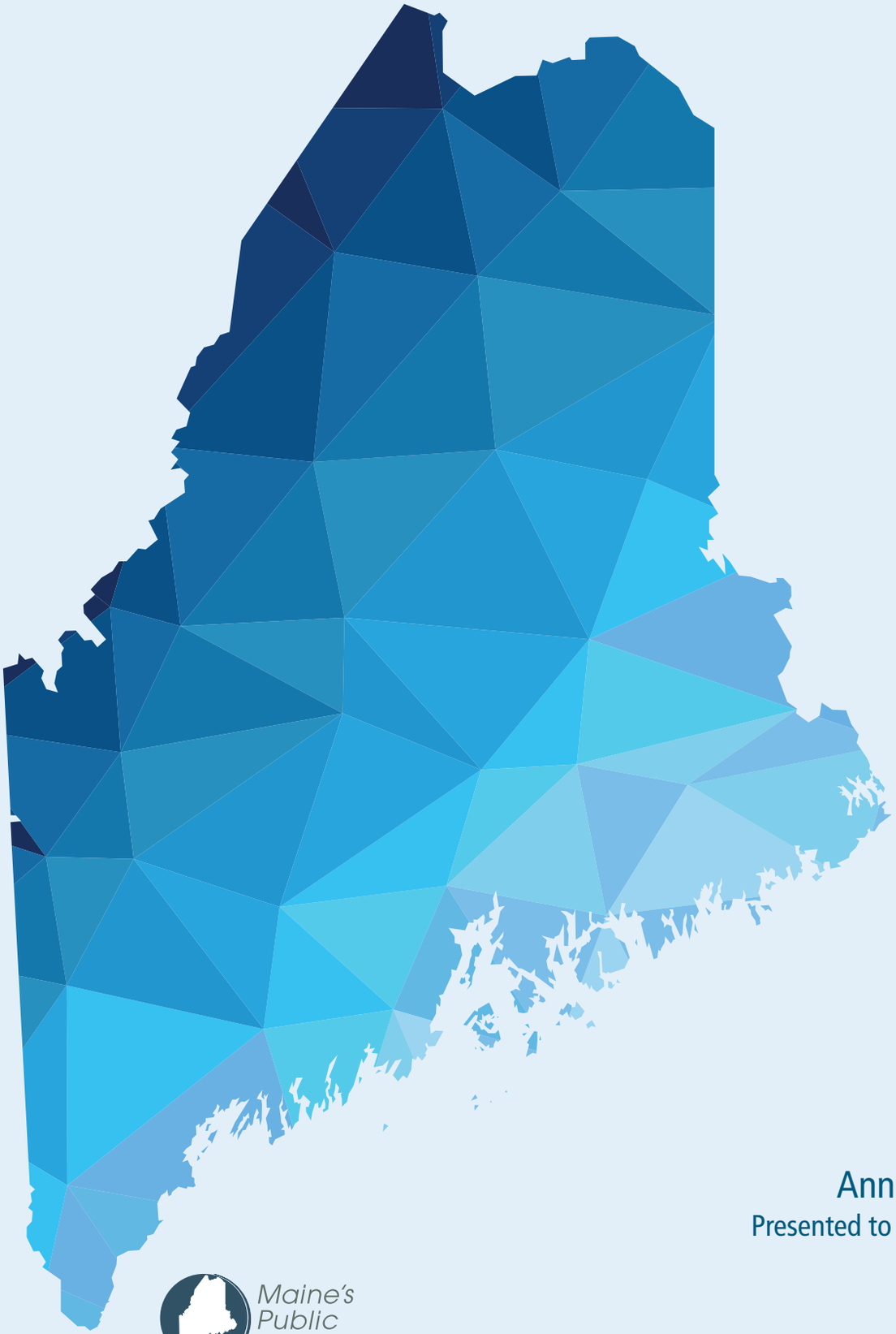
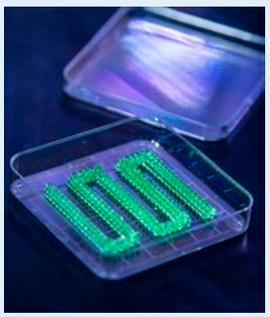
7-1-2022

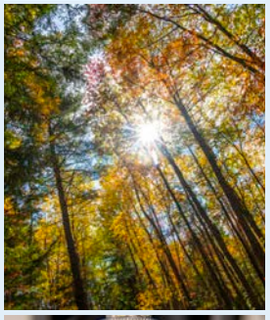
Maine Economic Improvement Fund Annual Report, FY2021

University of Maine System

MAINE ECONOMIC IMPROVEMENT FUND







Annual Report FY2021

Presented to Maine State Legislature

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

A successful partnership among Maine's government, private sector and public universities to build Maine's economy and future workforce through research and development.

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

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MAINE ECONOMIC IMPROVEMENT FUND
2021 ANNUAL REPORT

Memo from the Chancellor

The State of Maine's investment in the Maine Economic Improvement Fund (MEIF) is a vital and ongoing commitment to advancing the research enterprise at Maine's public universities to improve the civic and economic life of Maine.

At the start of 2022, the flagship University of Maine earned an R1 Carnegie Classification, joining the ranks of the nation's top 146 doctoral research universities engaged in "very high research activity." The R1 designation is the world standard for research universities, and this recognition is a direct result of more than 20 years of consistent MEIF and other investment that has supported the growth of UMaine's research capacity. The entire University of Maine System and the State of Maine as a whole are indebted to the foresight of the Maine Legislature for its commitment to this investment, which pays dividends back to Maine many times over.

UMaine's R1 classification will help Maine's public universities attract even more talent, investment and innovation to Maine at a pivotal moment in the state's history. Throughout the ongoing pandemic, Maine's public universities have been an essential and responsive partner, supporting Maine's communities and innovating to solve problems. Now, the University of Maine System is increasingly focused on supporting Maine's recovery and building resilience for the future. To do so, we draw upon the deep research strengths we have built across the seven MEIF sectors.

This MEIF report, which details the results of the System's research efforts over the last fiscal year, demonstrates what advancements are possible from sustained research investment. A few highlights include:

- In FY2021, the state's $17.35 million MEIF investment was leveraged at a rate of 5.7:1 by our UMS campuses, leading to more than $98 million in additional federal and private-sector grants and contracts in the seven sectors.
- MEIF funds, and the external grants and contracts they leverage, supported the work of 506 researchers and technicians, as well as 1190 graduate and undergraduate students.
- MEIF-supported grants and contracts provide funds to purchase major equipment to upgrade and outfit university laboratories.
- Maine's public universities secured 7 new US patents and 32 associated foreign patents, worked on development projects with large and small businesses and start-ups, and provided R&D support to 390 companies and individuals.

Also included with this FY2021 MEIF report are additional financial reports and information required in the statute that created MEIF.

I am available at your convenience to discuss how we use MEIF funding to expand knowledge, research, and economic opportunity in Maine. Please contact me directly if you'd like to do so.

Sincerely,

Dannel Malloy
Chancellor

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 the Maine Legislature established MEIF 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 directed 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 support the solution of fundamental problems and discover new solutions, and 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 federal or private sector grants, and this investment in Maine's public university R&D helps faculty, staff and students successfully leverage tens of millions of dollars in grants and contracts annually.

MEIF directly supports faculty, grad students and staff who are working to make the universities more competitive for federal grants, expanding opportunities to support Maine companies and involve students in research learning and real applications of their education.

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

The University of Maine and the University of Southern Maine are the two universities with established research and graduate programs in the seven targeted research sectors and have received MEIF funds, with 76.6 percent to the University of Maine and 19 percent to the University of Southern Maine. In addition, 1.4 percent of MEIF funds are awarded to the University of Maine Machias 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 500 faculty and staff, and nearly 1200 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.
- Generating new intellectual property and working to commercialize patents and innovations.
- 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.

Progress in FY2021: Strategic Outcomes, Goals and Metrics

In December 2018, the University of Maine System Board of Trustees issued a Declaration of Strategic Priorities, the first of which is Advancing Workforce Readiness and Economic Development, with a priority action item: Strengthen research and economic development efforts to support Maine industries, and to foster business formation and expansion. The five-year University of Maine System Research and Development Plan was approved in the Spring of 2019 with three specific goals that drive the UMS research activities including the Maine Economic Improvement Funds.

Goal One – Make Maine the best state in the nation in which to live, work, and learn by 2030
Goal Two – Establish an innovation-driven Maine economy for the 21st century
Goal Three – Prepare the knowledge-and-innovation workforce for Maine

The the following metrics help measure the progress against these goals and recognize that MEIF activity is restricted to Maine's legislatively selected seven R&D sectors.

UMS MEIF Metric 1 – Increase Research Capacity and Activity
UMS MEIF Metric 2 – Support New Technologies, Licensing, and Commercialization
UMS MEIF Metric 3 – Increase Economic Development Partnerships
UMS Metric 4 – Support R&D Workforce Development

This report addresses these 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 Office of Innovation (5 MSRA 13107).

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

MEIF Metric 1: Increase Research Capacity and Activity

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 utilization of MEIF funds will leverage other resources including grants and contracts from the federal government and the private sector increasing the impact of the State's investment.

Table 1

FY2021 Total Grants and Contracts (ALL Activity Inclusive)	Number of Proposals UM/UMM	Total Value UM/UMM	Number of Proposals USM	Total Value USM	Number of Proposals ALL	Total Value ALL
Total Proposals Submitted	935	$277,167,149	186	$49,000,000	1,121	$326,167,149
Total Proposals Awarded	763	$107,537,744	146	$23,000,000	909	$130,537,744

Grants and Contracts Awarded in MEIF Sectors Only

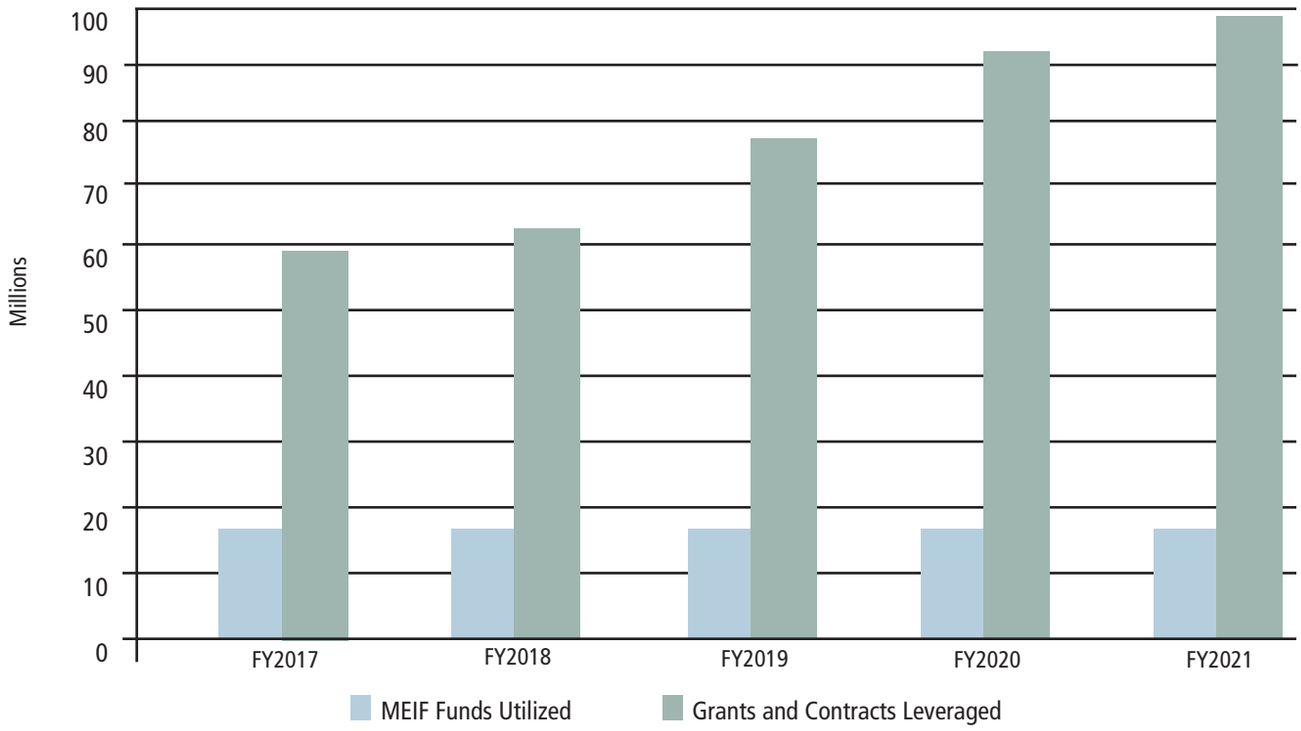
	FY2017 MEIF Awards	FY2018 MEIF Awards	FY2019 MEIF Awards	FY2019 MEIF Awards
Aquaculture and Marine	21,229,069	16,032,068	8,084,961	8,698,761
Biotechnology	3,821,390	6,552,964	16,035,473	14,611,906
Composites	13,504,642	9,952,947	11,478,611	31,093,652
Cross Sector	4,274,394	3,034,812	21,301,337	2,783,430
Environmental Technologies	5,543,121	7,407,213	7,250,820	7,466,987
Forestry and Agriculture	4,660,014	10,685,631	9,598,475	17,624,566
Information Tech	5,292,726	5,582,266	951,594	7,069,113
Precision Manufacturing	1,602,646	3,099,123	1,870,527	3,077,779
Total	**$59,334,874**	**$62,347,023**	**$76,571,798**	**$92,426,194**

FY2021 Detail

UM/UMM MEIF Awards	USM MEIF Awards	Total UMS MEIF Awards
10,764,452	8,801	10,773,253
8,292,946	36,685	8,329,631
38,754,403	0	38,754,403
4,565,468	1,093,651	5,659,119
9,890,019	1,718,935	11,608,954
15,592,117	19,633	15,611,749
6,553,246	133,126	6,686,372
1,158,472	0	1,158,472
$95,571,122	**$3,010,831**	**$98,581,953**
	FY2020–FY2021 Increase 7%	

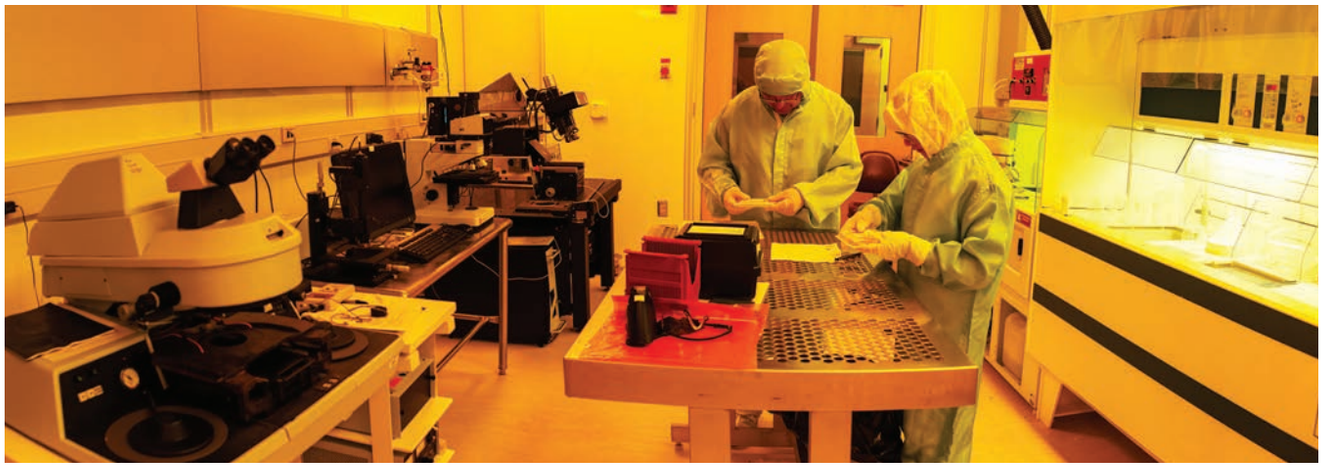
Strategic Outcomes, Goals and Metrics

Figure 1 FY2017-2021 MEIF Return on Investment 5.7:1 (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 7 percent over the previous fiscal year exceeding the goal of 3 percent per year. Continued growth can be attributed to the efforts of UMS researchers and energized by the turnover in faculty researchers resulting in more than 150 new faculty in the last few years. New faculty researchers typically need several years of start-up activity to become competitive proposal writers, and their success is starting to show. Another key contributor to this growth is larger multi-principle investigator proposals at well- established centers.

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 Metric 2: Support New Technologies, Licensing, and Commercialization

UMS annual revenue from commercialization including intellectual property licensing from the MEIF sectors increases at least 10 percent annually on a three-year rolling average.

Table 2

MEIF Target 2 — Commercialization Activity	FY2017	FY2018	FY2019	FY2020	FY2021	Five-Year Average
Revenue from Commercialization	$329,840	$914,120	$289,088	$519,019	$299,430	$470,299
Rolling three year average	$298,091	$482,890	$511,016	$574,076	$369,179	$447,050
Number of Patents Filed (US/PCT)	18	20	17	16	23	19
Number of Patents Issued (US)	8	6	6	11	7	8
Number of License Agreements and License Options	7	9	11	8	4	7.8

FY2020–FY2021 Change in Three-Year Average Revenue -36%

In summary, three-year rolling average revenue from commercialization has shown an overall increase over the last decade, but fell over the last fiscal year. Commercialization relies on private companies utilizing UMS intellectual property to secure private investment to advance technology, products and services into markets. Maine continues to rank very low in comparison to other states for its industry R&D and innovation. This has been recognized by the state economic development agencies and is addressed in the 2020 Maine Economic Development Strategy. The lingering pandemic has greatly impacted the startup and new venture community, yet activity is starting to return.

The timeline for commercialization of newly invented technology is hard to predict, but it is lengthy. U.S. patent applications take four to five years from initial application to issuance. Newly issued UMS patents reported above and detailed in Appendix 1 were filed four to five years ago. In addition, many UMS technologies fall into capital-intensive categories, such as transportation infrastructure, pulp and paper, sensors and biotechnology.

These sectors have longer timelines from lab to market at five to 10 years. UMS is focusing additional effort to accelerate commercialization with private-sector partners and other investment programs, such as the Maine Technology Institute and Maine Venture Fund.

MEIF Metric 3: Increase Economic Development Partnerships

The UMS annual revenue from activities with business and industrial partners in the MEIF sectors has stalled, due in large part to reduced activity during the pandemic. Revenue reached $9,581,790 in FY2021, a decrease of approximately 12 percent, but was buoyed by a few large projects started before the pandemic. The number of business and industry contracts in the MEIF sectors is beginning to rebound from the pandemic-related drop-off seen in FY2020.

Table 3

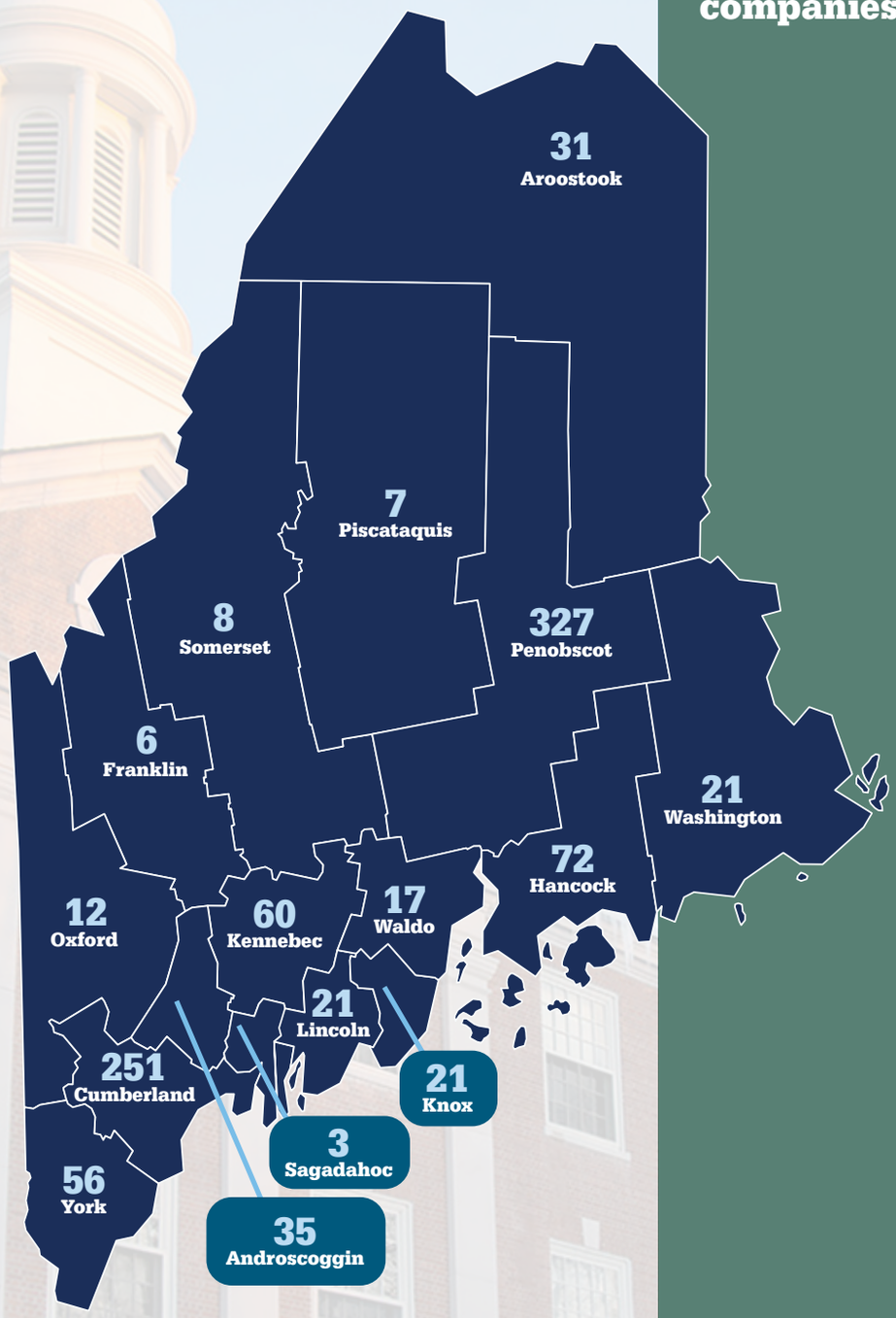
MEIF TARGET 3 — Business and Industry Contracts	FY2017	FY2018	FY2019	FY2020	FY2021
Revenue from Business and Industrial Contracts	$5,035,394	$6,339,260	$7,211,422	$10,876,661	$9,581,790
Number of Business and Industrial Contracts	565	528	530	327	390

FY2020–FY2021 Change in Revenue -11.91%

In summary, many MEIF investments not only leverage external grants and contracts, but – through a combination of MEIF funds, and grant and contract funds – help UMS campuses build capacity to work directly with industry partners. Figure 2 illustrates the breadth of contract work with companies throughout the state. Some industry partners are companies licensing and commercializing UMS intellectual property, while many companies are working with UMS campuses for problem solving and product development. 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 that does not result in formal contracts.

Office of Innovation and Economic Development

Figure 2
Innovation projects with Maine companies FY2017–FY2021



948
Innovation projects with Maine companies

Every day, the University of Maine strives to turn research and development activities into new opportunities that will create jobs and grow Maine's economy.

In the past five years, UMaine has supported 948 innovation projects, providing access to facilities and expertise to help organizations with research, new products and business development.

MEIF Metric 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 the 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. Non-student 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 fewer 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, positioning them well to be leading contributors to Maine's key growth sectors.

Success and Strategic Impact

By investing MEIF funds in researchers, facilities and matching for grants, UMS has attracted more than $389 million over the last five years (FY2017-2021) 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, biomaterials and bridges, new potato varieties, aquaculture technologies, offshore wind hulls, and software, which lead to improvements in Maine's industries.

Return on Investment

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

Developing Workforce and Creating Jobs

Five hundred plus full-time equivalent jobs are funded in Maine through the grants and contracts leveraged and expended related to MEIF. These positions include faculty, technicians and research staff. Currently, 1,190 graduate and undergraduate students are funded for their involvement in research, development and commercialization. This student involvement in research, development and commercialization projects is comparable to an internship and gives students great real-world experience as well as life-long networks and connections.

Table 4-A FY2021

MEIF Target 4 — Workforce Development	Wages paid from MEIF	Wages paid from Grant/Contract	Totals
Number of faculty staff supported (FTE = Full Time Equivalent)	143.01	362.95	505.96
Number of Graduate students supported (headcount)	28	515	543
Number of Undergraduate students supported (headcount)	113	534	647

Table 4-B

Student costs from grants and contracts	FY2017	FY2018	FY2019	FY2020	FY2021
Student salaries and wages from grants and contracts	$4,957,536	$4,853,956	$6,361,381	$6,869,073	$7,559,179
Student tuition paid by grants and contracts	870,787	795,339	916,618	1,384,425	$1,306,089
Student fellowships/scholarships paid by grants and contracts	233,111	373,118	457,884	422,111	$799,695
Student health insurance paid by grants and contracts	203,406	214,000	298,386	296,807	$308,195
Total soft money student support	$6,658,528	$6,264,840	$6,236,413	$8,034,269	$9,973,158

FY2020–FY2021 Change 19%

MEIF Small Campus Initiative

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).

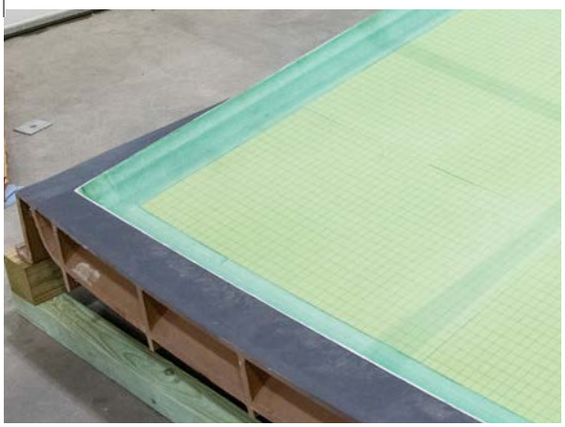
Table 5-A

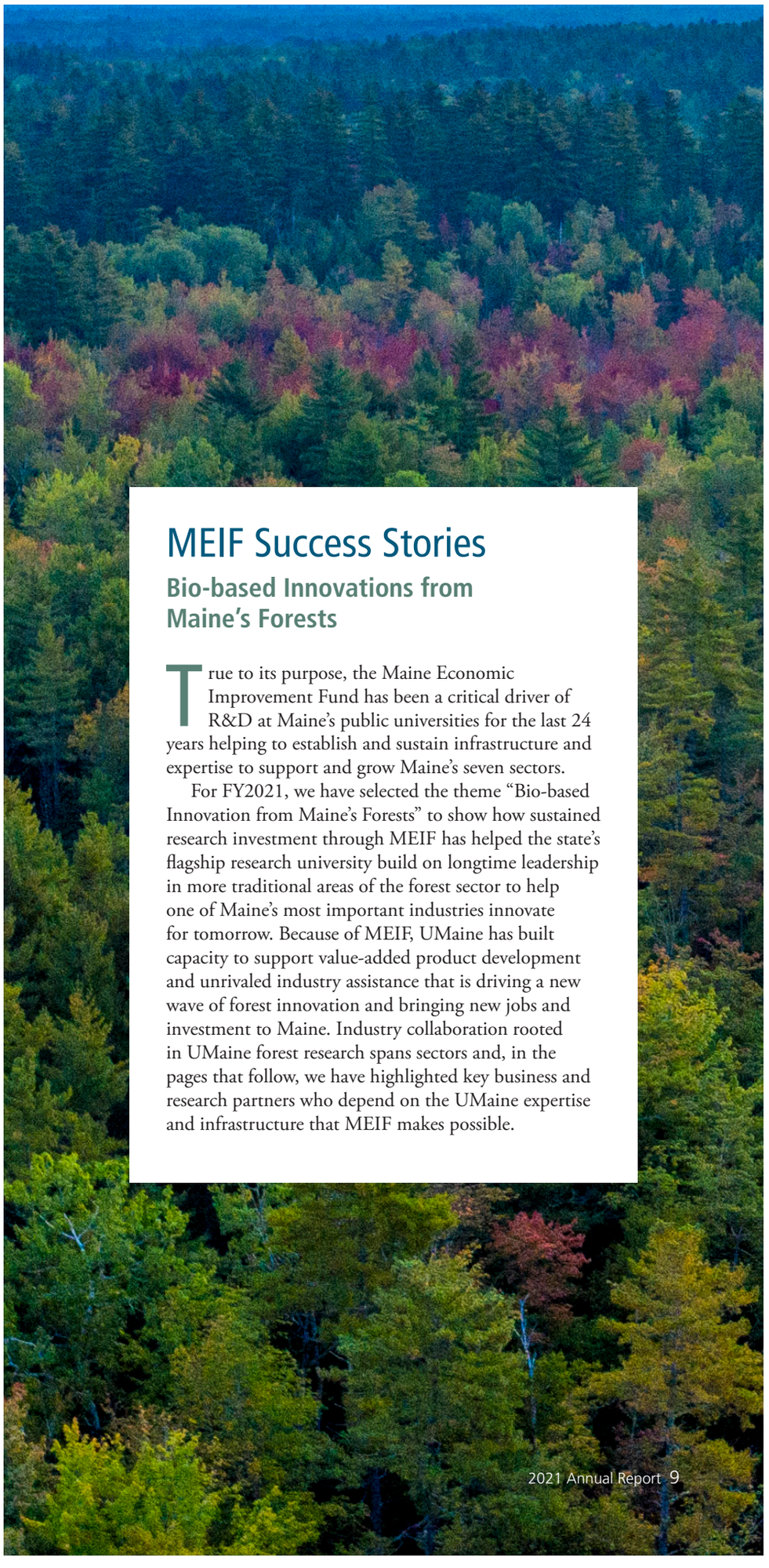
MEIF Small Campus Initiative Awards by Fiscal Year	FY2017	FY2018	FY2019	FY2020	FY2021
UM – Augusta	$0	$0	$85,129	$0	$25,000
UM – Farmington	$77,000	$0	$0	$300,000	$0
UM – Fort Kent	$0	$182,500	$0	$130,000	$24,899
UM – Machias	$200,000	$300,000	$300,000	$0	$250,000
UM – Presque Isle	$0	$182,500	$0	$0	$168,474
Maine Maritime Academy	$97,257	$0	$49,934	$130,000	$0
Total Annual Awards	**$374,257**	**$665,000**	**$435,063**	**$560,000**	**$468,373**

Table 5-B FY2021

Awards by Campus	PI(s)	Campus	Amount
MLT Program: Modernization & Meeting Demand	Elisha Sirois	UMA	$25,000
Monitoring the Impacts of Climate Change on Forest Dynamics in Northern Maine	Kennedy Rubert-Nason	UMFK	$24,899
Applied R&D to Foster Economic Growth in Maine's Shellfish Aquaculture Industry	Brian Beal	UMM	$250,000
Distributed Machine Learning Approaches for Big Data Analysis	Rafiul Hassan	UMPI	$168,474
			$468,373

- The Medical Laboratory Technologist (MLT) Program of Maine, a highly successful collaboration that trains skilled biotech professionals to meet a clinical laboratory workforce shortage
- Data collection and analysis to measure the impacts of climate change on four ecologically and economically important tree species: sugar maple, red spruce, balsam fir, and northern white cedar
- R&D in Maine's shellfish aquaculture industry (including the biological ramifications of ocean change on three commercially important bivalves and one crustacean) to inform decision-making for state and local officials, fisheries managers, harvesters, and aquaculturists
- The development of new machine learning approaches that can analyze analyze large complex data sets using massive parallel and distributed computing power and help examine big data from biomedical, environmental and agricultural studies relevant to Maine.





MEIF Success Stories

Bio-based Innovations from Maine's Forests

True to its purpose, the Maine Economic Improvement Fund has been a critical driver of R&D at Maine's public universities for the last 24 years helping to establish and sustain infrastructure and expertise to support and grow Maine's seven sectors.

For FY2021, we have selected the theme "Bio-based Innovation from Maine's Forests" to show how sustained research investment through MEIF has helped the state's flagship research university build on longtime leadership in more traditional areas of the forest sector to help one of Maine's most important industries innovate for tomorrow. Because of MEIF, UMaine has built capacity to support value-added product development and unrivaled industry assistance that is driving a new wave of forest innovation and bringing new jobs and investment to Maine. Industry collaboration rooted in UMaine forest research spans sectors and, in the pages that follow, we have highlighted key business and research partners who depend on the UMaine expertise and infrastructure that MEIF makes possible.

UNIVERSITY OF MAINE

Oak Ridge National Laboratory Partnership

Founded: 2019
Phase 1: $20M
MEIF Sectors: Advanced Technologies for Forestry and Agriculture, Biotechnology, Composites and Advanced Materials, Environmental Technologies, Precision Manufacturing

The goal of the partnership between Oak Ridge National Laboratory and UMaine is to accelerate the advancement of nanocellulose and other forest products composite technology, reduce the time from laboratory discovery to market impact, and facilitate the transition of bio-based additive manufacturing technologies to industry. This collaboration is the first large-scale bio-based additive manufacturing program in the U.S., connecting regional industry and university clusters with national lab resources.

Scientists from ORNL and UMaine are conducting research in several key areas, including CNF production, drying, functionalization, and compounding with thermoplastics, multiscale modeling, and sustainability life-cycle analysis. ■

OAK RIDGE National Laboratory

“Technology collaborations are short-term, focused projects that enable industry partners to access UMaine and ORNL capabilities to explore a pressing challenge related to additive manufacturing or bio-based materials. **The goal is to help U.S. manufacturers large and small** incorporate next-gen materials and processes to help them be more competitive, efficient, and sustainable. The whole team is so driven and excited to share all the work we’ve been doing and start transferring it out into the marketplace.”

Susan MacKay
Senior R&D Program Manager, UMaine ASCC

TOPSHAM

Muddy River Farm Aquaponics

Founded: 2019
MEIF Sectors: Advanced Technologies for Forestry and Agriculture, Biotechnology, Aquaculture and Marine Sciences, Composites and Advanced Materials, Environmental Technologies, Precision Manufacturing

Muddy River Farm Aquaponics (MRF) is a food production and research facility with a straightforward motto: "Healthy innovation you can eat." The company grows fresh produce (mixed greens, tomatoes, cucumbers, and lettuce), Rainbow Trout, and Brook Trout in a sustainable and symbiotic semi-automated freshwater aquaponics system in Topsham, supplying several local restaurants and markets.

In addition to their freshwater aquaponics production, MRF is exploring terrestrial, saltwater recirculation systems made from 3D-printed bioplastic. For help with this project, founder Matt Nixon turned to UMaine's Advanced Structures and Composites Center (ASCC). Through a technology collaboration made possible by UMaine's partnership with Oak Ridge National Laboratory (ORNL), MRF worked with researchers to print an aquaculture tank insert made from forest product feedstocks and bioplastic. The "Oyster Pod" is designed to capitalize on the space-saving and energy-reducing principles of vertical aquaculture, eliminating the need for a flow-through seawater system and promoting a consistent growth environment in which shellfish will mature swiftly and thrive. The long-term goal is to commercialize a scalable system that will help Maine's small shellfish farmers improve efficiencies and reduce risk. ■

"MRF's goal is to help lead Maine's aquaculture and freshwater produce industries to a more sustainable, climate change-ready future through research, innovation, and adaptation. The UMaine ASCC and the U.S. Department of Energy's ORNL have helped bring MRF's R&D to the next level. Their engineering consultation, design advice, and additive manufacturing capacity have been **instrumental in developing and proving MRF's prototype systems.** We look forward to working with both partners in the coming years to refine and commercialize our product."

Matt Nixon
Owner and Founder, Muddy River Farm Aquaponics

BANGOR

Biofine Developments Northeast (BDNE)

Founded: 2019
MEIF Sectors: Advanced Technologies for Forestry and Agriculture, Biotechnology, Environmental Technologies

Biofine Developments Northeast is the exclusive licensee of a suite of patents that position it to become a highly profitable leader in the fast-growing bio-economy. The proprietary technology, licensed from Biofine Technology, enables the economic production of a bio-based carbon negative substitute for heating oil and has been developed over the past 25 years with strategic partners, including the University of Maine.

To support commercialization, UMaine is demonstrating the biomass to mixed organic acid conversion process at the Forest Bioproducts Research Institute's (FBRI) Technology Research Center (TRC) in Old Town. The Biomass to Bioproducts Pilot Plant has the capacity to convert market pulp, recycled cardboard, and forest residues into the platform chemical levulinic acid, which can then be converted into renewable specialty chemicals and fuels for end-market testing. Complementing BDNE's efforts, FBRI researchers are using the TRC's Synthetic Crude Oil Pilot Plant to demonstrate the production of synthetic, biomass-derived crude oil using patented UMaine technology. The university also is a crucial technical consultant on a Maine Technology Institute award to BDNE to support commercial development of a large-scale bio-refinery in Maine. In 2021, BDNE announced an agreement with Lincoln and Lincoln Lakes Innovation Corp. to open a multi-phase biofuels refinery development on the former Lincoln paper mill site and a preliminary offtake contract with a large northeast-based fuel-oil distributor. ■

BDNE

"We consider Maine the ideal location to develop a sustainable biorefining industry. Here, we have access to plentiful wood-based biomass from Maine's sustainably managed forests, industrial infrastructure suitable for co-location, a ready local market and the opportunity to continue to leverage collaborative research and development at the University of Maine. The Forest Bioproducts Research Institute has been **a critical partner in demonstrating our technology and helping to set the stage** for our planned project in Lincoln, which we believe will be an engine for economic growth in the community."

Stephen Fitzpatrick
Founder and CEO, BDNE

CAPE ELIZABETH

Xylogen Medical, LLC

Founded: 2020
MEIF Sectors: Advanced Technologies for Forestry and Agriculture, Biotechnology, Composites and Advanced Materials, Environmental Technologies

UMaine researchers, led by professor of biomedical engineering, Michael Mason, have developed a nanocellulose composite material suitable for a range of biomedical uses. Unlike most existing medical devices, this nanocellulose composite is a cost-effective, customizable, platform with the potential to offer a more environmentally friendly alternative to a host of medical products. Early research looked at applications such as synthetic bone, surgical bone scaffold, and bone grafting implement, designed for dissolution and gradual replacement with native bone cells.

UMaine, along with the team at BESPA GLOBAL, a consortium of doctors experienced in commercializing technology, have co-founded Xylogen Medical to bring this technology to market. The company has secured its first medical device company partnership, established an R&D&C timeline, and is generating prototypes for customer and market evaluation. ■

BESPA GLOBAL

“BESPA GLOBAL is dedicated to improving patient care through education and advancements in medical science. **UMaine’s nanocellulose composite material is exactly the kind of technology we seek to develop.** In addition to holding great promise for products that improve patient outcomes, it is also environmentally friendly and cost-effective.”

Lisa Viele
President, BESPA Global

BELFAST & MADISON

GO Lab

Founded: 2017
Projected Jobs: 120
MEIF Sectors: Advanced Technologies for Forestry and Agriculture, Biotechnology, Composites and Advanced Materials, Environmental Technologies

GO Lab, a privately-held, building products company, was founded in 2017 with one purpose — to manufacture high-performance, wood fiber insulation in North America under the brand name TimberHP. The company's boards, batts, and loose fill—building on wood fiber's two-decade legacy of proven market success in Europe—offer safe, cost competitive, sustainable insulation solutions.

TimberHP is a value-added, innovative product line for Maine's new forest economy. In its very early stages, GO Lab participated in the UMaine-facilitated Big Gig pitch competition and the Bangor-region Top Gun accelerator program. Early R&D collaborations included work with the Advanced Structures and Composites Center to test the response of wood fiber insulation boards to a variety of adhesives.

Now, as GO Lab renovates the shuttered former paper mill in Madison and prepares to begin manufacturing TimberHP wood fiber insulation there, the university remains a valued partner for the company.

Current collaborations include ongoing work with both the ASCC and the School of Forest Resources on wood fiber insulation product testing data monitoring of wood fiber insulated CLT buildings and discussions are underway exploring next generation technologies to enhance wood fiber board insulation with weather resistant barriers and bio-based adhesives. ■

TIMBERHP
INSULATE BETTER. LIVE BETTER.™

"The University of Maine's commitment to finding innovative new ways to use wood and wood composites has been a tremendous asset to GO Lab's growth. Early on, we used our research and development partnership with the university to determine if it was even feasible to bring wood fiber insulation to North America. **Today, they continue to help us with product testing and more R&D on cutting-edge building prototypes** that, over time, can fundamentally change the built environment as we know it today."

Josh Henry
President, GO Lab

MEIF at USM Success Stories

■ Growing Quality Control Collaboratory (QC2) to support brewing industry

MEIF Sector: Advanced Technologies for Forestry and Agriculture

The Quality Control Collaboratory (QC2) is an analytical chemistry laboratory at the University of Southern Maine supporting Maine's craft beverage industry through testing services, research, and education, while also providing undergraduate USM students with real-world lab experiences. Since 2016, MEIF has supported 25 highly trained QC2 students who have performed 2,500 testing services for more than 100 breweries in Maine and beyond. In the summer of 2021, QC2 launched a pilot internship program that placed students at local brewery worksites. The successful program will expand in 2022 and further strengthen USM's ties with the brewing community.

In addition to hands-on workshops and webinars that serve the brewing industry in Portland and around the world, QC2 has a robust research program dedicated to developing new and innovative analytical methods for quality testing in the brewing industry. Since 2016, the novel research conducted by undergraduate students has been presented at the American Chemical Society Spring Conference and other trade-specific conferences and events. In 2021, QC2 was awarded competitive funding from the American Society of Brewing Chemists to develop a portable device to analyze a volatile compound in beer.

Despite the challenges of COVID-19, demand for QC2's testing services doubled in 2021 thanks to expanded marketing outreach, website improvements, and the efforts of a newly hired lab manager. This growth has allowed the lab to invest in new instrumentation, fund more students, and involve new brewer partners in collaborative research.

■ Removing Barriers to Licensing for Foreign-Trained Professionals

MEIF Sector: Cross-Sector

Responding to the workforce challenges facing Maine businesses and with the support of MEIF dollars, a partnership between the State of Maine Department of Professional and Financial Regulation's Office of Professional and Occupational Regulation (OPOR), USM's Cutler Institute, Maine Regulatory Training and Ethics Center (MERTEC), and Maine Law seeks to remove barriers for foreign-trained professionals seeking licensure in specific professions/occupations. The goal is to enable those seeking licenses to work at the highest level of their education and training.

The partnership focuses on developing guides that explain the licensing process using clear language and charts. These guides identify licensing requirements and pathways to licensure, as well as relevant resources.

The project commenced in January 2021 and Maine Law interns have worked with OPOR & Cutler staff to complete four licensing guides. The hope is to complete a licensing guide for each of OPOR's 37 licensing entities. While the project is focused on foreign-trained or foreign-educated individuals, these easy-to-use guides will benefit all individuals seeking professional licensure in Maine.

"This partnership has helped expand the resources available to OPOR to dedicate to this to this important workforce initiative. It has also provided Maine law students with real world experience in regulation. OPOR is grateful for the university's and MEIF's financial and in-kind support of this valuable initiative," says Joan Cohen, deputy to the commissioner, Department of Professional and Financial Regulation.

Gateway to Opportunity (G2O)

MEIF Sector: Information Technologies

Gateway to Opportunity is a comprehensive youth-adult partnership focused on building the workforce of tomorrow. Through partnerships and collaborations with high schools, colleges, and employers, G2O bridges workforce gaps in the community and offers an innovative model for supporting underserved youth while improving the local economy.

Based on best-practice research from Brandeis University, G2O was developed at the University of Southern Maine through grant funding, including USM's Maine Economic Improvement Fund (MEIF) support for the USM student leaders and mentors. Through G2O, USM students are trained as team leaders to provide mentorship and guidance to young people, typically 16 to 19 years old, with paid, work-based learning projects where they can hone and develop 21st Century skills needed in the local job market. The projects have focused on helping young people, particularly those from low-income backgrounds, work on real business problems and solutions. With the USM team leaders serving as peer mentors, youth hold responsibility for driving the work forward, culminating in a final presentation of their results. The program benefits youth and young adults, undergraduate college students and employers who are able to interact with young people who can fill the in-demand jobs of the future.

Since launching in the summer of 2016, G2O has supported project teams based at over 20 different host sites serving close to 120 youth. Analysis of data collected from youth, team leaders and host sites demonstrate that the program achieves results year after year, most notably statistically significant gains in communication, teamwork, problem-solving, and work-readiness skills for participating youth. In 2021, as part of an effort to expand beyond the Greater Portland community, USM's G2O team revamped a program toolkit and provided a three-part virtual training series to interested organizations across Maine to provide tangible strategies to implement G2O in their communities. In the summer of 2021, G2O successfully transitioned the management of the program to the Maine Youth Action Network (MYAN) at The Opportunity Alliance.

Collaborating for Arctic Solutions

MEIF Sector: Aquaculture and Marine Sciences

Since 2019, USM's Maine Economic Improvement Fund has been instrumental in convening North Atlantic partners for the Arctic Circle Assembly (ACA) Graduate Student Cohort, a collaborative of faculty and students from the University of Southern Maine, the Arctic University of Norway, the University of Iceland, Reykjavik University, and the University of Akureyri. This collaborative began at the 2019 Arctic Circle Assembly in Reykjavik, Iceland, and in 2020-2021 multi-disciplinary teams of one faculty and two students from the same academic institutions came together representing the fields of business, law, social work, public health, mental health/counseling, psychology, and environmental science.

Participants considered Arctic-related issues through the lens of the "Triple Bottom Line" (TBL), a model that seeks to consider "People, Planet, and Profit" through measuring the social, environmental, and economic impacts of work and products. In practice, this can result in broad workable solutions, integrating the traditional silos of thought and action.

The collaborative demonstrated that interdisciplinary and multi-institutional teams of faculty/students from the United States, Iceland, and Norway with common interests

in the Arctic can work together to identify and promote solutions to concerns related to the Arctic. The result was a published research paper about the collaborative Arctic solutions and partnership processes of the cohort. Finally, students were able to present their work at a panel session at the 2021 Arctic Circle Assembly, "Triple Bottom Line in the Arctic: Graduate Student Cross Disciplinary Cohort." The panel included all who could travel to the Assembly, including three faculty members and four students.

The Planning Committee is currently at work on the next International Graduate Student Cohort scheduled to begin work in January 2022 with plans to publish and present at the 2022 Arctic Circle Assembly.

Appendix 1 — University of Maine System Intellectual Property

Table A1-1

University of Maine System — New Patent Applications Filed FY2021

Title	Application Type	Filing Date	Inventor	Campus
MOTION ABSORBING SYSTEM AND METHOD FOR A STRUCTURE	United States	5/7/21	Andrew Goupee, Habib Dagher, Anthony Viselli, Christopher Allen	Orono
CONTROLLED POROSITY STRUCTURAL MATERIAL WITH NANOCELLULOSE FIBERS	United States	11/10/20	Michael Mason, David Holomakoff, Muhammad Hossen	Orono
PROCESS FOR IMPROVING THE ENERGY DENSITY OF FEEDSTOCKS USING FORMATE SALTS	Norway	7/27/20	Paige Case, Adriaan van Heiningen, Clayton Wheeler	Orono
IMPROVED FILAMENTS FOR 3D PRINTING	Hong Kong	3/9/21	Douglas Gardner, Jordan Sanders, Lu Wang	Orono
NON-ORTHOGONAL ADDITIVE MANUFACTURING AND THE TREATMENT OF PARTS MANUFACTURED THEREOF	European Patent Convention	2/25/21	Matthew Ireland, James Anderson	Orono
COMPOUNDS AND METHODS FOR IMPROVING PLANT PERFORMANCE	Argentina	6/22/21	Pat Unkefer, Thomas Knight	USM
IMPROVED FILAMENTS FOR 3D PRINTING	China	7/8/20	Jordan Sanders, Lu Wang, Douglas Gardner	Orono
DOPPLER RADAR BASED BEE HIVE ACTIVITY MONITORING SYSTEM	United States	12/9/20	Herbert Aumann, Nuri Emanetoglu	Orono
TUNED MASS DAMPER FOR FLOATING STRUCTURES	United States	4/30/21	Andrew Goupee, Habib Dagher, Anthony Viselli, Christopher Allen	
NON-ORTHOGONAL ADDITIVE MANUFACTURING AND THE TREATMENT OF PARTS MANUFACTURED THEREOF	United States	1/22/21	Matthew Ireland, James Anderson	Orono
METHODS AND DEVICES FOR TREATMENT OF NEUROPATHY	PCT	5/7/21	Rosemary Smith, Kristy Townsend	Orono
LIGNOCELLULOSIC FOAM COMPOSITIONS AND METHODS OF MAKING THEREOF	PCT	10/28/20	Islam Hafez, Seyed Tayeb, Aileen Co, Michael Mason, Mehdi Tajvidi	Orono
PATHOGEN COLLECTION AND HANDLING SYSTEM "	PCT	6/30/21	Caitlin Howell, Daniel Regan	Orono
AF4124-7 HAMLIN RUSSET	United States	1/25/21	Gregory Porter	Orono
SYSTEMS AND METHODS FOR DETERMINING WATER CONTENT IN A SAMPLE	United States	9/14/20	Sfoog Saleh, Carl Tripp	Orono
METHODS AND SYSTEMS FOR AUGMENTING AND/OR SIMULATING FLAVORS	United States	7/24/20	Jonathan Roman Bland; Michael Gecawicz; R A Nimesha Ranasinghe, Meetha-Nesam James-Ravindran-Santhakumar	
CEMENT COMPOSITIONS, AND METHODS THEREOF	United States	3/12/21	Warda Ashraf, Hemant Pendse	Orono
ACTIVE COLOR-CHANGING LIQUID CRYSTAL FILAMENT AND YARN	United States	3/16/21	David Erb Jr, Christopher Erb	Orono
ADJUVANT FOR AQUACULTURE VACCINES USING ENGINEERED BACTERIA TARGETING THE STING PATHWAY	United States	11/24/20	Ian Bricknell, Jiahe Li, Deborah Bouchard	Orono
COMPOSITIONS AND METHODS FOR TOXIC SPECIES REMOVAL FROM FLUID	United States	6/15/21	Islam Hafez, Md Rahman	Orono
AUTONOMOUS ROAMING OFFSHORE WIND TURBINES	United States	4/9/21	Andrew Goupee, Habib Dagher, Anthony Viselli, Richard Kimball	Orono
DIGITAL MANUFACTURING FACILITY AND METHOD OF MANUFACTURING	United States	6/2/21	Habib Dagher	Orono
ELECTRICALLY CONTROLLABLE SURGICAL TOOLS	United States	12/4/20	Robert Ecker, Mohsen Shahinpoor	Orono
	Total 23			

Table A1-2

University of Maine System — Patents Issued FY2021

Tech ID	Title	Country	Type	Patent Number	Issue Date
2011-10US	RELEASE PAPER AND METHOD OF MANUFACTURE	United States	Utility	10731298	8/4/20
2012-17-05	IMPROVED METHODS OF CANCER DETECTION	United States	Divisional	10769790	9/8/20
2013-12US	SOFT TISSUE IN-GROWTH OF POROUS, THREE-DIMENSIONALLY PRINTED, TRANSCUTANEOUS IMPLANTS OF VARYING MATERIAL AND PORE GEOMETRY	United States	Nationalized PCT	10792129	10/6/20
2014-14US	METHODS FOR THE PRODUCTION OF HIGH SOLIDS NANOCELLULOSE	United States	Utility	10794002	10/6/20
2015-11US	COMPOSITE PRODUCTS OF PAPER AND CELLULOSE NANOFIBRILS AND PROCESS OF MAKING	United States	Utility	10875284	12/29/20
2015-16US	CONTROLLED POROSITY STRUCTURAL MATERIAL WITH NANOCELLULOSE FIBERS	United States	Nationalized PCT	10,870,950	12/22/20
2016-01US	ELECTRICALLY CONTROLLABLE SURGICAL TOOLS	United States	Utility	10881418	1/5/21

Total Issued	**39**
United States	7
International	32

The above table lists
US Patents Only

Appendix 2 — Maine Economic Improvement Fund Financial History and Tables

Table A2-1

A History of Legislative Actions on Appropriating State Research Funds

The following is a summary of the actions of the 118th–130th (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 FY1998 year-end state surplus for use in FY1999.

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 FY1999 $4 million research appropriation that was funded from the FY1998 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 FY2003 $2 million Supplemental Appropriation by $1 million.

July 1, 2002: Governor signed a Financial Order that curtailed the FY2003 $2 million Supplemental Appropriation by an additional $1 million. This eliminated the FY2003 increase of $2 million for research, bringing the FY2003 research and development appropriation back to the FY2002 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 FY2004. 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 FY2005 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 FY2007 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 FY2008 and an additional $1 million in FY2009 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 FY2009 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.

128th LEGISLATURE
July 4, 2017: Governor signs into law the state budget that maintains the annual funding at $17.35 million.

129th LEGISLATURE
June 17, 2019: Governor signs into law the state budget that maintains the annual funding at $17.35 million.

130th LEGISLATURE
July 1, 2021: Governor signs into law the state budget that maintains the annual funding at $17.35 million.

Table A2-2

Legislative History of MEIF New Appropriations

118th LEGISLATURE	FY98	FY99	Total 2-Year
UM	$400,000	$400,000	$3,200,000
USM	100,000	100,000	800,000
Total	**$500,000**	**$500,000**	**$4,000,000**

119th LEGISLATURE	FY00	FY01	Total 2-Year
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	FY03	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
Total	**$0**	**$0**	**$0**

121st LEGISLATURE	FY04	FY05	Total 2-Year
UM	$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	FY06	FY07	Total 2-Year
UM	$0	$540,000	$540,000
USM	0	60,000	60,000
Total	**$0**	**$600,000**	**$600,000**

*One-time funding

123rd LEGISLATURE	FY08	FY09	Total 2-Year
UM	$1,200,000	$720,000	$1,920,000
USM	300,000	180,000	480,000
INITIATIVES	0	100,000	100,000
Total	**$1,500,000**	**$1,000,000**	**$2,500,000**

124th LEGISLATURE	FY10	FY11	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

125th LEGISLATURE	FY12	FY13	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

126th LEGISLATURE	FY14	FY15	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

127th LEGISLATURE	FY16	FY17	Total 2-Year
UM	$2,056,400	$0	$2,056,400
USM	514,100	0	514,100
INITIATIVES	79,500	0	79,500
Total	**$2,650,000**	**$0**	**$2,650,000**

128th LEGISLATURE	FY18	FY19	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

129th LEGISLATURE	FY20	FY21	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

130th LEGISLATURE	FY22	FY23	Total 2-Year
UM	$0	$0	$0
USM	0	0	0
INITIATIVES	0	0	0
Total	**$0**	**$0**	**$0**

Total Yearly Research Appropriations for FY2021

UM	$13,263,600
USM	3,315,900
UMM	250,000
UMFK	0
UMA	0
UMPI	0
UMS	520,500
MMA	0
Total	**$17,350,000**

Small Campus Initiatives	S.C. Initiatives
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 Improvement Fund

Utilization of FY2021 Operating Research Appropriation by Targeted Research Areas

UMAINE	Source of R&D Funds						Utilization of R&D Funds				Balance
Targeted Research Area	FY2021 R&D Initial Base Budget	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	FY2021 R&D Funding Transfers	FY2021 Total R&D Funds Available	FY2021 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	Unused Funds Carried Forward To FY2022[1]
Adv. Technology Forestry & Agriculture	$1,764,951	$(893,741)	$-	$(893,741)	$-	$871,210	$2,455,400	$257,667	$(1,042,862)	$1,670,205	$(798,995)
Aquaculture & Marine Science	2,354,090	(1,072,229)	-	(1,072,229)	-	1,281,861	2,874,130	703,128	(1,402,493)	2,174,765	(892,904)
Biotechnology	1,285,268	(1,061,522)	-	(1,061,522)	-	223,746	1,517,752	127,060	(606,750)	1,038,062	(814,316)
Composites	1,628,070	144,607	-	144,607	-	1,772,677	2,275,448	440,725	(1,010,055)	1,706,118	66,559
Environmental	1,576,902	(383,676)	-	(383,676)	-	1,193,226	2,047,986	215,783	(894,828)	1,368,941	(175,715)
Information Technology	1,767,007	(719,912)	-	(719,912)	-	1,047,095	2,426,288	88,498	(887,391)	1,627,395	(580,300)
Precision Manufacturing	1,568,649	209,072	-	209,072	-	1,777,721	2,051,361	56,955	(776,848)	1,331,468	446,253
Cross Sector	1,318,663	(245,300)	-	(245,300)	-	1,073,363	1,237,413	192,284	(282,197)	1,147,500	(74,137)
Total State Funding	**$13,263,600**	**$(4,022,701)**	**$-**	**$(4,022,701)**	**$-**	**$9,240,899**	**$16,885,778**	**$2,082,100**	**$(6,903,424)**	**$12,064,454**	**$(2,823,555)**
UM Cost Sharing Funding[2]	6,903,424	-	-	-	-	6,903,424	-	-	6,903,424	6,903,424	-
Total Funding	**$20,167,024**	**$(4,022,701)**	**$-**	**$(4,022,701)**	**$-**	**$16,144,323**	**$16,885,778**	**$2,082,100**	**$-**	**$18,967,878**	**$(2,823,555)**

[1]Includes year-end equipment carry-over funds (equipment ordered, not received, and not paid).
[2]Salary and benefits from University.

USM	Source of R&D Funds						Utilization of R&D Funds				Balance
Targeted Research Area	FY2021 R&D Initial Base Budget	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	FY2021 R&D Funding Transfers[3]	FY2021 Total R&D Funds Available	FY2021 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	Unused Funds Carried Forward To FY2022[1,2]
Forestry & Agriculture	$629,054	$152,543	$-	$152,543	$-	$781,597	$497,681	$133,305	$-	$630,986	$150,611
Aquaculture & Marine	366,234	376,955	-	376,955	-	743,189	397,109	-	-	397,109	346,080
Biotechnology	207,920	44,411	-	44,411	16,642	268,973	229,439	-	-	229,439	39,534
Composites	-	-	-	-	-	-	21,059		-	21,059	(21,059)
Environmental	25,593	5,971	-	5,971	24,139	55,703	31,862	-	-	31,862	23,841
Information Technology	623,855	217,198	-	217,198	-	841,053	525,570	32,967	-	558,537	282,516
Precision Manufacturing	20,000	3,546	-	3,546	29,643	53,189	33,263	20,000	-	53,263	(74)
Cross Sector	1,443,244	206,604	-	206,604	-	1,649,848	1,213,766	4,395	-	1,218,161	431,687
Unassigned	-	337,864	-	337,864	(70,424)	267,440	-	-	-	-	267,440
Total State Funding	**$3,315,900**	**$1,345,092**	**$-**	**$1,345,092**	**$-**	**$4,660,992**	**$2,949,749**	**$190,667**	**$-**	**$3,140,416**	**$1,520,576**

[1]Includes year-end equipment carry-over funds (equipment ordered, not received, and not paid).
[2]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 FY22 are committed to multi year projects.
[3]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.

Table A2-4 Maine Economic Improvement Fund

FY2021 Summary Utilization of Operating Research Appropriation by University

	Source of R&D Funds						Utilization of R&D Funds				Balance
Targeted Research Area	FY2021 R&D Initial Base Budget	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	FY2021 R&D Funding Transfers[3]	FY2021 Total R&D Funds Available	FY2021 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts[2]	Total R&D Funds Utilized	Unused Funds Carried Forward To FY2022[1]
UMAINE	$13,263,600	$(4,022,701)	$-	$(4,022,701)	$-	$9,240,899	$16,885,778	$2,082,100	$(6,903,424)	$12,064,454	$(2,823,555)
USM	3,315,900	1,345,092	-	1,345,092	-	4,660,992	2,949,749	190,667	-	3,140,416	1,520,576
UMM	250,000	98,896	-	98,896	250,000	598,896	313,375	-	-	313,375	285,521
UMFK	-	167,413	-	167,413	25,000	192,413	155,046	-	-	155,046	37,367
UMPI	-	9	-	9	168,474	168,483	-	-	-	-	168,483
UMA	-	1	-	1	25,000	25,001	-	-	-	-	25,001
UMF	-	308,186	-	308,186	-	308,186	156,184	-	-	156,184	152,002
UMS	520,500	(7,728)	-	(7,728)	(468,474)	44,298	-	-	-	-	44,298
MMA	-	216,793	-	216,793	-	216,793	79,310	-	-	79,310	137,483
Total State Funding	**$17,350,000**	**$(1,894,039)**	**$-**	**$(1,894,039)**	**$-**	**$15,455,961**	**$20,539,442**	**$2,272,767**	**$(6,903,424)**	**$15,908,785**	**$(452,824)**

[1]Includes year-end equipment carry-over funds (equipment ordered, not received, and not paid).
[2]UM Cost Sharing.
[3]Inter-unit R&D funding transfers related to FY2021 MMA and Small Campus Initiative (SCI) awards.

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