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Annual Report of the Maine STEM Council to the Education and Cultural Affairs Committee of the 127th Maine Legislature, January 2016

Maine STEM Council

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20 January 2016

Delivered by Jerry Pieh, Chair and Tom Keller, Executive Director

Maine STEM Council

1. Introductions
2. Background
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4. Broadening participation milestone development
5. Maine Academy of Sciences and Innovation
6. Next steps - What would help the EDU committee?

January 2016 Report

1. Introduce Council members who are present.

2. Quick Background

    - Unanimously created by the Governor and Legislature and began operating late in 2011 to develop strategies for enhancing STEM education and workforce development in Maine.

    - 16 members – 5 ex officio – Commissioners of Education and Labor, Chancellor of UMaine System, President of Community College System, President of Maine Maritime; and 11 Governor-appointed to represent specified business and education constituencies.

    - Meets quarterly with annual meeting in the summer.

    - Since December 2014, operating under Maine STEM Education and Workforce Plan 1.0:

    - Widely circulated to this Committee, State Board of Education, Maine Development Foundation, State Chamber of Commerce, the ex officio organizations, etc.

    Five general target areas in Plan 1.0.

    - One: Improve STEM achievement and interest K-12.

    - Two: Increase percentage of students completing post-secondary degrees or certificates in STEM.

    - Three: Better align secondary (including CTE) and post-secondary training with State's workforce needs.

    - Four: Promote STEM education and careers across the State.

    - Five: Broaden opportunities for currently underrepresented populations in all fields of STEM education and workforce.

3. Status of Plan 1.0

    See Appendix A

4. Broadening Participation milestone development

See Appendix B

5. Maine Academy of Science and Innovation

See Appendix C

6. Next Steps

Appendix A: Maine STEM Education and Workforce Plan 1.0 Subgoals and Milestones

Subgoal	Milestone	Description		Responsible organization	Status as of 18 January 2016
		Short Term/Immediate Impact	**Long Term**		
A. To improve STEM achievement and interest among grades K-12 age students.	1	The Maine STEM Council recommends that Maine adopt the Next Generation Science Standards as soon as possible.		Legislature, Maine DOE	Passed by House and Senate, vetoed by governor, House overrode, Senate did not
	2	The Maine STEM Council recommends that certified teachers in the K-12 system who teach mathematics be required to pass a three-credit course in current mathematics content and pedagogy …		State Board of Education	Idea presented to State Board; attempted to get meeting with new Certification Director
	3	Recognizing the critical importance of reading in the content areas, the Maine STEM Council recommends that the content literacy sections of the Maine Learning Results (Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects) …		Maine DOE, public schools	No progress
	4	The Maine STEM Council recommends that out of school and after school STEM programs across the state be catalogued and that program providers be provided with opportunities for professional development in STEM content		Maine Afterschool Network, 21st CCLC program at MDOE	MASN has committed to undertake this inventory in 2016

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		knowledge, pedagogy, and positive youth development.			
	5	The Maine STEM Council recommends that the Maine Department of Education develop stakeholder-based content advisory committees in STEM (including computer science) content areas. The Maine Department of Education, with input from the stakeholder-based content advisory committees, should develop and actualize implementation plans for STEM subjects.		MDOE	legislation introduced in 127th Legislature but withdrawn; MDOE indicated that such groups are organized as needed but are temporary
	6		The Maine STEM Council recommends that incentives be provided to new and existing teachers of STEM subjects who are accredited in their content area at the Bachelors and beyond levels. …	MDOE, public schools	No progress
	7		The Maine STEM Council recommends … a professional teaching endorsement for teaching computer science.	MDOE, State Board of Education	Requested meeting with MDOE certification coordinator
B. To increase the percentage of	1	The Maine STEM Council recommends that University of Maine System and the Maine Community		UMS, MCCS	Underway at UM and UMM; proposal being written at

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students completing post-secondary degrees or certificates in STEM.		College System initiate or expand system-wide professional development in research-based best classroom practices for instructors of STEM courses.			USM – see Active Learning Increases Performance in Science, Engineering and Math - http://www.pnas.org/content/111/23/8410
	2	The Maine STEM Council recommends that the Maine Department of Education gather and report data on remediation courses in STEM subjects at all public higher education institutions and cite best practices for overcoming remediation.		UMS, MCCS, MDOE	Data reported as per Public Law 2011, Chapter 615, however no citing of best instructional practices or analysis.
	3		The Maine STEM Council recommends that Maine's institutions of higher education increase the levels of partnerships with research and non-profit organizations in Maine, possibly through credit bearing research and teaching internships.	UMS, MCCS, Maine's research institutions	No progress
	4		… the Maine STEM Council recommends that the content literacy sections of the Maine Learning Results … be	UMS. MCCS	No progress

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			given significant attention in higher education classrooms, particularly with a focus on STEM subjects.		
C. To better align secondary (including CTE) and post-secondary training with the state's workforce needs.	1	The Maine STEM Council recommends that Maine develop a one-stop clearinghouse for internship opportunities, perhaps building off the Maine State Chamber of Commerce InternHelpMe.com and Educate Maine's efforts.		Coalition to be built, perhaps led by Maine State COC	A variety of efforts are underway but success is not assured
	2	The Maine STEM Council recommends that all Maine residents know about vocations and avocations in STEM.		Maine media	The Maine STEM Collaborative has agreed to take action on this.
	3	The Maine STEM Council recommends that a regular survey of Maine's top businesses and economic growth clusters be undertaken …		Maine Department of Labor with Maine Tech Institute and MACTE	MDOL is surveying current job vacancies in STEM professions
D. To create conditions across sectors in the state that promote STEM education and careers.	1	The Maine STEM Council recommends that the Legislature consider ways to facilitate high school student participation in scientific endeavors at research labs through reducing liability of working in laboratories.		Legislature	Further research as revealed that this is not a priority issue.
	2	The Maine STEM Council recommends that cognizant Maine		This requires leadership	The Maine STEM Collaborative has

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		agencies collaborate on STEM education and workforce issues. For example, there should be regular communication channels about STEM education and workforce issues: • Among …(education) • Among …(community development) • Between both groups identified above.		and collaboration, perhaps initiated by the legislature or Maine DOE for education and Maine ECD for economic development	engaged in cross sector collaboration but the named groups have not yet undertaken such collaboration.
	3	The Maine STEM Council recommends that Maine recruit and retain talent though development of support systems for individuals and families moving to Maine, with the collaboration of the Maine Development Foundation and the Maine State Chamber of Commerce.		MDF and Maine State COC, perhaps with Maine DOL	Maine Career Connect is a newly forming organization that supports newly relocated professionals with their transition to Maine. Maine Career Connect partners with employers across the state and provides a proactive approach to their efforts with recruitment and retention of top talent from across

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					the globe. Details can be found here - http://www.mainecareerconnect.org/how-we-help/ This program is currently being piloted internally at University of Maine and supporting the newly relocated professionals that have recently began appointments.
	4		The Maine STEM Council recommends that all Maine communities have access to technology and education to enable productivity and recreation through completion of efforts to; • Connect affordable, high speed Internet to each house • …	Many organizations call for this; Maine PUC may be the responsible organization	According to the September 25, 2015 issue of the Portland Press Herald, "Maine is considered to have relatively low Internet speeds when compared to the rest of the nation. Last year, Maine found itself ranked 49th out of 50 for broadband speeds on one list. Roughly 80 percent of Maine households are now considered to be "unserved" by high-speed Internet service, according to the

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					ConnectME Authority. That percent is based on a new standard the authority adopted in January that considers an area "unserved" if residents don't have access to download and upload speeds of at least 10 megabits-per-second."
	5		The Maine STEM Council recommends that Maine youth aged 16 to 26 have at least one internship, apprenticeship or mentorship for an extended (longer than one month) term, such that:… • A network of existing internship opportunities – e.g. Project Log>in, USM's Internships and Career Placement, Maine State Chambers InternHelpMe.com	This requires a unique partnership to be built among the named and other organizations	No progress

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			be coordinated		
	6		The Maine STEM Council recommends that Maine become the "State of Innovation" through supporting creative, collaborative and problem solving activities such as: • Regular, high quality opportunities such as the Maine State Science Fair and CTE Auto Skills Competition. • Regular, high quality challenges such as Maine FIRST Robotics, VEX Robotics, Skills-USA competitions and the Maine Wind Blade Challenge. • STEM activities such as CAD Camp and the Acadia Night Sky Festival.	This requires a new and unique partnership, perhaps led by the ME STEM Council or Collaborative	MMSA convened various groups that host a STEM challenge or competition. This first ever gathering resulted in a guide to such events and a pledge to develop a website to ease access to them by parents and students. No funding is allocated to this effort however.

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E. To broaden opportunities for currently underrepresented populations such as low-income, first-generation college and minorities, including females, in all fields of STEM education and workforce.		Milestones are to be developed			The University of Maine at Machias has an NSF grant to: 1. implement a bridge program and residence hall learning communities to support transition to college for at-risk students (e.g., first-in-family college attendees, rural poor, and minority students; and 2. transform instruction in all first-year STEM courses (see Plan 1.0 B1)

Subgoal A Additional ideas that surfaced during Maine STEM Council deliberations:		
		Status
1.	Each student in grades K through 12 should have at least one out-of-school STEM experience or Extended Learning Opportunity per year that is student-driven. The intent is not that these be an additional burden upon the school system but that we encourage, promote, and support out-of-school as well as in-school STEM learning.	
2.	The Maine STEM Council recommends that the legislature and Maine Department of Education consider adding a computer science requirement for high school graduation. Despite most every student carrying a computer (cellphone) that has more computing power than the Apollo 11 mission that landed on the moon, our students are remarkably naïve about computer science. It has been said that youth today can 'read computers' but they cannot 'write computers'—referring to reading and writing English as a necessary part of learning.	
3.	Each student must demonstrate proficiency in the Maine Learning Results Guiding Principles through STEM subjects. The current proficiency based graduation law mandates that students demonstrate proficiency in the eight content areas of the Maine Learning Results plus the Guiding Principles. But demonstrating the Guiding Principles (for example, being an effective communicator or problem solver) through the STEM subjects makes it a much more authentic experience.	
4.	The Maine Department of Education should capitalize on the expertise of high quality educators and students (e.g. Principal of the Year, Teacher of the Year, Nationally Board Certified teachers, National Youth Science Camp alumni, Presidential Awardees for Excellence in Science and Math Teaching) by, for example, placing them on stakeholder task forces and program reviews of teacher preparation programs.	

Appendix B Maine STEM Council – DRAFT milestones related to Subgoal E – Broadening Participation

Target 1. Encourage post-secondary attendance

The Maine STEM Council recommends that:

a group, perhaps Maine CAN or Maine Education Opportunity Center, convene Maine groups such as Jobs for Maine Graduates, Maine Educational Talent Search, Maine GEAR UP, Maine Youth Transition Collaborative, MELMAC Education Foundation, and other groups that support college attendance for sharing of best practices/what works in recruiting and retaining STEM majors from low-income, first-generation college students and minorities populations. Post-secondary institutions in state that are experiencing record growth – for example Unity College and the Maine Maritime Academy or that have innovative partnerships such as Bates/SMCC or that have specific support structures for such students such as the University of Maine at Machias MIST program should be invited to share their strategies. Two-year institutions must be invited to participate.

Target 2. Be bold with innovations

The Maine STEM Council recommends that:

the Maine Department of Education or the EDU Committee of the Legislature charge MEPRI (Maine Education Policy Research Institute) with investigating the free community college models in TN and OR as to costs and effectiveness in broadening participation in STEM majors.

Target 3. STEM learning for all in computer science

The Maine STEM Council recommends that:

that all local educational agencies explore the addition of computer science instruction in their K-12 systems. School districts such as Falmouth and MDI have already implemented such 21st century thinking and one district (RSU3) requires computer applications for high school graduation. Add "as more CS instruction is implemented, keep records concerning recruitment and enrollment in the courses (especially at high school). Take steps to ensure that girls and other under-represented groups are participating at a rate proportional to their representation in the school population."

Target 4. Improve undergraduate teaching

The Maine STEM Council recommends that:

the instructional methods of "active learning" be implemented at all UMS, MMCS and MMA campuses in appropriate STEM courses for undergraduate and teacher education candidates. This is consistent with the Maine STEM Council Plan 1.0, Subgoal B, milestone 1.

Target 5. Start early

The Maine STEM Council recommends that:

the State of Maine support and promote preschool/early childhood education programs. These have been shown to be effective in helping youth at all levels to grow cognitively as well as socially. (NOTE: support at endorsement level only; no further action to be taken)

Target 6. STEM as an essential tool

The Maine STEM Council recommends that:

the Maine STEM Collaborative create and implement a plan to increase public awareness of STEM and STEM employment statewide. Their biannual STEM Summit could be a forum for this.

Target 7. Enrollment should at least mirror representation

The Maine STEM Council recommends that:

local school districts increase the numbers and diversity of students participating in Advanced Placement (AP) and International Baccalaureate programs and promote AP for All. As an example of current participation rates, in 2015, Maine had:

- 22 females take the AP Computer Science test (9 Asian and 13 white) and
- 144 males (16 Asian, 4 Black, and 118 white – 4 were not stated or other).

These levels of participation should be publicized.

Target 8. Increase dual enrollment

The Maine STEM Council recommends that:

local school districts increase dual enrollment courses from high schools to college and from Career and Technical Education schools to college.

Target 9. Multiple pathways to proficiency

The Maine STEM Council recommends that:

the Maine Department of Education provide leadership in meeting with the Maine Administrators of Career and Technical Education (MACTE), Maine Principals Association, the Maine Curriculum Leaders Association and the Maine School Superintendents Association to facilitate the awarding of graduation credit or proficiency for learning undertaken in CTE centers as a model for non-traditional settings.

Appendix C
Building Bridges: A Thought Paper
Maine STEM Council, January 2016

Maine has a history of being known as a small pond, which is true when compared to places like Massachusetts, New York City or Washington, DC. But Maine actually is a series of small ponds that are connected in a myriad of ways. Building those bridges is one way to accomplish the works of Alan Caron and Charles Lawson.

For instance, Maine has an amazing asset in the number and focus of research institutions in state – here we are defining research institutions as those organizations that compete for grant funding and engage undergraduate and graduate students, post-docs, and junior and senior faculty in research. These tend to be young, smart, well educated, innovative and capable people – just the ones Maine needs to thrive.

But our research ponds are separate. One example is in a key area of marine resources. Maine has the Bigelow Laboratory, a world class oceanography facility, that focuses on key ocean processes, most frequently at the microscopic level, the University of Maine System with a marine center that focuses on aquaculture and food production, the Gulf of Maine Research Institute that has community, education and research as its bases, and the Downeast Institute for Applied Marine Research and Education. We have a whole set of outstanding medical related research institutions lead by another world class institute, the Jackson Laboratory, as well as the Maine Medical Center Research Institute that supports and encourages a broad spectrum of research ranging from basic laboratory-based research through the translational research and Eastern Maine Heathcare Systems that is involved in clinical and cancer research. Many of these and others are part of the Maine IDeA Network of Biomedical Research Excellence (INBRE) led by the Mt Desert Island Biological Laboratory.

Then there is the pond system of entrepreneurialism and economic development. Again Maine has tremendous resources, with groups such as the award winning and highly effective Coastal Enterprises, Inc. The Maine Technology Institute conducts market analysis and provides funding. The University of Maine System has joined in with its Professional and Graduate Center Initiative. Envision Maine's stated mission is to accelerate the growth of Maine's next economy by supporting our entrepreneurs, innovators, visionaries and doers. Plus the Maine State Workforce Investment Board provides planning and policy work. Maine Career Connection (http://www.mainecareerconnect.org/) is a good pilot as well.

We propose that Maine build stronger and more durable connections between these pond systems of science, technology, engineering and mathematics related education and research and economic development/innovation by creating a Maine Academy of Science and Innovation (MASI). Academy of sciences exist in forty-eight other states and large cities across the country. Maine is a notable exception.

The mission of the Maine Academy of Sciences and Innovation is to keep highly trained and educated young people in Maine and, with them, create more economic opportunity for all Mainers. The goals are to grow undergraduate and graduate research programs at public and private institutions and organizations in Maine through communication, networking and support and to broaden the base of scientific research to include entrepreneurialism.

Here is how this might work - A winter and a summer meeting would be held, ideally in conjunction with the Maine STEM Summit or annual meeting of the STEM Council, to facilitate discussions about the research occurring in Maine, discuss the sociology of life in the world of research (to broaden participation), establish mentorships among senior scientists, junior scientists and business innovators, identify areas of potential cross disciplinary research and imagine ways to monetize scientific research. The objective regarding economic opportunity will be stimulated by participation in the twice-annual meetings by Maine organizations with economic development experience. Other examples of support are – groups on making the most of a post-doc position, combining a professional life and a personal life, accommodating dual career issues and learning leadership skills.

Certainly there is value in basic research, just as there is value in applied research. What we are proposing is the development of an environment that is conducive to supporting and developing creative and innovative people interested in science, technology, engineering and mathematics in Maine with ways for them to stay here and be gainfully employed. MASI could become a bridge builder to a brighter future for Maine.