2016 Annual Report

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Table of Contents

Executive Summary

Now midway through our third year of operation, MassCAN continues to work toward two high-level outcomes:

- Preparing Massachusetts youth for 21st century success by inspiring them to develop their computer science, technology, and problem-solving skills and their analytic abilities, which can be applied in any capacity and to any field
- Expanding the Massachusetts workforce to increase success across all information-based sectors of our economy

MassCAN (the Massachusetts Computing Attainment Network) is a coalition comprising K–12 education, higher education, business, and nonprofit partners. When we use the term "MassCAN" in this report, we are usually referring to both MassCAN and its coalition partners. (See Appendix E for a list of coalition partners and a summary of their many contributions to MassCAN's work.)

MassCAN strives to achieve these outcomes by focusing on four goals:

- Expand opportunities for all Massachusetts K–12 students to learn computer science (CS)
- Promote opportunities for all students, especially many more females and underrepresented minorities, to pursue CS careers
- Inform and inspire educators, administrators, parents, and students about the extraordinary employment opportunities available in technology fields across all industries and nonprofits—locally, nationally, and globally
- Mobilize, organize, and collaborate with partners across Massachusetts in industry, education, nonprofits, and the public sector to achieve the above goals

MassCAN activities, coalition partners, and successes are outlined in both the MassCAN Briefing Book and this annual report, which is provided to the Massachusetts legislature and the public to present the past year's activities and planned future efforts.

MassCAN's Strategic Framework consists of four pillars: Policy, District Education Partner Engagement, Coalition and Collective Impact, and National Leadership.

- Our **Policy** roadmap has remained unchanged, even as our focus shifts from the Massachusetts K–12 Digital Literacy and Computer Science (DLCS) standards

(recently approved by the State Board of Education) to teacher licensure, training, and inclusion of CS in MassCore.[1]

- **District Education Partnership Engagement** represents the evolution of the teacher-focused education strategy we've pursued for the past several years to a district-focused one, in which our goal is to achieve deep (a large percentage of students learning CS at grade level) and broad (a large number of grades offering CS education) engagement within a handful of forward-looking school districts, charter schools, and other education partnership organizations.
- As the **Coalition** matures, we are adopting **Collective Impact**, a proven formal model for cross-sector metrics-based collaboration to achieve sustainable social change.
- **National Leadership** is a new priority in response to President Obama's Computer Science for All initiative. Massachusetts is already widely recognized as a national leader in K–12 CS education; under this initiative, the state is now positioned to receive federal funding for CS education.

MassCAN has been very lightly staffed over the past year, with fewer than two full-time people. As a result of successful fundraising in the first half of 2016 and the legislature's renewal of MassCAN funding for FY 2017, we are in our strongest fiscal position since inception. Staffing will expand in late 2016 to add a Communications Director, to improve communications within the coalition and for the public, and a Director of District and Teacher Engagement, to work with districts and their teachers to create a CS education technology plan and support its implementation through teacher professional development (PD), community development, and informational resource support.

Detailed information on MassCAN's Advisory Board, fundraising, teacher PD, and coalition partner activities is provided in the Appendices. Minutes from our Advisory Board meetings are available in Appendix G.

Strategic Framework

Policy

MassCAN's policy work has two strands:

[1] MassCore (the Massachusetts High School Program of Studies) is designed to prepare Massachusetts high school graduates for college or the workplace and to reduce the number of students taking remedial courses in college.

- Expanding awareness among legislators, state administration officials, and business organizations of the importance of CS education and the efforts in Massachusetts to promote CS education as part of K–12 education
- Establishing policy elements at the state level, such as standards and frameworks, to guide, encourage, and enable K–12 CS education

Raising awareness is an ongoing activity. MassCAN coalition members participate in the Governor's STEM (Science, Technology, Engineering, and Math) Advisory Council (see Appendix F) and the Tech Hub Collaboration; meet regularly with state and national policymakers; work to establish ongoing communication channels with workforce and education administration officials and provide them with regular progress updates; present at state and national events, such as the STEM Summit, the MassCUE[2] Annual Conference, the Education Commission of the States' National Forum on Educational Policy, and White House conferences on the President's Computer Science for All Initiative; and meet regularly with superintendents and teachers.

At the forefront of MassCAN's policy work is the formal adoption of the first Massachusetts DLCS standards by the Commonwealth's Board of Elementary and Secondary Education (BESE) in June 2016. This was the culmination of a two and a half-year collaboration between the MassCAN coalition and the Massachusetts Department of Elementary and Secondary Education (DESE), as represented by an assembled panel of 40 educators, researchers, industry volunteers, and staff from DESE and Education Development Center, Inc. (EDC).[3] The panel incorporated public feedback into a final draft and completed the Curriculum Framework in which the standards are framed. Over the next year, MassCAN partners and DESE officials will conduct public meetings across the state to broaden awareness of the standards and answer educators' questions about them.

However, while a major milestone in policy progress, the standards are only one step in a sequence needed to put CS on a level playing field with other academic disciplines, such as math and science. In the coming year, MassCAN will engage in at least four key policy-related activities, listed in priority order:

- **Teacher Licensure and Training:** How should the state certify DLCS teacher preparation through licensure, and what guidelines re: training teachers to acquire licensure should it provide? These questions are the focus of a new panel being formed in a collaboration between MassCAN, MassCUE, and DESE. As with the standards panel, a broadly representative membership has been assembled to address both DLCS licensure and related teacher preparation programs over the

[2] MassCUE (Massachusetts Computer Using Educators) is a leading state champion of digital literacy education.

[3] EDC serves as both a coalition partner and MassCAN's physical home.

coming 18 months. BESE is expected to act on recommendations to approve regulations for new DLCS teaching licenses late in 2016. However, due to a backlog in the development of new Massachusetts Tests for Educator Licensure and exams for the Common Core and STEM, the work group may have to wait until 2018–19 before it can collaborate with Pearson (the state's test developer) to create the two new DLCS exams.

- **Inclusion of CS in MassCore:** MassCore is designed to "help our state's high school graduates arrive at college or the workplace well prepared and reduce the number of students taking remedial courses in college. MassCore recommends a comprehensive set of subject area courses and units as well as other learning opportunities to complete before graduating from high school."[4] MassCAN's goal for the year is to collaborate with the Secretary of Education's office to include a CS course in MassCore's next iteration.
- **Standards and Course Alignment:** Due to the concurrent development of CS courses in the past few years and the development and release of the DLCS standards, there is now a need to align the courses with the standards. To support this process, MassCAN will establish work groups to do a crosswalk between all high-quality K–12 CS curricula and the DLCS standards, in collaboration with the curriculum developers. The crosswalks will then be shared widely throughout the state. MassCAN's goal for the year is to complete the crosswalk to the DLCS standards for three CS course curricula.
- **University Admissions Standards:** MassCAN will set up a work group to explore whether the Admissions Standards for the Massachusetts State University System and the University of Massachusetts (UMass) should recognize one or more high school CS courses as satisfying math and/or science entrance credits for incoming freshman. MassCAN's goal for the year is to form a work group and initiate discussions on this topic.

District Education Partner Engagement

Over the past three years, MassCAN and its partners have delivered CS PD to close to 700 teachers from about half the Massachusetts school districts and a number of charter schools serving K–12 students. (See Appendix D for a complete list of teachers and districts participating in the PD provided by MassCAN partners over the past three years, including over 90 teachers participating this year.) These "early adopters" are a strong and cohesive cohort, teaching high-quality CS in their districts, advocating for greater CS offerings, and influencing other teachers and school districts. However, in general,

[4] Massachusetts DESE. (2016). *What Is MassCore?* Retrieved from http://www.doe.mass.edu/ccr/masscore/

Massachusetts school districts do not offer CS to most of their students, much less to all students at all grade levels, which is our goal.

Over the next year, MassCAN will work to promote deep engagement among school districts, charter schools, and other education organizations that support CS education in local schools and districts. We will collaborate with a small group of "pilot" school districts who are committed to implementing the new state standards and providing a complete K–12 CS program over a four- to five-year period. This deeper engagement will involve MassCAN partners in a number of ways—advocating for CS education within schools and districts, collaborating in the development of an education plan at the district level for offering CS at all grade levels, arranging and offering PD on implementing the district plan, identifying out-of-school-time programs that complement the district plan, and helping to connect schools with experts and volunteers in the state or country.

MassCAN's goals for the year include the following:

- Thanks to a major grant from General Electric (GE) that prioritizes CS education, MassCAN leaders and coalition members are actively assisting the Boston Public Schools (BPS) in planning a major CS initiative for all high school students.
- UMass Amherst has secured a National Science Foundation (NSF) grant to engage the Holyoke and Springfield school districts and their charter school partners in a year-long intensive planning process for implementing a K–12 CS education program.
- In collaboration with the Governor's STEM Advisory Council, MassCAN will seek to support three to five additional school districts who are developing plans to implement a K–12 CS program. The Somerville and Burlington school districts have expressed strong interest in participating in such a pilot program.

MassCAN is actively encouraging and offering its support to several other activities to stimulate interest in CS education within school districts:

- In FY 2016–17, the STEM Advisory Council is budgeting significant funds to incentivize school districts to plan and offer CS education.
- The Massachusetts Math & Science Initiative is deeply engaged in providing teacher PD for the College Board's Computer Science Principles course in the state's Gateway Cities.
- MassCAN is serving as Code.org's Professional Learning Partner for Massachusetts and will work with the organization to expand opportunities for districts to develop plans to support CS education in their districts.

Coalition and Collective Impact

The MassCAN coalition seeks to expand and strengthen its ability to implement a comprehensive agenda that achieves the high-level outcomes referenced above. When MassCAN was established, we had no model or existing program to emulate. The coalition model was adopted so that many different programs in the state that are pursuing different aspects of CS education (e.g., research, tools development, curriculum development, educational materials, PD, after-school programs) could collaborate on a shared agenda to drive the statewide expansion of CS education.

The coalition has had much success in its first few years, including increasing the visibility and priority of CS education in the state, catalyzing community-building across the public and private sectors, and establishing a statewide strategy for driving CS education in a loosely coupled, school district-centric educational system. However, despite all our progress, many improvements are needed to move the effort to a new level of impact, particularly around communication and building new collaborations between organizations.

A new model called Collective Impact, which coordinates multiple organizations who share a common agenda and a commitment to a metrics-driven outcomes process, has emerged nationally, and our initial due diligence suggests that it is a good fit for guiding the MassCAN coalition, as it specifically addresses our precise situation:

> *Large-scale social change requires broad cross-sector coordination, yet the social sector remains focused on the isolated intervention of individual organizations.*[5]

The Collective Impact approach, as set forth in Kania and Kramer's article, is based on five elements:

- A Common Agenda
- Shared Measurement Systems
- Mutually Reinforcing Activities
- Continuous Communication
- Backbone Support Organizations

NSF strongly encourages adopting Collective Impact as a model for engaging a broad partnership in driving and sustaining CS education. This approach is also recognized and supported by GE, which recently relocated its headquarters to Boston and is investing heavily in the Boston Public Schools' CS initiative.

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[5] Kania, J., & Kramer, M. (2011, Winter). Collective impact. *Stanford Social Innovation Review*. Retrieved from http://ssir.org/articles/entry/collective_impact

MassCAN has outlined a process for adopting the Collective Impact model. We plan to solicit proposals from three consulting teams. We will then engage a committee of Advisory Board members and coalition partners (Leads) to select the team most capable of implementing the model with the MassCAN coalition and supporting MassCAN in building its capacity to serve as the "backbone organization" (a critical element of the overall Collective Impact model). In parallel, MassCAN will slightly increase its staffing to fulfill the need for expanded communication and data-gathering.

National Leadership

Funding is a challenge for all who have made CS education a priority. The MassCAN vision of CS for every student in every grade is an expensive undertaking, requiring roughly multi-millions of dollars over 8–10 years, predominantly for teacher PD. Other states proportionally face the same challenges. However, President Obama's announcement of the Computer Science for All initiative transforms the state-level discussion of CS education to a national one, and provides a concrete foundation for a state-federal funding partnership.

MassCAN has responded to this changing landscape by prioritizing the positioning of Massachusetts as a national leader on CS education, with the following goals:

- Expand relationships with other state leaders and federal officials who are driving CS education in order to share best practices and increase awareness of Massachusetts' activities
- Join other state and national leaders in advocating for and influencing the implementation plan for federal funding, and position Massachusetts to pursue new federal funding for states and/or school districts

Rick Adrion, a member of the MassCAN Advisory Board, has been pushing the national agenda forward for many years. The Expanding Computing Education Pathways (ECEP) Alliance, centered at UMass Amherst and led by Rick Adrion and Renee Fall, received a five-year funding grant from NSF to foster communication and collaboration between state leaders at the forefront of CS education. ECEP's work includes hosting annual conferences and monthly phone calls between state educators and researchers to collaboration on CS research, curriculum, and policy activities.

Building on ECEP's work, Google has funded MassCAN/EDC to host a National Workshop of state leaders in early 2017 to develop state strategies to do the following:

- Effectively engage a state's elected and government leaders as K–12 CS champions
- Effectively engage a state's business leaders as K–12 CS champions
- Build effective and diverse state coalitions

- Effectively communicate awareness of the urgency of maximizing the state's diverse talent pool to provide all students with essential 21st century CS literacy skills

MassCAN's Executive Director Jim Stanton organized a pre-conference planning meeting for fall 2016 and has been in discussions with prominent leaders who are driving CS education nationally, including Ruthe Farmer (White House Office of Science and Technology Policy), Jan Cuny (NSF), Ted Wells (STEMConnector.org), Jennifer Zinth (Exploring Computer Science), Amy Hirotaka (Code.org), Michael Preston (the New York City Foundation for Computer Science Education), and Leslie Aaronson (National Center for Women and Information Technology).

Operations

Finances

With strong legislative support, MassCAN was guaranteed a $1.5 million allocation in the FY16 state budget. As in the previous year, the state funds are released on a dollar-for-dollar basis as private funds are raised. For the period January 1, 2015, to June 30, 2016, MassCAN raised $1,095,961 in private funds (see Appendix C), which released a corresponding $1,095,961 in FY16 state funds.

The private funds were or will be used in the following ways to achieve MassCAN's goals:

- $325,000 for public awareness
- $225,961 for teacher PD
- $200,000 for the "Building State Capacity for Leadership in K–12 Computer Science Education" national summit, planned for February 6–7, 2017
- $160,000 for MassCAN's operations
- $130,000 for business engagement (including the Technovation Challenge, Hour of Code, and teacher PD)
- $55,000 to be held in reserve

The state FY16 funds were or will be used in the following ways to achieve MassCAN's goals:

- To be spent in FY16:
  - ✦ $211,747 for staff salaries and benefits
  - ✦ $100,636 for EDC's indirect costs
  - ✦ $100,000 for a strategic consultant
  - ✦ $45,492 for operational expenses (rent, communications, travel, printing, etc.)

- ✦ $7,875 for teacher stipends

- To be spent in FY17:
  - ✦ $183,618 for staff salaries and benefits (for the period July 1, 2016, to December 30, 2016)[6]
  - ✦ $150,000 for subcontracts (UMass Amherst, UMass Boston, Framingham State, and the Massachusetts Technology Leadership Council (MassTLC)'s Education Foundation)
  - ✦ $99,518 for EDC's indirect costs
  - ✦ $89,000 for a strategic consultant
  - ✦ $59,805 to be held in reserve
  - ✦ $48,270 for operational expenses

Again, thanks to strong legislative support, MassCAN received a $1.5 million allocation in the FY17 state budget with the same requirement of a one-to-one match of private funds. MassCAN is currently planning a private fundraising campaign and developing a budget for the state funds. The new private funds will be used primarily to support the work of MassCAN's coalition partners in implementing the four priorities in our Strategic Framework. The state funds will be used to expand MassCAN's modest infrastructure by adding an enhanced communications capacity, a new data-gathering and analysis capacity, and extending all operations through the remainder of FY17.

MassCAN has been most fortunate in that it has received extraordinary financial management support from both the Massachusetts Technology Collaborative, to which it reports all funds raised and all expenditures, and EDC, which provides budget forecasting, budget management, management of subcontracts, and payroll and vendor payment services. Both organizations also provide a wealth of valuable advice on MassCAN's programmatic and strategic work.

Staffing

During FY16, MassCAN operated with an Executive Director and added an Administrative & Equity Coordinator partway through the year. In FY17, MassCAN will add a Senior Administrative Coordinator, a Director of District and Teacher Engagement, a Communications Coordinator, and a Data Analysis Manager.

Coalition Partners

EDC has continued to provide both a physical home for MassCAN and an extraordinary work environment, including deeply knowledgeable, passionate, and collaborative

[6] Note that there will be two additional full-time staff members during this period.

colleagues who are eager to serve as a sounding board and to share their wisdom and experience, which has strongly informed MassCAN's work on the Strategic Framework. EDC colleagues and leaders Joyce Malyn-Smith, Joanne Brady, and Ilene Kantrov have been especially valuable partners.

The MassCAN coalition partners (Leads) have also richly informed our work this year. In particular, EDC and its University Hub partners have provided extraordinary leadership in raising awareness about K–12 CS education and delivering high-quality CS teacher PD programs to districts and teachers in their respective regions. Rick Adrion and Renee Fall at UMass Amherst led the Western Mass. Hub, Deborah Boisvert led the Greater Boston Hub, and Irene Porro and Evan Pagliuca led the MetroWest Hub.

MassTLC's Education Foundation, under the leadership of Shereen Tyrrell, has been extraordinarily effective in mobilizing and preparing employees and business leaders to participate in an array of CS offerings in school-day and out-of-school-time programs.

Additional information on the work of MassCAN coalition partners to advance K–12 CS education in the state is provided in Appendix E.

Appendices

Appendix A: Legislative Language Related to Funding MassCAN

Note: This language is excerpted from Bill No. 4377; MassCAN-relevant text is highlighted in blue.[7]

HOUSE . . . . . No. 4377

The Commonwealth of Massachusetts
In the Year Two Thousand Fourteen

An Act promoting economic growth across the Commonwealth.

Whereas, The deferred operation of this act would tend to defeat its purpose, which is to strengthen and promote forthwith economic growth across the commonwealth, therefore, it is hereby declared to be an emergency law, necessary for the immediate preservation of the public convenience.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. To provide for certain unanticipated obligations of the commonwealth, to provide for alterations of purposes for current appropriations and to meet certain requirements of law, the sums set forth in section 2A are hereby appropriated from the General Fund, unless specifically designated otherwise, for the several purposes and subject to the conditions specified in this section and subject to the laws regulating the disbursement of public funds for the fiscal year ending June 30, 2015. These sums shall be in addition to any amounts previously appropriated and made available for the purposes of those items. Unexpended balances of appropriations in section 2A shall be made available for expenditure in fiscal years 2016 and 2017.

SECTION 2A. EXECUTIVE OFFICE FOR ADMINISTRATION AND FINANCE

Office of the Secretary.

1100-6000 For a reserve to provide loan guarantees to small businesses pursuant to section 57 of chapter 23A of the General Laws to be administered by the Massachusetts office of business development, in cooperation with the Massachusetts business development corporation $2,500,000 Reserves

. . .

7002-1512 For the Big Data Innovation and Workforce Fund established in section 6H of chapter 40J of the General Laws; provided, that $150,000 shall be expended for the Venture Development Center at the University of Massachusetts at Boston $2,150,000

[7] The complete text of Bill H.4377 is available on the website of the 189th General Court of The Commonwealth of Massachusetts (https://malegislature.gov/Bills/188/House/H4377).

Massachusetts Office of Business Development.

7007-0210 For the purpose of the Brownfields Redevelopment Fund established in section 29A of chapter 23G of the General Laws $10,000,000

7007-0952 For a competitive grant program for zoos not operated by the Commonwealth Zoological Corporation; provided, that in awarding such grants, the Massachusetts office of business development shall ensure that all zoos that received funding in fiscal year 2014 shall receive funding in fiscal year 2015 and shall award such grants to zoos in equal amounts to all grant recipients $150,000

7007-1202 For the Massachusetts Technology Park Corporation established in section 3 of chapter 40J of the General Laws and doing business as the Massachusetts Technology Collaborative, to develop and implement a plan to promote and establish computer science education in public schools as required by section XX; provided however, that the Massachusetts Technology Collaborative shall seek private funds necessary to match contributions equal to $1 for every $1 contributed by the collaborative; provided further, that the report shall be filed with the chairs of the senate and house committees on ways and means and the senate and house chairs of the joint committee on economic development and emerging technologies that includes a 3-year strategic plan and annual goals and progress in achieving those goals; and provided further, that the reports shall be made available on the Massachusetts Technology Collaborative's website $1,500,000

7007-1641 For a grant for the Smaller Business Association of New England for the layoff aversion through management assistance program for consultant and technical assistance to manufacturing companies to prevent business closure and employee displacement; provided, that the expenditure of the layoff aversion through management assistance program shall leverage at least $1 in matching funds for every $1 granted pursuant to this item; and provided further, that the president of the Smaller Business Association of New England shall file a quarterly report with the house and senate committees on ways and means, the joint committee on economic development and emerging technologies and the joint committee on labor and workforce development on the number of employees and manufacturing companies that have received financial assistance through this item, a detailed description of the services provided to manufacturing companies through the layoff aversion through management assistance program and a detailed account of the expenditures of the layoff aversion through management assistance program, including administrative costs $250,000

. . .

Massachusetts Marketing Partnership.

SECTION 101. Notwithstanding any general or special law to the contrary, the department of housing and community development shall consider the town of Stoughton as an eligible location for the purposes of chapter 40R of the General Laws and shall assist the town in developing a plan to revitalize the town center by identifying projects that could accompany the construction of any planned new rail stations.

SECTION 102. (a) The Massachusetts Technology Park Corporation doing business as the Massachusetts Technology Collaborative shall, subject to appropriation, develop and implement a plan to promote and establish computer science education in public schools. The Massachusetts Technology Collaborative shall serve as the state agent in support of the objectives of the Massachusetts Computing Attainment Network, or MassCAN; provided, that the primary goal of MassCAN shall be to strengthen the growth and vitality of the state's technology industry and the technology dependent business sectors by implementing a broad-based education and workforce

strategy with the objective of increasing the number of students prepared to pursue computing technology careers. In furtherance of this goal, MassCAN shall seek to promote an environment in which all students in grades kindergarten to grade 12, inclusive, have access to computer science courses. MassCAN may, subject to the availability of funds: (i) promote the development and implementation of educational programs, courses and modules for students in grades kindergarten to grade 12, inclusive, and teachers; (ii) collaborate with the department of elementary and secondary education in developing new voluntary kindergarten to grade 12, inclusive, computer science standards; (iii) collaborating with the department of higher education to create computer science professional development hubs at universities in each of the regional PreK-16 science, technology, engineering and mathematics networks established by the department; (iv) develop a school district-based program to assist teachers and administrators with the implementation of new computer science courses; (v) develop and maintain a website to share computer science resources and broadly communicate best practices and successes; (vi) connect computer science students with industry professionals to enhance students' understanding of the relevance of their educational experience to the workplace and science, technology, engineering and math, or STEM, career opportunities; (vii) identify the particular needs of school districts with disproportionately high numbers of underrepresented minorities; and (viii) leverage at least $1 in matching funds from non-state sources of funding for every $1 expended within the commonwealth. MassCAN shall take into consideration the recommendations of the STEM advisory council when developing and implementing educational programs.

(b) MassCAN shall be guided by the MassCAN advisory board to be appointed by the governor, 1 whom shall be recommended by Massachusetts Competitive Partnership, Inc., 1 of whom shall be recommended by the Massachusetts Business Roundtable, 1 of whom shall be recommended by the Massachusetts Technology Leadership Council, Inc., 1 of whom shall be recommended by a federally-funded research corporation, 1 of whom shall be recommended by a public university computer science department chair, 1 of whom shall be recommended by the Massachusetts Association of School Superintendents, Inc., 1 of whom shall be recommended by the Greater Boston chapter of the Computer Science Teachers Association, 1 of whom shall be recommended by the METCO program and 1 whom shall be recommended by the Massachusetts chapter of the Society of Women Engineers.

(c) The Massachusetts Technology Collaborative shall file an annual report by September 30 for the duration of the program with the chairs of the senate and house committees on ways and means and the senate and house chairs of the joint committee on economic development and emerging technologies that shall include a 3-year strategic plan and annual goals and progress in achieving those goals. The reports shall be made available on the Massachusetts Technology Collaborative's website.

SECTION 103. The chief information officer of the information technology division shall establish an online business portal, which shall include a streamlined step-by-step guide to starting a business in the commonwealth and tools to complete this process. The portal shall include information on federal and state resources available to assist small businesses. Each page and link associated with the portal shall have a uniform layout, design and branding and shall limit its search results to information available within the portal. The portal shall reflect development procedures that enable functionality, security and interoperability across state entities. The chief information officer shall, within 12 months after the effective date of this section, develop and report to the secretary of administration and finance, the executive office of housing and economic development and the senate and house committees on ways and means on the status of the portal. The report shall examine the benefits of having an independent analysis to ensure that the commonwealth's investment in information technology supports the needs of users trying to start, expand or operate a business in the commonwealth. The report shall include the results of independent verification, validation and testing as a means to ensure that the technology being implemented satisfies the changing needs of businesses, life expectancy and budget of the commonwealth. The report shall include recommendations on ways to ensure that the commonwealth's

information technology small business strategy is meeting the needs of business people, entrepreneurs and other users of the portal. The report shall be made available on the division's website.

SECTION 104. (a) For the purposes of this section, the following words shall have the following meanings unless the context clearly requires otherwise:

"Affiliate", a nonprofit entity including, but not limited to, a hospital or a medical or research institution that is connected or associated with an institution through shared ownership or control, shared directors or trustees or contractual rights and obligations.

"Entrepreneurship institution," the University of Massachusetts at Lowell and the University of Massachusetts at Boston.

FY2016 State Budget Language for MassCAN Allocation

7007-1202

For the Massachusetts Technology Park Corporation established in section 3 of chapter 40J of the General Laws and doing business as the Massachusetts Technology Collaborative, to develop and implement a plan to promote and establish computer science education in public schools as required by section 102 of chapter 287 of the Acts of 2014; provided, that the Massachusetts Technology Collaborative shall seek private funds necessary to match contributions equal to $1 for every $1 contributed by the collaborative; provided further, that the Massachusetts Technology Collaborative shall file an annual report by September 30 for the duration of the program; provided further, that the report shall be filed with the chairs of the house and senate committees on ways and means and the house and senate chairs of the joint committee on economic development and emerging technologies that includes a 3-year strategic plan and annual goals and progress in achieving those goals; and provided further, that the reports shall be made available on the Massachusetts Technology Collaborative's website

$1,500,000

Appendix B: MassCAN Advisory Board Members FY16

As of September 2016:

	Nominating Organization	Representative	Representative's Organization
1	Massachusetts Competitive Partnership	**Bryan Jamele**, Executive VP	Massachusetts Competitive Partnership
2	Massachusetts Business Roundtable	**Steve Vinter**, Engineering & Site Director	Google
3	Massachusetts Technology Leadership Council	**Tom Hopcroft**, President	Massachusetts Technology Leadership Council
4	Federally funded research corporation	**Carole Mahoney**, Department Head, Agile and Adaptive Software Engineering	The MITRE Corporation (a federally funded research corporation)
5	Public university computer science department chair	**Rick Adrion**, PI, NSF Expanding Computing Education Pathways – Broadening Participation Alliance	UMass Amherst (College of Computer and Information Sciences)
6	Massachusetts Association of School Superintendents	**Dr. Eric Conti**, Superintendent, Burlington Public Schools	Burlington Public Schools
7	Computer Science Teachers Association (CSTA), Greater Boston Chapter	**Hans Batra**, Computer science, algebra, and robotics teacher	Needham High School
8	Society of Women Engineers, Massachusetts Chapter	**Danielle Curcio**, Chief Software Engineer	Raytheon Company
9	Metropolitan Council for Educational Opportunity (METCO)	Recommendation has been forwarded to the Governor	METCO
	New Board Seats Authorized by Amendment of H.4461, July 2016		
10	The Partnership, Inc.	Recommendation has been forwarded to the Governor	
11	TechNET	Recommendation has been forwarded to the Governor	
12	MassTLC Education Foundation	In process of being recruited	
13	Society of Hispanic Professional Engineers	In process of being recruited	

Appendix C: MassCAN Contributors and Funding

From January 1, 2015, through June 30, 2016:

Contributors and Funders	Amount
Vertex Pharmaceuticals	$50,000
State Street	$50,000
Verizon	$10,000
Facebook	$30,000
Google	$300,000
Kraft Family Foundation	$10,000
Suffolk Construction	$10,000
MassCUE	$1,000
Mass Mutual	$10,000
Liberty Mutual	$40,000
Partners HealthCare	$20,000
Eversource	$20,000
Putnam Investments	$10,000
Bank of America	$10,000
Microsoft (MassTLC Education Foundation)	$130,000
Google (Computer Science Teachers Association teacher PD)	$35,000
Google (UMass Amherst PD)	$34,961
Anonymous donor (Museum of Science)	$325,000
TOTAL	**$1,095,961**

Appendix D: Teacher Professional Development

The PD programs offered to schools and districts by MassCAN and its partners in the past 12 months (as of September 2016) are summarized in the table below.

			Number of teachers who have taken specific PD programs				
			grades K–5	grades 6–8	grades 6–8	grades 9–12	grades 9–12
	No. of programs	School/District	Code Studio[8]	Bootstrap[9]	GUTS[10]	ECS[11]	CSP/BJC[12]
1	2	Abington			1	2	
2	3	Acton		2	2	2	
3	1	Amesbury	2				
4	1	Amherst				1	
5	3	Andover	19		1	3	
6	3	Arlington	2	1		6	
7	1	Ashburnham			1		
8	3	Ashland	1		1	4	
9	1	Ayer	1				
10	2	Barre	1			1	
11	1	Bedford	2			1	
12	1	Belmont	1				
13	2	Beverly	3		1		
14	2	Billerica	2		1		
15	4	Bolton	2	1		1	1
16	5	Boston	14	12	6	51	2
17	2	Bourne	1	1			
18	1	Boxford	2				
19	1	Bradford	1				
20	2	Braintree			2	2	
21	2	Brookline			2	3	
22	1	Burlington	1				
23	5	Cambridge	2	1	2	5	1
24	1	Carlisle	1				
25	1	Carver	1				
26	1	Charlton		1			

[8] A K–5 PD program that introduces basic computing concepts into the K–5 curriculum.

[9] A middle school PD program that integrates CS concepts into Algebra I-level courses through video game design.

[10] GUTS (Growing Up Thinking Scientifically) is a middle school PD program that introduces modeling and simulations into middle school life science, Earth science, and physical science courses.

[11] ECS (Exploring Computer Science) is a highly acclaimed high school-level broad introduction to CS.

[12] Mobile CSP and The Beauty and Joy of Computing are high school-level PD programs that prepare teachers to teach the year-long AP CS curriculum.

			Number of teachers who have taken specific PD programs				
			grades K–5	grades 6–8	grades 6–8	grades 9–12	grades 9–12
	No. of programs	School/District	Code Studio	Bootstrap	GUTS	ECS	CSP/BJC
27	1	Chelmsford	3				
28	2	Chelsea	5			2	
29	1	Chicopee			1		
30	1	Concord	1				
31	1	Dartmouth		3			
32	2	Dedham			1	1	
33	1	Denis-Yarmouth	2				
34	1	Dighton-Rehoboth	1				
35	1	Douglas			1		
36	2	Dover-Sherborn	3		3		
37	1	Dracut		1			
38	1	Dudley				1	
39	1	Easton				1	
40	4	Everett	4	1	1	1	
41	1	Fairhaven		1			
42	5	Fall River	2	1	1	1	1
43	2	Falmouth	2			1	
44	2	Fitchburg		1			1
45	3	Foxborough	1		1	2	
46	4	Framingham	5	1	2	3	
47	1	Franklin				1	
48	1	Gloucester	1				
49	2	Greenfield		1	2		
50	4	Groton-Dunstable		2	2	4	2
51	1	Hanson	1				
52	1	Harvard		1			
53	4	Haverhill	10	3	5	7	
54	1	Hingham	1				
55	1	Holbrook				2	
56	1	Holden			1		
57	1	Holliston				1	
58	2	Holyoke			1	1	
59	1	Hopkinton		2			
60	1	Hubbardston	1				
61	1	Hudson					1
62	1	Kingston	1				
63	2	Lawrence	4	1			
64	1	Lenox	2				
65	2	Leominster	2		1		
66	2	Lexington		1	1		

			Number of teachers who have taken specific PD programs				
			grades K–5	grades 6–8	grades 6–8	grades 9–12	grades 9–12
	No. of programs	**School/District**	**Code Studio**	**Bootstrap**	**GUTS**	**ECS**	**CSP/BJC**
67	1	Lincoln		1			
68	3	Littleton	1			3	1
69	2	Lowell	21		1		
70	1	Ludlow				1	
71	1	Lunenburg				1	
72	2	Lynn	4		1		
73	3	Lynnfield	3		1		1
74	1	Malden	15			1	
75	2	Mansfield	2		1		
76	1	Marblehead	1				
77	1	Marian				1	
78	3	Marlborough		2		8	1
79	2	Mashpee	1	2			
80	2	Maynard			1	1	
81	2	Medfield	2			1	
82	3	Medford		2	2	6	
83	2	Methuen	3	1			
84	1	Middleton	2				
85	1	Milford	1				
86	3	Millis	1	1		1	
87	2	Milton	1			7	
88	1	Nantucket		1			
89	3	Natick	7		2	4	
90	4	Needham	4	5	4	2	1
91	1	New Bedford	2			1	
92	1	Newbury	1				
93	1	Newburyport	1				
94	5	Newton	9	2	1	6	1
95	1	Norfolk	2				
96	1	North Andover	2				
97	1	North Attleborough			1		
98	1	North Brookfield	1				
99	2	North Reading	1			3	
100	1	Northampton		2			
101	2	Northborough-Southborough	2			1	
102	1	Northbridge				1	
103	1	Norwell	1				
104	2	Norwood	2		1		
105	1	Oakham-Hardwick	1				
106	1	Orange			1		

			Number of teachers who have taken specific PD programs				
			grades K–5	grades 6–8	grades 6–8	grades 9–12	grades 9–12
	No. of programs	School/District	Code Studio	Bootstrap	GUTS	ECS	CSP/BJC
107	1	Palmer			4		
108	4	Pembroke		3	1	2	1
109	1	Petersham			1		
110	2	Plymouth	2				
111	3	Reading	4			10	3
112	2	Revere	8			1	
113	1	Rochester				1	
114	1	Rockland	1				
115	1	Rutland	3				
116	1	Salem			1		
117	1	Sandwich			1		
118	1	Sharon	2				
119	1	Shelburne Falls				2	
120	1	Shrewsbury	1				
121	1	Somerville				2	
122	1	South Deerfield				1	
123	1	South Easton			1		
124	1	South Hadley	1				
125	1	Southbridge			1		
126	1	Southwick				1	
127	2	Springfield		3		4	
128	1	Stoneham	1				
129	1	Sudbury	2				
130	5	Swampscott	2	2	2	1	1
131	1	Taunton			1		
132	1	Templeton	1				
133	1	Topsfield	2				
134	1	Townsend			1		
135	2	Tyngsborough	3			1	
136	1	Uxbridge				1	
137	1	Wachusett Regional			2		
138	2	Wakefield	3	1			
139	3	Walpole		1	1	1	
140	3	Waltham	6			6	1
141	1	Wareham		2			
142	2	Watertown	6	1			
143	3	Wayland	2			4	1
144	1	Webster	1				
145	1	Wellesley				6	
146	1	West Boylston				1	

			Number of teachers who have taken specific PD programs				
			grades K–5	grades 6–8	grades 6–8	grades 9–12	grades 9–12
	No. of programs	**School/District**	**Code Studio**	**Bootstrap**	**GUTS**	**ECS**	**CSP/BJC**
147	1	West Newbury	1				
148	1	West Yarmouth	1				
149	3	Westborough	1		2	2	
150	2	Westford	1		1		
151	1	Westhampton				1	
152	1	Westminster	1				
153	1	Weston		1			
154	2	Westwood	2	1			
155	4	Weymouth	6	2		5	2
156	1	Whitman-Hanson	1				
157	1	Wilbraham				2	
158	1	Wilmington	2				
159	2	Winchendon	1			1	
160	4	Winchester	4	2		3	1
161	1	Winthrop			1		
162	1	Woburn	1				
163	5	Worcester	3	3	1	4	1
		Total # of Teachers	**281**	**80**	**83**	**223**	**25**

LEGEND	
1 program	**95 districts have participated**
2 programs	**37 districts have participated**
3 programs	**16 districts have participated**
4 programs	**9 districts have participated**
5 programs	**6 districts have participated**

Total # of schools and districts that have participated in PD	**163**

Appendix E: MassCAN Coalition Partners Activities

Massachusetts Department of Elementary and Secondary Education/Education Development Center Partnership

- **DESE/EDC are collaborating on the *Broadening Participation of Elementary School Teachers and Students in Computer Science through STEM Integration and Statewide Collaboration*** project. This STEM+C National Science Foundation grant began in October 2015. The goal of this project is to integrate the Computational Thinking (CT) strand of the newly developed Massachusetts Digital Literacy & Computer Science (DLCS) Standards into elementary school math and science activities (grades 1–6) through STEM Integrated Modules (I-Mods). Ten school teams, compromised 51 educators were recruited to develop the I-Mods with support from the Project Management team. The educator teams drafted 12 I-Mods the end of June and piloting of the completed units will begin during the 2016-2017 school year.

Educational Development Center, Inc.

- The project, ***Workshop to Develop an Interdisciplinary Framework for Integrating Computational Thinking in K-12 Science, Mathematics, Technology, and Engineering Education***, places Massachusetts among the leaders of the national Computational Thinking movement. Funded by the National Science Foundation's CS10K initiative, the project will host a four and a half-day conference with the primary goal of evolving an NSF Computational Thinking (CT) "Think Tank" comprised of NSF STEM+C and ITEST grantees whose work has focused on CT. Workshop participants will (1) identify underlying constructs that help to define and operationalize CT within the various disciplines represented in NSF's ITEST and STEM+C projects, (2) draft a Theoretical Framework for Computational Thinking from an Interdisciplinary Perspective describing CT in ITEST and STEM+C Projects, and, (3) produce recommendations for the development of CT assessment instruments that would support ongoing interdisciplinary CT work.
- The project, ***Massachusetts Exploring Computer Science* (ECS) *Partnership*** exceeded their three-year computer science professional development goals. Collaborating partners Building Advanced Technological Education Connections (BATEC) Center at UMass Boston, the Commonwealth Alliance for Information Technology Education (CAITE) at UMass Amherst, and the McAuliffe Center for Integrated Science Learning at Framingham State University built the capacity of more than 150 teachers to utilize ECS teaching/learning strategies that broaden participation in computing. The project produced six highly qualified and nationally recognized ECS facilitators who now lead ECS professional development in the state.
- The project ***Online Professional Development for Exploring Computer Science*** is a collaboration of EDC and the University of Oregon. This project was funded by the National Science Foundation to develop and implement an online professional development (PD) option for the highly acclaimed Exploring Computer Science (ECS) high school program making ECS accessible to a larger and more diverse group of students. ECS PD Online will provide a much-needed alternative to the four quarterly in-

person ECS workshops, which many teachers, particularly those in rural areas, are not able to attend.

Broadening Advanced Technological Education Connections (BATEC)

BATEC is an NSF-funded Advanced Technological Education National Center for Computing and Information Technologies supports an urban mission that promotes linkages between and among organizations to provide the "system-netting" critical for student entry into and advancement through computing and IT programs. This is achieved through the development and implementation of computing and information technology pathways that connect high school, community college and university as a seamless progression using industry-relevant curriculum that develops strong technical knowledge along with the professional and entrepreneurial attributes necessary for today's workplace. BATEC forges strategic partnerships with education, business, government and community to build awareness, generate interest, and support learning opportunities for students and facilitates recruitment and retention strategies that include college and career days, dual enrollment, internships and bridge programs. In addition, BATEC engages in actionable research on the IT landscape to inform policy makers, IT educators and workforce development agencies.

- **Exploring Computer Science**
  - Summer 2016 trained 27 educators with 2 facilitators
  - Offers three-credit graduate course that extends the learning of ECS to analyze district/school needs and identify ways to champion computing in their region
- **BATEC Summer Institute**
  - Five courses serving 85 educators across high school, community college and university;
  - 24 of which were high school teachers;
  - courses focused on high school relevant content included Python programming, Raspberry Pi/Arduino Activities and CyberPatriot
- **Early College and Dual Enrollment**
  - BATEC is involved in planning and advisory roles in five high schools in MA: Charlestown, Excel and Madison Park (Boston), Brockton and Marlborough
  - Computing pathways that allow programs of study in programming, web development, networking, and security
  - Based on work in Chicago with five Early College STEM Schools. First graduating class in June of 2016 achieved a 40 point increase in on-time rate for graduation.
- **Summer Bridge**
  - MassBay Community college offered a choice of an intensive 10 day course for college credit (CS/engineering) and four 2.5-day hands-on workshops (Raspberry Pi, Artbotics, Scratch, AppInventor) for 60 rising juniors and seniors, or recently graduated seniors
  - Bunker Hill Community College offered two Summer Bridge options that included a total of 40 students. One was for rising freshman in the C-Town Tech program and the other for rising seniors and recently graduated students.

- **Tech Apprentice**
  - Paid internship program that places approximately 120 tech-savvy Boston Public Schools' high school students' per year in technology-focused summer jobs.
  - The program runs for seven weeks each summer. Prior to the program start date, students participate in a mandatory business etiquette workshops. Most students receive an hourly rate of $10 per hour for 35 hours/week.
  - Students work at companies throughout Boston in a wide range of industries. Positions are determined by the employers' needs as well as the student's interests and skills. Assigned projects include but are not limited to helpdesk/ troubleshooting support, web design and programming, quality control, and social media and video production

Museum of Science

- Maker Media published and is promoting a full-length book, *Start Making! A Guide to Engaging Young People in Maker Activities,* authored by The Museum of Science's Clubhouse Network and researchers at MIT Media Lab. The book features curriculum promoting computational thinking and STEM design activities.
- The Clubhouse @ the Museum of Science is launching Clubhouse-to-Career Pathways to provide real-world work experience to youth from under-represented populations with high-level technology skills but who lack workplace readiness and access to the social and cultural capital that would enable them to succeed in professional jobs and meet their full potential.
- The Museum of Science, in collaboration with Pixar Animation Studios and the Science Museum Exhibit Collaborative, premiered *The Science Behind Pixar*, and award-winning exhibition about the STEM and computer science used in Pixar's production pipeline. The exhibition includes experiences designed to engage visitors in computational thinking, and to build self-efficacy, interest, and a stronger understanding about the creativity and problem-solving practices used by programmers. A NSF-funded research study focused on these experiences is elaborating how design can be leveraged to support sustained engagement and improvements in interests, attitudes, and capacity for computational thinking among diverse middle and high school students.

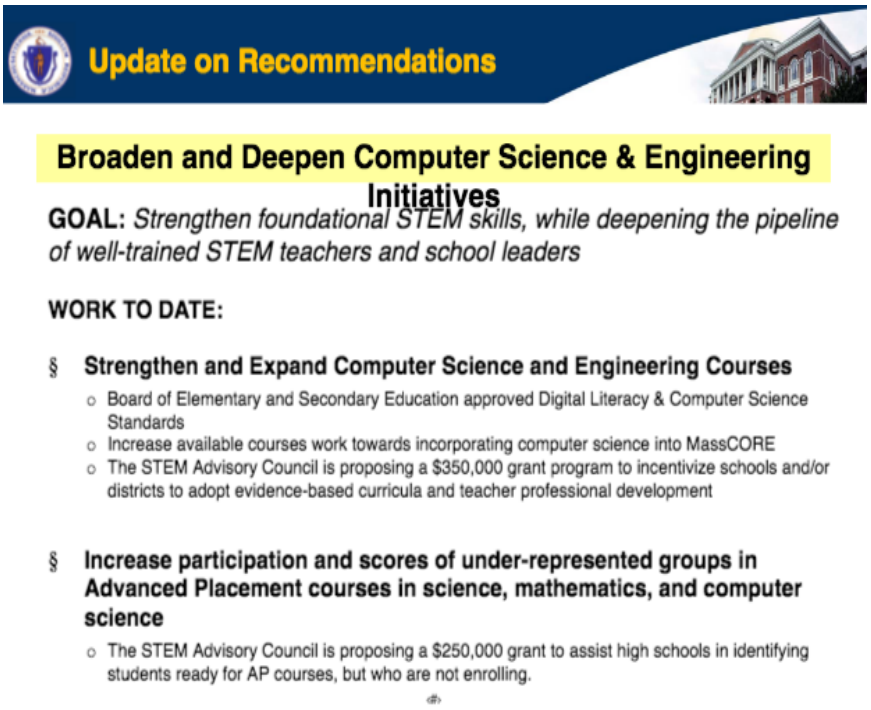
Appendix F: STEM Advisory Council

The vision of the Governor's STEM Advisory Council is to ensure that all students in the Commonwealth receive comprehensive STEM education from highly qualified educators so that they are better informed and better prepared to pursue post-secondary degrees or careers in these areas. In 2015, the Council established four recommendations as the Council's focus:

- Expand work-based learning programs
- Develop and grow STEM early college and career pathways

- Broaden and deepen CS and engineering initiatives
- Align the work of the Regional STEM Networks to the STEM Advisory Council priorities

Steve Vinter, a co-founder of MassCAN, serves on the Council and is chair of the Computer Science and Engineering Subcommittee that was formed to push forward its CS and Engineering initiatives. The Council is currently planning its 2017 programming; the following slide outlines the draft recommendation for the CS and engineering initiatives in 2017.



The Council's proposal aligns well with MassCAN's priorities, in its emphasis on funding school districts to drive CS PD and continuing policy activities related to the DLCS standards and the inclusion of CS in MassCORE.

Appendix G: MassCAN Advisory Board Meeting Minutes

Minutes of the 2015–16 MassCAN Advisory Board Meetings can be found here:

- September 14, 2016
- July 25, 2016
- June 15, 2016
- March 23, 2016
- February 24, 2016
- January 20, 2016
- September 23, 2015