.umaine.edu/archives/spring-summer-2016/phage-hunters/)

*"UMaine has pushed me to strive for excellence and has allowed me to pursue research that I never expected I would have the opportunity to do as a first-year student."*

— UMaine Honors student Ethan Thibault

## ■ Seeing Forests and Trees

Through his research at the University of Maine's Advanced Structures and Composites Center and School of Forest Resources, wood scientist Stephen Shaler strives for a sustainable future. Shaler is the principal investigator for two projects that involve testing wood and composite materials to determine if they're suitable for building construction. The first involved testing Norway spruce to meet industry standards and be included in the Spruce-Pine-Fir South grouping for construction-grade dimensional lumber.

The second project involves evaluating the performance of cross-laminated timber (CLT) made from solid-sawn and composite lumber from trees that grow in Maine and the northeastern U.S. The plywood product consists of two-by-laminated lumber or composite — two-by-fours, two-by-sixes, or two-by-eights — stacked at right angles — with as few as three and as many as nine laminated layers — and bonded with an adhesive. The strong, stable panels are used as full wall segments, as well as in floors and roof systems. UMaine is testing the strength, thermal and moisture properties of CLT made with woods in the Spruce-Pine-Fir South group. Provided that Norway spruce passes U.S. Industry standards, it, too, will be included in CLT development.

[umainetoday.umaine.edu/archives/spring-summer-2016/seeing-forests-and-trees](http://umainetoday.umaine.edu/archives/spring-summer-2016/seeing-forests-and-trees)





### ■ Pest Management — 2.9 Million Views

University of Maine Cooperative Extension's Experts on Demand video "How to Look for and Avoid Bedbugs in Hotel and Motel Rooms," by Extension professor James Dill, went viral when cited by online media and has over 2.9 million views. Bed bugs are making a comeback in the U.S. for several reasons. Some factors include increased international travel, increased popularity of thrift shops, yard sales, and buying used furniture. Bed bugs have a secretive lifestyle and can hide in any crack or crevice, going undetected. The video demonstrates how to look for and identify bed bug infestations while traveling.

### ■ From the Ground Up

The University of Maine's potato breeding program, conducted in collaboration with the Maine Potato Board, is committed to cultivating new varieties of spuds. It is a process that takes more than a decade and involves the expertise of growers, entomologists, food scientists, agronomists and geneticists. This year, UMaine's breeding program produced 50,000 seedlings, each with a unique set of genetic material that could hold the key to the next decade's successful potato varieties. Creating a new successful potato variety takes a great deal of time, expertise and ample, uninterrupted funding.

Though each of the varieties of potato has some useful disease-resistance traits, one is not resistant to all of the major plant

diseases that affect today's potato industry. UMaine's potato breeding program is working to change that. Predicting what genes will be important to fight diseases 15 years in the future in a constantly adapting environment is almost as difficult. But as genetic testing capabilities have continued to advance, the breeding process has steadily picked up speed. UMaine Professor of Agroecology Gregory Porter's breeding program is aimed at selecting genes that produce resistance to three common potato diseases currently affecting growers in the eastern United States. The breeding program collaborates with Cornell University, North Dakota State University and North Carolina State University, which provide genetic material to breed varieties resistant to potato beetles and aphids.

*"The University of Maine has the research and development capability and commitment for developing new potato varieties, from the lab to the field, which takes years."*

— Don Flannery, Executive Director of the Maine Potato Board

### ■ Record Harvest

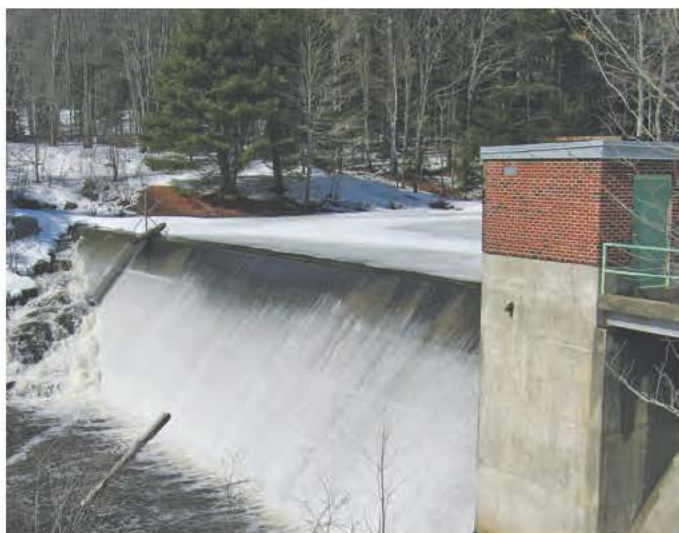
In 15 years, University of Maine Cooperative Extension's statewide Maine Harvest for Hunger program has distributed more than 2.19 million pounds of food to people in Maine experiencing food insecurity. Maine has the highest rate of food insecurity in New England, and ranks 12th in the United States. In 2015, record-breaking donations of over 318,000 pounds of food went to 188 distribution sites and directly to individuals. Nearly 500 program volunteers in 14 counties collectively logged more than 5,000 hours.





## ■ Improved Sensor Data

Two UMaine researchers in the School of Computing and Information Science have received a \$500,000 National Science Foundation award to advance scientists' ability to analyze massive data samples collected by real-time sensors. The technology could be used to model a broad range of environmental phenomena, such as air pollution, smog levels, pollen distribution, toxic chemical plumes and humidity. Sensors are capable of taking samples at discrete points in space. However, in many cases the data have to be physically stored and retrieved on a memory card from a research site, which can be time consuming and inconvenient. Real-time sensors can bring in 20,000 new samples every few seconds, dramatically enhancing the scope of data available to scientists. The research team created software to allow for the collection and analysis of tens of thousands of new data points every few seconds.



## ■ The Future of Dams

A new \$6 million grant from the NSF's EPSCoR program is funding a four-year study examining the future of dams in New England. The new tristate collaboration, led in Maine by the Senator George J. Mitchell Center for Sustainability Solutions at the University of Maine, will strengthen connections between scientists and decision-makers about potential dam options, including maintaining existing hydropower dams, expanding hydropower capacity, and removing aging dams to restore fisheries or reduce safety risks. By examining economic, environmental and social trade-offs, the project will help individuals and communities make better decisions about dams. Hydropower is a major source of renewable energy in New England, and more than 50 hydropower dams are scheduled for relicensing in the next decade.



## Waves of the Future

At UMaine, the world-class W<sup>2</sup> Alford Ocean Engineering Laboratory at the Advanced Structures and Composites Center is assisting businesses in developing products for the ocean economy, including improved boat and ship hulls; ocean energy devices such as wind, wave and tidal energy; aquaculture facilities; oil and gas structures; waterfront infrastructure, such as bridges, piers, docks and port facilities; and systems to protect coastal cities from the effects of erosion, sea-level rise and extreme storms. It is one of the only labs of its kind in the nation.

The unique facility is equipped with a high-performance rotating wind machine over a wave basin, which can simulate some of the largest wind and wave storms seen on Earth. The basin will be an important resource for companies in Maine and throughout the world to develop next-generation ocean devices and structures. The Composites Center is the largest STEM research and development program located at a Maine university, and is key to one of the seven University of Maine Signature Areas of Excellence — Advanced Materials for Infrastructure and Energy.

*"We are investing in people and infrastructure that will support ocean engineering and advanced manufacturing education and research, and grow Maine jobs."*

— Gregory Powell, Chairman  
Harold Alford Foundation

## MEIF Success Stories

### ■ Out of This World

Civil engineering Ph.D. student Andrew Young was named a 2015 NASA Space Technology Research Fellow for his work on the Hypersonic Inflatable Aerodynamic Decelerator (HIAD) project at the UMaine Advanced Structures and Composites Center. HIAD is a nose-mounted device on a spacecraft that slows the vehicle as it enters a planet's atmosphere. The NASA technology is intended to make it possible for a spaceship large enough to carry astronauts and scientific equipment to Mars and beyond. UMaine is assisting NASA by analyzing stresses and deformities in the device in the laboratory. NASA annually selects a group of graduate students to become NASA Space Technology Research Fellows. The goal is to sponsor U.S. citizen and permanent resident graduate students who show significant potential to contribute to NASA's goal of creating innovative new space technologies for the nation's science, exploration and economic future.

### ■ Offshore Wind Project Receives \$40 Million Construction Grant

In July 2016, the UMaine-led New England Aqua Ventus I project won top-tier status from the U.S. Department of Energy (DOE) Advanced Technology Demonstration Program for Offshore Wind. This means that the Aqua Ventus project is now automatically eligible for an additional \$39.9 million in DOE construction funding. With this new funding, the Aqua Ventus project will likely become the first commercial-scale floating wind project in the Americas. The total DOE funding for this demonstration project will be \$50 million, including \$10 million in design and development funding.

This major development represents the strongest possible endorsement of the transformational VoltturnUS concrete hull technology by DOE. The UMaine-developed, patented, VoltturnUS floating concrete hull technology can support wind turbines in water depths of 150 feet or more, and has the potential to significantly reduce the cost of offshore wind.

Maine Aqua Ventus I, GP, LLC, is leading a demonstration project called New England Aqua Ventus I, a 12 MW floating offshore wind pilot project to develop a clean, renewable energy source off Maine's shores. Partners include Emera Inc., Cianbro Corporation and the University of Maine. The objective of the pilot is to demonstrate the technology at full scale, allowing floating farms to be built out of sight in the U.S. and the world in the 2020s, bringing lower-cost, clean renewable energy to coastal population centers.

### ■ Structural Thermoplastics Lab, NIST Road Map

The UMaine Alford Advanced Manufacturing Laboratory for Structural Thermoplastics will utilize digital, additive and robotics manufacturing to reduce cycle time and cost of traditional manufacturing. Thermoplastics could transform composite materials used in cars, ships, boats and aerospace applications. This lab will officially open spring 2017.

In May 2015, the National Institute of Standards and Technology (NIST) awarded the University of Maine Advanced Structures and Composites Center \$497,965 to map technical manufacturing challenges in structural thermoplastic materials. Through this award, the Composites Center has formed Consortium for Manufacturing Innovation in Structural Thermoplastics (CMIST), with national partners U.S. Army Corps of Engineers Engineer Research and Development Center (ERDC), Celanese Corp., Eastman Chemical Co., Polystrand, and Royal TenCate, and Maine-based partners Hinckley Yachts of Southwest Harbor, Front Street Shipyard of Belfast, Custom Composite Technologies of Bath, Fiber Materials Inc. of Biddeford, and the Composites Engineering Research Laboratory of Brunswick.

The use of thermoplastic composite materials for structural applications is a segment of the manufacturing industry that has abundant potential for growth because of the material's desirable qualities. Thermoplastic composites are low-cost, low-weight, recyclable, corrosion-resistant and strong enough to be used as a substitute in many primary structural applications. CMIST wants U.S. manufacturers to benefit from the opportunities that structural thermoplastics have to offer. The consortium will work to solve technical issues that exist, while also disseminating the knowledge it has cultivated so that U.S. manufacturers can advance their solutions to market.

## Small Campus Initiative — MEIF FY16

### ■ University of Maine at Presque Isle

The construction of a new greenhouse at the University of Maine at Presque Isle (UMPI) will support the university's new sustainable agriculture concentration and help expand agricultural research, education and innovation across Aroostook County. Agriculture is one of the region's most important economic sectors. UMPI's sustainable agriculture program is founded on hands-on approaches and proficiency-based learning in many fields, including soils, energy, natural sciences, traditional agronomic knowledge, management,

marketing and GIS technology. The new greenhouse will be an integral part of several courses in the program.

The greenhouse will be used to support current and future research projects by UMPI faculty and students. Research projects include the development of new potato varieties, nutrient recommendations and crop root studies concerning soil compaction and fertilization. The facility will provide a research venue for visiting scholars, postdocs and scientists. The facility will also provide an opportunity for the University of Maine, UMaine Cooperative Extension and Maine Organic Farmers and Gardeners Association to further promote their existing programs in combination with those at UMPI, facilitating academic and community collaboration.

### ■ University of Maine at Fort Kent

The University of Maine at Fort Kent (UMFK) is expanding its GIS and remote sensing research through the use of a new spectroradiometer. The state's GIS and remote sensing needs are growing, with increased use in satellite, airborne and drone-based imagery to assess forestry, agriculture and urban planning over large areas. The device allows for the precise collection of light reflectance, which can characterize different types of land cover. The data can be used for more accurate mapping, or detection of important features or characteristics on a land surface, including forest and agricultural land structure and composition.

To date, the device has been used to monitor vegetation as part of an ongoing project to monitor and map endangered plant communities on rare rock glacier landscapes in Maine. The device is also being used to leverage more external research funding to UMFK and Maine.

### ■ University of Maine at Machias and University of Maine at Farmington

A multiyear project by the University of Maine at Machias (UMM) and the University of Maine at Farmington (UMF) aims to produce valuable kelp products for human consumption and for use as fertilizers in organic gardening operations. This effort is providing kelp nursery production training for undergraduate UMM students and molecular research training for UMF students. The project is also providing seaweed-farming experience for members of the Passamaquoddy Nation, as well as students from Cobscook Community High School.

Students at UMF are working to identify and characterize Maine's kelp populations by using a suite of DNA markers. The identification of kelp population structure in this region will

enable growers to identify optimal strains for aquaculture. The team aims to improve yields and possibly speed growing time. Identifying regional kelp population differences could allow growers throughout the state to market geographically branded seaweed products. This pilot project is promoting seaweed farming in Washington County and is providing important experiential training for all who participate in the nursery, grow-out, harvest and post-production phases.

### ■ University of Maine at Machias

Soft-shell clams represent the second most important commercial marine resource in Maine, generating approximately \$21 million in dockside revenues in 2015. Clam landings, however, are depressed in most areas of the state compared to a decade ago. A UMM project examines potential reasons for the decline with a goal of developing adaptive methods that clammers and elected officials can use to manage wild and cultured stocks. The work is being conducted in southern Maine in Casco Bay, which has recently seen an explosion of both invasive and endemic predators whose population increases have coincided with a protracted warming of ocean seawater temperatures. The work that is ongoing through the end of December 2016 is divided into six discrete areas to examine potential measures to combat declining clam stocks. These include both large- and small-scale field experiments to examine factors affecting growth and survival of cultured clam stocks, as well as factors affecting the distribution and abundance of wild soft-shell clams.

Field trials are being conducted in Freeport, and are engaging local clammers and elected officials in the deployment of gear and collection of data. The field trials are designed to test: 1) the relative importance of coastal acidification versus predation in abundance of wild clam juveniles; 2) factors affecting the distribution of wild clam juveniles at three spatial scales; 3) the efficacy of impounding commercial-size clams during periods of low price/pound and selling them when market prices are highest during the year; 4) effects of mesh size and stocking density of cultured clams on growth and survival in protected boxes placed in the intertidal zone; 5) how to cope with large densities of a native gastropod (mud snail) that lays its eggs on predator-deterrent netting, rendering it ineffective; and 6) bioremediation measures to curb predation on cultured and wild soft-shell clam juveniles by the milky ribbon worm. The applied research effort will shed light on the efficacy of adaptive measures to increase clam stocks, and will play a role in decisions made by shellfish managers at both the local and state levels.



Table A1-1

## University of Maine System New Patent Applications Filed FY16

Title	Application Type	Filing Date
EXPLOITING PCM WRITE ASYMMETRIES TO ACCELERATE WRITE	US - PROVISIONAL	7/2/2015
PROCESS FOR RECOVERY OF ACETIC ACID FROM BIOMASS	US - PROVISIONAL	7/6/2015
EXPLOITING PCM WRITE ASYMMETRIES TO ACCELERATE WRITE	KOREA	8/3/2015
EXTRACTION OF LIGNOCELLULOSICS FOR PRODUCTION OF FIBERS AND A PRECIPITATE-FREE HEMICELLULOSE EXTRACT	US - PROVISIONAL	8/6/2015
BUOY WITH INTEGRATED MOTION COMPENSATION	PCT	8/12/2015
COMPOSITE LAMINATES	US	9/10/2015
FLOATING CONCRETE WIND TURBINE PLATFORM DESIGN AND METHODS FOR MODULAR CONSTRUCTION AND LAUNCH	US	9/18/2015
STYLIZED ADAPTIVE MOBILITY DEVICE	US	10/1/2015
PAPERBOARD PRODUCT	PCT	10/16/2015
IMPROVED METHODS OF CANCER DETECTION	US	10/22/2015
POTATO VARIETY AF3362-1 CARIBOU RUSSETT	US, CANADA	11/12/2015
POLYMERIC COMPOSITE MATERIALS AND METHODS OF MAKING THEM	US, MEXICO	11/25/2015
CNF REINFORCED NANOCOMPOSITES	BRAZIL	1/14/2016
CELLULOSE NANOFIBRILS REINFORCED POLYPROPYLENE NANOCOMPOSITES: MECHANICAL AND MORPHOLOGICAL PROPERTIES	US	1/15/2016
SOFT TISSUE IN-GROWTH OF POROUS, THREE-DimensionALLY PRINTED, TRANSCUTANEOUS IMPLANTS OF VARYING MATERIAL AND PORE GEOMETRY	PCT	2/3/2016
HULL FOR A FLOATING WIND TURBINE PLATFORM	PCT	2/24/2016
METHODS OF CONSTRUCTION, ASSEMBLY, AND LAUNCH OF A FLOATING WIND TURBINE	PCT	2/24/2016
METHOD TO INCREASE NANOCELLULOSE SOLIDS BY CAPILLARY ACTION EXTRACTION AND RESULTANT MATERIAL	US - PROVISIONAL	3/21/2016
STYLIZED ADAPTIVE MOBILITY DEVICE	US - PROVISIONAL	3/31/2016
METHODS FOR THE PRODUCTION OF HIGH SOLIDS NANOCELLULOSE	PCT	4/22/2016
METHODS OF CONTROLLING THE HYDROPHILICITY OF CELLULOSE	PCT	5/13/2016

Table A1-2

## University of Maine System — Patents Issued FY16

Title	Patent No.	Issue Date
SURFACE ACOUSTIC WAVE RESONATOR WITH AN OPEN CIRCUIT GRATING FOR HIGH TEMPERATURE ENVIRONMENTS — US	9,048,807	6/2/2015
PROCESS FOR IMPROVING THE ENERGY DENSITY OF FEEDSTOCKS USING FORMATE SALTS — US	9,120,712	9/1/2015
SYSTEM FOR EARLY DETECTION OF MILD TRAUMATIC BRAIN INJURY (MTBI) — US	9,192,333	11/24/2015
FLOATING HYBRID COMPOSITE WIND TURBINE PLATFORM AND TOWER SYSTEM — JAPAN	5,950,923	6/17/2016

Table A2-1

## A History of Legislative Actions on Appropriating State Research Funds

The following is a summary of the actions of the 118th–127th (first regular session) Maine Legislature with regard to appropriating research and development funds to the University of Maine System

### 118th LEGISLATURE

March 26, 1997: Governor signed into law the Economic Improvement Strategy (Chapter 24) that appropriated \$500,000 to UMS for research.

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

### 119th LEGISLATURE

March 15, 1999: Governor signed into law the Part I Current Services budget (Chapter 16) that appropriated \$4 million in 1999–2000 and 2000–01 to UMS 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.

June 4, 1999: Governor signed into law the Part II Supplemental Appropriation budget (Chapter 401) that appropriated an additional \$5.55 million in 1999–2000 and an additional \$50,000 in 2000–01 to UMS on a “base budget” basis for research.

April 25, 2000: Governor signed into law the Part II Supplemental Appropriation budget (Chapter 731) that appropriated \$300,000 in 2000–01 to UMS on a “base budget” basis for the Maine Patent Program.

### 120th LEGISLATURE

June 21, 2001: Governor signed into law the Part II Supplemental Appropriation budget (Chapter 439) that appropriated an additional \$2 million in 2002–03 to UMS on a “base budget” basis for research.

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

July 1, 2002: 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 and development appropriation back to the FY02 level of \$10.1 million.

November 18, 2002: Governor signed into law a Supplemental Appropriation budget (Chapter 714) that deappropriated the \$1 million curtailment that was signed July 1, 2002.

### 121st LEGISLATURE

March 27, 2003: Governor signed into law the Part I Current Services budget (Chapter 20, Part RR) that appropriated \$100,000 in 2003–04 and 2004–05 on a “base budget” basis for research.

January 30, 2004: Governor signed into law a Supplemental Appropriation budget (Chapter 513, Part P, Sec. P-2) that includes a provision to transfer to MEIF up to \$2 million of any unbudgeted State revenue remaining at the close of FY04. The full amount was subsequently transferred to UMS. This same Chapter 513, Part P, Sec. P-3 made the \$2 million part of the MEIF FY05 base appropriation.

## **122nd LEGISLATURE**

March 29, 2006: Governor signed into law a Supplemental Appropriations budget (Chapter 519, Part A, Sec. A-1) that includes providing one-time funding of \$600,000 in FY07 for the commercialization of research and development activity, and for the Gulf of Maine Ocean Observing System.

## **123rd LEGISLATURE**

June 7, 2007: Governor signed into law a budget (Chapter 240, Part A, Sec. A-68) that provides an increase of \$1.5 million in FY08 and an additional \$1 million in FY09 on a “base budget” basis for research.

## **124th LEGISLATURE**

May 28, 2009: Governor signed into law a budget (Chapter 213, Part A, Sec. A-67) that maintains the annual funding at the FY09 level of \$14.7 million.

## **125th LEGISLATURE**

June 15, 2011: Governor signed into law a budget (Chapter 380) that maintains the annual funding at \$14.7 million. May 29, 2012: PUBLIC Law (Chapter 698) creates the formula funding for the Small Campus Initiative, reserving a percentage of MEIF exclusively for the five smaller campuses of the University of Maine System.

## **126th LEGISLATURE**

June 10, 2013: Governor signed into law (Chapter 225) an amendment to the MEIF statute to include Maine Maritime Academy as a MEIF-eligible small campus.

June 26, 2013: Legislature approved into law a budget (Chapter 368) that maintains the annual funding at \$14.7 million.

## **127th LEGISLATURE**

June 30, 2015: Legislature approved into law a budget (Chapter 267) that increases the annual funding by \$2.65 million in each year of the biennium.



Table A2-2

## Legislative History of MEIF New Appropriations

### 118th LEGISLATURE

	<u>FY98</u>	<u>FY99</u>	<u>Total 2-Year</u>
UMaine	\$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

	<u>FY00</u>	<u>FY01</u>	<u>Total 2-Year</u>
UMaine	\$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

	<u>FY02</u>	<u>FY03</u>	<u>Total 2-Year</u>
UMaine	\$0	\$0	\$0
USM	0	0	0
Total	\$0	\$0	\$0

### 121st LEGISLATURE

	<u>FY04</u>	<u>FY05</u>	<u>Total 2-Year</u>
UMaine	\$80,000	\$1,600,000	\$1,680,000
USM	20,000	400,000	420,000
Total	\$100,000	\$2,000,000	\$2,100,000

### 122nd LEGISLATURE

	<u>FY06</u>	<u>FY07</u>	<u>Total 2-Year</u>
UMaine	\$0	\$540,000	\$540,000
USM	0	60,000	60,000
Total	\$0	\$600,000	\$600,000

### 123rd LEGISLATURE

	<u>FY08</u>	<u>FY09</u>	<u>Total 2-Year</u>
UMaine	\$1,200,000	\$720,000	\$1,920,000
USM	300,000	180,000	480,000
S.C. Initiatives	0	100,000	100,000
Total	\$1,500,000	\$1,000,000	\$2,500,000

**124th LEGISLATURE**

	<u>FY10</u>	<u>FY11</u>	<u>Total 2-Year</u>
UMaine	\$0	\$0	\$0
USM	0	0	0
S.C. Initiatives	0	0	0
<b>Total</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

**125th LEGISLATURE**

	<u>FY12</u>	<u>FY13</u>	<u>Total 2-Year</u>
UMaine	\$0	\$0	\$0
USM	0	0	0
S.C. Initiatives	0	0	0
<b>Total</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

**126th LEGISLATURE**

	<u>FY14</u>	<u>FY15</u>	<u>Total 2-Year</u>
UMaine	\$0	\$0	\$0
USM	0	0	0
S.C. Initiatives	0	0	0
<b>Total</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

**127th LEGISLATURE**

	<u>FY16</u>	<u>FY17</u>	<u>Total 2-Year</u>
UMaine	\$2,056,400	\$0	\$2,056,400
USM	514,100	0	514,100
S.C. Initiatives	79,500	0	79,500
<b>Total</b>	<b>\$2,650,000</b>	<b>\$0</b>	<b>\$2,650,000</b>

**Total Yearly Research Appropriations for FY16****FY16 Appropriation**

UMaine	\$13,263,600
USM	3,315,900
UMM	250,000
UMFK	0
UMF	0
UMA	0
UMPI	0
MMA	520,500
<b>Total</b>	<b>\$17,350,000</b>

S.C. Initiatives ..... Small Campus Initiatives  
 University of Maine ..... UMaine  
 University of Southern Maine ..... USM  
 University of Maine at Augusta ..... UMA  
 University of Maine at Farmington ..... UMF  
 University of Maine at Fort Kent ..... UMFK  
 University of Maine at Machias ..... UMM  
 University of Maine at Presque Isle ..... UMPI  
 Maine Maritime Academy ..... MMA

Table A2-3 Maine Economic Development Fund

## Utilization of FY16 Operating Research Appropriation by Targeted Research Areas

UMAINE Targeted Research Area	Source of R&D Funds					Utilization of R&D Funds					Balance Unused Funds Carried Forward To FY17 <sup>1</sup>
	FY16 R&D Initial	Unused R&D Funds from Prior Years As Reported	Adjustment To Prior Years Unused R&D Funds	Adjusted Unused R&D Funds From Prior Years	FY16 R&D Funding Transfers	FY16 Total R&D Funds Available	FY16 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	
	Base Budget										
Adv. Technology Forestry & Agriculture	\$1,651,037	\$(56,881)		\$(56,881)		\$1,594,156	\$2,309,972	\$301,899	\$(815,624)	\$1,796,247	\$(202,091)
Aquaculture & Marine Science	3,515,805	(2,383,235)		(2,383,235)		1,132,570	3,337,568	1,067,060	(1,218,947)	3,185,681	(2,053,111)
Biotechnology	841,538	361,171		361,171		1,202,709	1,441,917	101,067	(418,644)	1,124,340	78,369
Composites	1,575,562	823,717		823,717		2,399,279	2,177,573	56,081	(859,044)	1,374,610	1,024,669
Environmental	1,147,351	728,716		728,716		1,876,067	2,123,244	193,944	(606,035)	1,711,153	164,914
Information Technology	2,500,464	(569,813)		(569,813)		1,930,651	2,684,833	269,846	(859,430)	2,095,249	(164,598)
Precision Manufacturing	1,494,929	(63,657)		(63,657)		1,431,272	2,102,495	8,330	(762,136)	1,348,689	82,583
Cross Sector	536,914	(185,001)		(185,001)		351,913	808,274		(91,916)	716,358	(364,445)
Total State Funding	\$13,263,600	\$(1,344,983)		\$(1,344,983)		\$11,918,617	\$16,985,876	\$1,998,227	\$(5,631,776)	\$13,352,327	\$(1,433,710)
UMaine Cost Sharing Funding <sup>2</sup>	5,631,776					5,631,776			5,631,776	5,631,776	
Total Funding	\$18,895,376	\$(1,344,983)		\$(1,344,983)		\$17,550,393	\$16,985,876	\$1,998,227		\$18,984,103	\$(1,433,710)

<sup>1</sup> Includes year-end equipment carry-over funds (equipment ordered, not received and not paid).<sup>2</sup> Salary and benefits from university.

USM Targeted Research Area	Source of R&D Funds					Utilization of R&D Funds					Balance Unused Funds Carried Forward To FY17 <sup>1,2</sup>
	FY16 R&D Initial	Unused R&D Funds from Prior Years As Reported	Adjustment To Prior Years Unused R&D Funds <sup>4</sup>	Adjusted Unused R&D Funds From Prior Years	FY16 R&D Funding Transfers <sup>3</sup>	FY16 Total R&D Funds Available	FY16 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	
	Base Budget										
Forestry & Agriculture					\$430,630	\$430,630	\$217,958		\$2,915	\$220,873	\$209,757
Aquaculture & Marine			1	1	640,276	640,277	255,645			255,645	384,632
Biotechnology		1,693,161	(1,445,819)	247,342	55,008	302,350	267,611	(2,351)	2,353	267,613	34,737
Environmental		80,264		80,264	256,626	336,890	174,246			174,246	162,644
Information Technology		1,371,725	(276,182)	1,095,543	1,307,973	2,403,516	837,368	3,453	944,434	1,785,255	618,261
Precision Manufacturing					22,726	22,726	22,016			22,016	710
Cross Sector			(7)	(7)	888,142	888,135	888,499			888,499	(364)
Unassigned - Reallocated By System	3,315,900	524,790	1,722,007	2,246,797	(3,601,381)	1,961,316		105,683	(949,702)	(844,019)	2,805,335
Total State Funding	\$3,315,900	\$3,669,940		\$3,669,940		\$6,985,840	\$2,663,343	\$106,785		\$2,770,128	\$4,215,712

<sup>1</sup> Includes year-end equipment carry-over funds (equipment ordered, not received and not paid).<sup>2</sup> At USM, projects are funded on a year-to-year basis with renewals contingent on performance. A majority of the unused funds carried forward into FY17 are committed but not yet allocated to multiyear projects.<sup>3</sup> Transfers for current year funding of USM R&D programs and awards from "Unassigned" UM base budgets the MEIF appropriation by sector and thus does not use funding transfers.<sup>4</sup> Unspent allocated FY15 funds returned to "Unassigned" for reallocation in FY16.

Table A2-4 Maine Economic Development Fund

## FY16 Summary Utilization of Operating Research Appropriation by University

	Source of R&D Funds				Utilization of R&D Funds					Balance	
	FY16 R&D Initial Base Budget	Unused R&D Funds from Prior Years As Reported	Adjustment To Prior Years Unused R&D Funds <sup>4</sup>	Adjusted Unused R&D Funds From Prior Years	FY16 R&D Funding Transfers <sup>3</sup>	FY16 Total R&D Funds Available	FY16 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	Balance Unused Funds Carried Forward To FY17 <sup>1</sup>
UMaine	\$13,263,600	\$(1,344,983)		\$(1,344,983)		\$11,918,617	\$16,985,876	\$1,998,227	\$(5,631,776)	\$13,352,327	\$(1,433,710)
USM	3,315,900	3,669,940		3,669,940		6,985,840	2,663,343	106,785		2,770,128	4,215,712
UMM	250,000	62,428		62,428	263,800	576,228	387,460		(910)	386,550	189,678
UMFK					109,083	109,083	1,998			1,998	107,085
UMPI		9		9		9					9
UMA		90,898		90,898		90,898	52,485			52,485	38,413
UMF		40,000		40,000		40,000	435			435	39,565
UMS	520,500	9,484		9,484	(372,883)	157,101					157,101
MMA		93,352		93,352		93,352	31,540			31,540	61,812
<b>Total State Funding</b>	<b>\$17,350,000</b>	<b>\$2,621,128</b>		<b>\$2,621,128</b>		<b>\$19,971,128</b>	<b>\$20,123,137</b>	<b>\$2,105,012</b>	<b>\$(5,632,686)</b>	<b>\$16,595,463</b>	<b>\$3,375,665</b>

<sup>1</sup> Includes year-end equipment carry-over funds (equipment ordered, not received and not paid).

<sup>2</sup> UMaine & UMM cost sharing.

<sup>3</sup> Interunit R&D funding transfers related to FY16 Small Campus Initiative (SCI) awards.





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