Introduction. The White House, National Skills Coalition, National Governors Association, and New England Board of Higher Education recognize Connecticut's Asnuntuck Community College Advanced Manufacturing Center (AMC) for educational innovation and industry-responsive training approaches. The AMC model offers accelerated, stackable certificate programs in Manufacturing Machine Technology, Welding Technology, and Electronics Technology, and holds National Institute for Metalworking Skills (NIMS) accreditation. The AMC places 88% of its graduates in high-wage manufacturing jobs ($18+/hour).

In 2011, Governor Dannel P. Malloy and the Connecticut General Assembly invested $17.8 million in State Bond funds for the Board of Regents for Higher Education/Connecticut State Colleges & Universities to replicate the AMC model at three colleges. The expansion earned the national 2013 Society for College and University Planning Award for Institutional Innovation and Integration, and a Connecticut Quality Improvement Award for innovation in higher education. The AMCs now represent the State's core advanced manufacturing education and training infrastructure. The **Connecticut Advanced Manufacturing Initiative (CAMI)** will enact the next logical step in further enhancing and growing Connecticut's statewide manufacturing education and training infrastructure.

> "By investing in community colleges and intensifying their manufacturing programs, we are making an investment into the economic health of Connecticut and building the workforce that attracts manufacturers to our state."
> *- Governor Dannel P. Malloy*

CAMI will activate a statewide consortium of all 12 Connecticut Community Colleges and Charter Oak State College (online), in coordination with a broad set of institutional and industry partners, to significantly increase the annual output of qualified workers in high-demand occupations in areas such as additive manufacturing. The model uses innovative and industry-driven instruction in combination with employer-sponsored work-based training opportunities including competency-based and hybrid apprenticeships in high-demand occupations. An attached Consortium Agreement describes the commitment of all 13 Consortium Members to their roles in the success of the project.

1. STATEMENT OF NEED

1.a. Serving the Education and Training Needs of TAA-Eligible Workers.

Impact of Foreign Trade. CAMI will mitigate the impact of foreign trade affecting 2,500 TAA-eligible workers statewide (see sidebar). CAMI will engage TAA workers, Veterans, un- and underemployed workers, incumbent workers, and traditional students through systems such as Connecticut's 17 American Job Centers; 12 Community Colleges; and the Veterans Administration service centers. Veterans and military personnel will receive custom services such as prior learning assessments and career planning.

Connecticut's 2,500 TAA-Eligible Workers by Workforce Investment Area

Eastern	202
North Central	724
Northwest	297
South Central	651
Southwest	577
Unknown	49

Source: CTDOL TAA Coordinator

Table 1.1 illustrates the economic impact of foreign trade on employment and earnings loss in a sample of five certified Connecticut TAA companies.

Table 1.1: Sample of Connecticut Certified TAA Cases with Employment and Earnings Losses[1]

TAW Number	Company Name	Location	Decision Date	NAICS	Description	Direct Layoffs*	Additional Job Losses†	Total Earnings Change (1,000s)
71507	Eastman Kodak	Norwalk	11/12/09	325992	Traditional Photographic Film, Paper, Plate, and Chemical Manufacturing	(100)	(140)	($18,461)
80341 and 81473	Hartford Financial Services	Bristol	8/19/11 and 4/17/12	524210	Insurance Company	(100)	(81)	($12,250)
80527	Mahle Engine	Trumbull	12/15/11	336312	Traditional Gasoline Engine and Engine Parts Manufacturing	(99)	(138)	($17,194)
74893	Precision Camera	Enfield	1/7/11	811211	Consumer Electronics Repair and Maintenance	(115)	(48)	($7,023)
73889	Health Net	Shelton	5/26/10	524114	Direct Health and Medical Insurance Carriers	(750)	(1,424)	($180,948)
Total						**(1,164)**	**(1,831)**	**($235,876)**

*WARN notices accounting for direct layoffs were used for 2010 and 2011 only.
† These include direct, indirect and induced job losses.

The analysis shows that an estimated 1,164 workers at these five companies lost their jobs directly due to foreign trade in 2010 and 2011, an additional 1,831 lost jobs indirectly, and lost annual earnings totaled $235 million for each year workers remained unemployed.

[1] EMSI Analysis. Indirect job loss data come from EMSI's input-output model, which measures the effects of economic changes upon communities according to regional supply-line relationships and spending patterns.

In 2012, the Connecticut Department of Labor (CTDOL) administered to 1,012 workers nearly $10 million in basic, traditional, and remedial/prerequisite TAA supports, as well as more than $1 million in relocation allowances. These TAA totals do not include other financial sources such as Pell grants, Wagner-Peyser, or personal savings.

Education and Training Needs. CTDOL reported 2,500 active TAA-eligible workers in Fiscal Year 2013 (10/1/2012 – 9/30/2013). The majority of TAA workers are above age 40 and hold less than an Associates degree (sidebar). TAA-eligible workers separated from industries including manufacturing, health care, and waste management. TAA-eligible workers hold many compatible skills for career pathways in manufacturing, including previous experience in manufacturing and related fields.[2]

Connecticut's 2,500 TAA Eligible Workers

Age
- 23.3% ages 40 to 49
- 37.0% ages 50 to 59
- 23.3% ages 60 to 69

Education (highest grade completed)
- 11.7% Less than high school
- 56.0% High school or equivalent (e.g., GED)
- 12.4% Some post secondary or certificate
- 8.5% Associates
- 15.9% Bachelors or beyond

NAICS Code (2 digit) of Exited TAA Workers
- 21.4% Manufacturing – metal (33)
- 18.5% Admin/support waste mgmt (56)
- 16.4% Health care & social assistance (62)
- 5.2% Manufacturing – wood (32)

Source: CT DOL TAA Coordinator June 2014

CAMI responds directly to the TAA market segment as Connecticut manufacturing companies upgrade the skills of incumbent workers and stretch the productive work life of baby boomers. CAMI design features address common barriers facing TAA-eligible workers, Veterans and under-employed incumbent workers. These barriers require additional supports such as financial assistance, career planning, tutoring and other academic supports, computer literacy training, mentoring/job coaching, and services to mitigate personal and family circumstances. CAMI partners will use NIMS accreditation to align manufacturing career pathways reaching back to the secondary school level. CAMI's approach offers well-articulated,

[2] A compatibility index measuring over 150 different competencies from the USDOL's O*NET system was developed to identify occupations that held a higher degree of transferrable skills and/or a stronger base upon which to build missing competencies. Examples of highly compatible occupations include: Trade Occupations; Technicians/Specialists; Assemblers; and Machine Operators.

two-year or less, manufacturing career pathways that include work-based experience, industry mentoring, credit for prior learning, online courses and course modules, tutoring, job placement, and ongoing learning supports (see section 2.b).

Partnerships with TAA Agencies. The CTDOL State TAA Coordinator determines the eligibility of and funding for TAA-eligible worker training and educational programs. The TAA Coordinator, in partnership with the Workforce Investment Boards (WIBs), informs TAA-eligible workers about benefits and education/training options. CAMI partners will use existing protocols and practices as the basis to enhance the service delivery system.

CAMI features a proven alliance of partners including Board of Regents for Higher Education/Connecticut State Colleges and Universities (BOR/ConnSCU) (which includes all 12 Community Colleges, four State Universities, and Charter Oak State College), CTDOL, the five WIBs, the State Departments of Economic Development and Education (including the Technical High School System), and statewide and regional industry advisory groups and associations. CAMI partners have successfully implemented four system-wide Community Based Job Training Grants, three TAACCCT grants, and a STEM Opportunities in the Workforce System grant. USDOL cites these efforts as models for innovation and impact.[3]

CTDOL, WIBs, and community colleges offer online and in-person services and tools that support career exploration, identify occupations in demand, and facilitate access to programs. For example, potential participants can complete a free online Introduction to Manufacturing course (http://www.charteroak.edu/bb/manufacturing/). The CTDOL Office for Veterans' Workforce Development web site (www.ctvets.org) helps Veterans access benefits and services and transition to civilian life. These partnerships represent a decade of deliberate actions to integrate the education

[3] For example, the 2/14/2013 US DOL Newsletter highlighted the STEM Opportunities in the Workforce System grant for placing 68% of its clients despite a recession and over half of its clients being over the age of 50.

and training infrastructure, and maximize available resources to help students and jobseekers enter the workforce in areas that lead to high-quality, high-wage jobs and opportunities for career growth.

1.b. Evidence of Job Opportunities in Targeted Industries and Occupations.

CAMI targets the manufacturing industry (NAICS codes 31-33), and focuses on two core occupations: machinists (SOC 51-4041) and welders, cutters, solderers, and brazers (SOC 51-4121). CAMI will train workers for similar occupations such as tool and die makers, industrial machinery mechanics/maintenance workers, metal/plastic machine workers, and millwrights.

Evidence of Job Opportunities. Connecticut ranks as the 18th most intensive manufacturing state, producing a gross state product (GSP) of $25 billion. The manufacturing sector employs 159,200 people, representing nearly 10% of all workers. Connecticut manufacturers nearly doubled exports from $9.1 billion to $16 billion in the past decade;[4] the annual output of manufacturing in Connecticut rose 5% over the past two years to represent 10.5% of the GSP. Manufacturing annual wages average $76,108 a year, almost 30% higher than wages for all industries.[5] All of this growth occurred despite Connecticut's slow recovery from the Great Recession.

Global industry leaders such as Pratt & Whitney, Electric Boat (EB), Sikorsky Aircraft Corporation, and UTC Aerospace Systems anchor vast manufacturing supply chains. EB, for example, spent nearly $300 million across 362 Connecticut suppliers over the past five years. Projected short- and long-term growth in aerospace (e.g., Airbus, Boeing) and shipbuilding (e.g., Virginia Class submarine) programs promise to stimulate innovation for next generation advanced manufacturing and to fuel growth in Connecticut for the next decade or longer.

Led by the advanced manufacturing sector, Connecticut's economy appears primed for a renaissance. Illustrative milestones include:

[4] Source: Connecticut Business & Industry Association. *Manufacturing: Vital to Connecticut's Future.* Contains a compilation of sources such as US Census Bureau, CTDOL, and CT Department of Revenue Services, among others.
[5] Source: U.S. Bureau of Economic Analysis

- A 2009 study cited Connecticut as one of six states succeeding at manufacturing innovation inputs and performance, saying: "Connecticut…and other states with available venture capital and a more skilled workforce likely resulting from a very strong education system do well."[6]
- In 2011, Connecticut joined seven other states selected by the National Governors Association for a Policy Academy Summit to develop and implement successful economic development strategies to grow advanced manufacturing industries.[7]
- In 2011, Governor Malloy and State lawmakers passed a bipartisan Jobs Bill that launched the AMC Initiative with $20 million in bond funds.[8]
- In 2012, 66% of Connecticut manufacturers expected to record a net profit in 2012, compared to 57% of all Connecticut businesses.[9]
- In 2014, Public Act 14-98 established the Connecticut Manufacturing Innovation Fund with $30 million to assist manufacturers to meet growing demand and create jobs by helping companies modernize and grow, purchase equipment and develop new technologies, and provide access to training and specialized education for workers.

Nationally, skilled trades employers (manufacturing and construction) report high levels of difficulty finding qualified workers. Connecticut maintains the highest percentage of skilled-trades workers over 45 (64%) and over 55 (27%)[10] placing it as the state with the most severe skilled-trades shortage in the nation.[11] Connecticut's manufacturing re-emergence, coupled with the aging manufacturing workforce, has created a skills gap which will only grow larger if not addressed.

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[6] Andrew, J., DeRocco E. & Taylor, A. (2009). The innovation imperative in Manufacturing. How the United States Can Restore Its Edge. Boston Consulting Group and Manufacturing Institute/National Association of Manufacturers.
[7] States received guidance and technical assistance from NGA staff, experts from the U.S. Department of Commerce NIST Manufacturing Extension Partnership Program, the U.S. Department of Commerce Economic Development Administration, the State Science and Technology Institute, and a range of consultants.
[8] $17.8 million to establish three new AMCs and $2.2 million to upgrade the Asnuntuck AMC.
[9] Source: Connecticut Business & Industry Association. *2012 Survey of Connecticut Businesses.*
[10] Source: QCEW Employees, Non-QCEW Employees & Self-Employed - EMSI 2013.1 Class of Worker
[11] http://www.forbes.com/sites/emsi/2013/03/07/americas-skilled-trades-dilemma-shortages-loom-as-most-in-demand-group-of-workers-ages/

Manufacturers report current job-skills mismatches and unfilled positions, as well as future openings due to retirements, growth, and/or increased use of advanced technologies (52 attached industry letters document occupational and skill shortages). A 2014 survey of 246 Connecticut manufacturing company leaders concluded that "the greatest barrier to expanding [businesses'] capabilities in advanced manufacturing technology is not cost or lack of time, but lack of talent", and found the most difficult positions to fill included core CAMI occupations such as tool and die maker (#1), CNC machinists (#4), and machinists (#6).[12] Fifty-six percent of Connecticut manufacturers surveyed expected to hire new (not replacement) workers in 2014, compared to 47% of all businesses. In 2012, 58% of Connecticut manufacturers surveyed reported having difficulty finding qualified workers despite unemployment exceeding 7%.[13] Online job boards typically show 1,000+ manufacturing related job openings (40% at entry level positions) at any point in time.

USDOL ETA 2020 employment projections for Connecticut[14] show significant growth in CAMI-related occupations despite the impact of the Great Recession, and without adjusting upward for projected growth in aerospace and shipbuilding programs. For example, jobs for Machinists will increase by 521; Computer Controlled Machine Operators by 243; Extruding & Drawing Machine Setters/Operators by 142; and Assemblers & Fabricators by 135. CAMI credit certificate programs will prepare students for these and other occupations with earnings upside toward Connecticut's average annual manufacturing wages of $76,108. Third-semester specialty certificate programs will build workforce competencies in areas such as additive manufacturing, tool and die, and metrology.

Skills, Abilities, and Credentials Required in Targeted Industries and Occupations. The Statewide Advanced Manufacturing Advisory Committee (SAMAC) and regional Industry Advisory Councils convened by each primary CAMI community college anchor the CAMI sector strategy.

[12] Source: Connecticut Business & Industry Association. *2014 Survey of Connecticut Manufacturing Workforce Needs.*
[13] Source: Connecticut Business & Industry Association. *2012 Survey of Connecticut Businesses.*
[14] www.bls.gov/ooh. Occupational Outlook Handbook.

Each of these groups includes 10-35 manufacturers who provide guidance on all aspects of statewide and regional advanced manufacturing program development, including sector skill needs across multiple employers and gaps in training.

CAMI's target occupations of machinists and welders, cutters, solderers, and brazers match up well with the characteristics of TAA-eligible workers (see section 1.a.). Machinists and welders require analytical, mechanical, and technical skills that allow them to: a) understand technical, electronic or written blueprints, models and specifications; b) operate milling machines, lathes, grinders, lasers, torches and welders; and c) interface with CAD/CAM technology, CNC machine tools, computerized measuring machines, and robotic equipment. Workers require attention to detail (e.g., precise tolerances) and physical stamina, as well as competencies in math and blueprint reading, computer literacy (including CAD/CAM), and knowledge of materials such as metals and plastics. These occupations require hands-on experience in laboratories, internships, apprenticeships, or on-the-job training. CAMI colleges will earn accreditation from NIMS, and offer other industry-recognized credentials such as certification from the American Welding Society (AWS). Stackable credentials will facilitate advancement along manufacturing career pathways (see section 2.b) including competency-based and hybrid Registered Apprenticeships[15] and advanced certificates in specialty manufacturing areas (see Table 2.2).

1.c. Gap Analysis. Statewide and regional analyses conducted by diverse stakeholders including higher education, economic development, workforce development, and industry leaders all confirm a significant gap between the capacity of the employment and training system to deliver sufficient skilled workers in response to industry demand due to growth and to replacing an aging workforce.[16]

[15] USDOL recognizes three types of apprenticeship programs: a) time-based programs which have a fixed set time for completion; b) competency/performance based programs; and c) hybrid programs (which blend time and competency).
[16] Sources include: WIB Workforce Development Five Year Plan documents; a SWOT analysis of the aerospace and shipbuilding industries conducted by Ernst and Young for the Department of Economic and Community Development; and surveys of manufacturing company owners by the Connecticut Business and Industry Association.

The gap can be explained with simple math: 1) Manufacturing employs more than 150,000 workers; 2) one third (50,000+) of the manufacturing workforce will retire by 2020; and 3) the education and training system must fill 50,000 job openings in the near-term. Current education and training capacity in manufacturing for middle-skill jobs cannot adequately meet current or future demand.

Core training providers include: the four AMCs; 13 Technical High Schools that offer industry-certified training in areas such as welding; fewer than 10 private or non-profit training entities; and internal training and professional development funded by manufacturing companies or with additional WIB-funded on-the-job training supports. Charter Oak State College offers access to online courses and prior learning assessments but remains an underutilized asset. Registered Apprenticeships in the manufacturing sector (most of which require 3-4 years to complete with time-based models) comprise just 6% of all Registered Apprenticeships in Connecticut. Collectively, these programs train fewer than 1,000 manufacturing workers statewide each year.

Education and training capacity constraints prevent TAA-eligible workers and others from entering high-wage, high quality career pathways with existing and projected job openings that require specialized training, industry certifications, or the completion of apprenticeships.

2. METHODOLOGY AND WORK PLAN

CAMI will implement four evidence-based strategies to address this gap: 1) expand the capacity of community college facilities to support more students and new certificate programs; 2) scale up industry-driven training programs resulting in credentials; 3) increase participant retention and accelerate participant completion with student supports; and 4) strengthen and scale up the AMC sector-based approach to employment and training.

2.a. Evidence-Based Design. Strength of evidence. A strong evidence base informs all CAMI strategies. Table 2.1 (page 10) offers examples of this evidence base.

Table 2.1: Summary of Evidence-Based Strategies

Strategies	Strength of Evidence	Illustrative References (see footnotes from text for details)
Sector-based strategies	Strong	Helmer, M. (2013); Aspen Institute; Insight CCED
Stacked and latticed credentials	Strong	Corp for a Skilled Workforce (2012); Jenkins & Weiss (2011)
Employer sponsored work-based training / apprenticeship	Strong	National Association of Colleges and Employers. (2010); Stone, Horn & Zukin (2012); Jenkins, D. & Weiss, M. (2011)
Prior Learning Assessment	Strong	Brigham, C. & Klein Collins, R. (2010); Klein Collins, R. (2010)
Educational content	Strong	Means, B., et. al. (2009); USDOE (2010)
Coaching and supports	Strong	Karp, M. M. (2011); Eyster, L., et al. (2009)

Evidence for Program Design. CAMI utilizes a sector-based strategy as its overarching program strategy. Sector initiatives: a) focus intensively on a specific industry over a sustained time period, customizing solutions for multiple employers in a regional labor market; b) strengthen economic growth and industry competitiveness by creating new pathways into targeted industries, and toward good jobs and careers for low-income and middle class workers; c) use workforce intermediaries – organizations with a deep understanding of worker and employer issues in an industry and within a regional labor market – to convene diverse stakeholders to develop and implement industry-responsive workforce solutions; and d) implement systemic change benefitting industry, workers, and the community.[17]

Sector-based initiatives outperform conventional workforce programs.[18] One initiative in Massachusetts reduced turnover by 41%, rework by 19%, and customer complaints by 23%. Moreover, 100% of employers reported that partnerships with other companies in the industry network created value.[19] An evaluation of sector initiatives confirmed that participants earned almost 30% more than control group members in the second year after training.[20] The success of CAMI's prototype Advanced Manufacturing Center (AMC) at Asnuntuck, as well as the three

[17] See http://www.insightcced.org for information and research on the National Network of Sector Partners.
[18] See http://dev.aspenwsi.org/research-resources/sector-approach/ for research and best practices on sector strategies.
[19] National Network of Sector Partners. Effective Sector Initiatives: Success Factors.
[20] Job Training that Works: Findings from the Sectoral Impact Study. Public/Private Ventures. 2009.

Connecticut AMCs launched in 2012, verifies the effectiveness of the model.[21] The 88% job placement rate achieved across the four AMCs in 2013 results directly from the high level of involvement by employers in regional Industry Advisory Councils. CAMI lead partners, such as BOR/ConnSCU, CTDOL, the five WIBs, and manufacturing associations, have met or exceeded performance benchmarks for sector-based initiatives, even during economic downturns.

Use of Evidence in Program Design. Stacked and Latticed Credentials. CAMI will deliver portable, stackable industry credentials such as NIMS and AWS. Colleges will bundle instruction in the form of credit-bearing certificate programs such as Manufacturing Machine Technology. Certificate programs accelerate completion. Credit-bearing courses in CAMI certificates align with requirements for Associates degrees as well as transfers into Bachelor's degree programs. CAMI will introduce third-semester certificates in advanced manufacturing specialty areas such as additive manufacturing. Additive manufacturing represents a new area of accreditation for NIMS. CAMI will assist NIMS to develop this new area in Connecticut, and as a possible national prototype.

CAMI participants will enroll as full-time students in credit certificate programs, with opportunities to earn multiple industry-recognized credentials. Students who plan to study in a field of concentration with a goal of earning an industry-recognized credential are more likely to complete their programs and advance to further studies.[22] A study of first-time students at Washington State University found that students who entered college with a concentration (coherent courses grouped for certificate or degree requirements) had higher rates of certificate and degree completion than students with no concentration.[23] "Two-thirds of students in this study who indicated their intent to

[21] Several TAACCCT advanced manufacturing grants inform CAMI: Central Lakes College, MN Regional Advanced Manufacturing Re-Training; Des Moines Area CC Iowa-Advanced Manufacturing; WI Advanced Manufacturing Pathways PLUS; New York TEAM Educational Pathways Project; and Illinois Network for Advanced Manufacturing.
[22] Helmer M. (2013). *Helping Adult Learners Navigate Community College and the Labor Market.* Courses to Employment No. 4. Workforce Strategies Initiative. The Aspen Institute.
[23] David Jenkins and Madeline Joy Weiss. (2011) Charting Pathways to Completion for Low-Income Community College Students. Community College Research Center Working Paper No. 34.

earn an academic degree or career technical credential entered a concentration."[24] The study found that students with defined concentrations who completed certificates and degrees successfully stacked their credentials and continued their education in pursuit of more advanced degrees.

Employer sponsored work-based training and Registered Apprenticeship. CAMI curriculum intentionally divides learning time equally between the manufacturing lab and course work (e.g., classroom, hybrid, simulation). CAMI will stretch work-based experiences by coordinating paid internships and cooperative work experiences for nearly 75% of students. Historically, 90% of Asnuntuck AMC students completing internships receive permanent employment offers from their internship sponsors, many of which participate on the regional Industry Advisory Council.

CAMI will support CTDOL Office of Apprenticeship Training (OAT) efforts to promote competency-based and hybrid Registered Apprenticeships in the manufacturing sector. A CAMI Apprenticeship Workgroup will support the process of awarding college credits for completed registered apprenticeships, aligning with the Registered Apprenticeship-College Curriculum Articulation Framework. The collective impact of competency-based and hybrid apprenticeships holds promise to transform the national landscape at a time of increasing educational costs and rapid technology advancement. Regional employers prefer graduates with workplace experience. A survey organized as part of a study by Rutgers University asked students about how well college prepared them for careers.[25] Students participating in internships reported that college had prepared them at much higher rates than students who did not take advantage of internships. In the same survey, students who participated in internships self-reported much higher levels of competencies such as verbal and written communication. Research confirms[26] that students who held internships during

[24] Ibid.
[25] Charley Stone, Carl Van Horn and Cliff Zukin. (2012) Chasing the American Dream: Recent College Graduates and the Great Recession. John J. Heldrich Center for Workforce Development at Rutgers University.
[26] National Association of Colleges and Employers. (2010) Internship and Co-op Survey.

college received more job offers and higher starting salaries than students who had no internships.

Prior Learning Assessment (PLA). CAMI will enhance an existing competency-based education and assessment platform (developed with prior TAACCCT grant funding) to specifically address manufacturing-related competencies, including for highly-skilled Veterans. Research shows that PLAs accelerate the progress of low-skilled workers, improve retention and achievement rates, and reduce time to completion. A Council for Adult and Experiential Learning (CAEL) study which included 62,475 students at 48 universities and colleges found that adult students who used PLA have higher graduation rates, stronger persistence in their studies, and complete their degrees more rapidly than students without PLA credits.[27] Other studies confirm the value of PLA for TAA-eligible workers who hold post-secondary experience and no formal degree.[28] [29] All 12 community colleges use American Council for Education (ACE) testing and will support PLA implementation.

Educational Content. Online learning has become an established fact of higher education. BOR/ConnSCU (via Charter Oak State College) intends to increase online enrollment system-wide by over 30% in the next five years. "Online learning appear[s] to be an effective option for undergraduates, graduates and professionals in a wide range of academic and professional studies."[30] A meta-analysis which examined evidence from a series of studies regarding online learning found that "on average, students in online learning conditions performed modestly better than those receiving face-to-face instruction."[31] CAMI will migrate selected courses from the classroom to an online or hybrid environment, and will utilize online learning modules to complement classroom

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[27] Klein Collins, Rebecca. "Fueling the Race to Post-Secondary Success." Council for Adult and Experiential Learning. March 2010. www.cael.org/pdf/PLA_Fueling-the-Race.pdf.
[28] Brigham, Cathy and Rebecca Klein Collins. "Availability, Use and Value of Prior Learning Assessment in Community Colleges." Council for Adult and Experiential Learning. July 2010. www.cael.org/pdf/PLA_CommunityColleges.pdf.
[29] Connecticut State TAA Coordinator.
[30] Means, B., et. al. "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies." U.S. Dept of Education Office of Planning, Evaluation, and Policy Development Policy and Program Studies Service. May 2009. p. 17. http://repository.alt.ac.uk/629/1/US_DepEdu_Final_report_2009.pdf.
[31] Evaluation of Evidence Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. (2010) U.S. Department of Education, Office of Planning, Evaluation and Policy Development.

instruction for adult students juggling many responsibilities. For example, self-paced classes available from Tooling U-SME prepare students for specific machine operation and applications theory and labs. Tooling U-SME classes expand enrollment and offer convenience and flexibility for both students and instructors. Manufacturing-specific videos, CNC control simulators, and virtual labs will enrich training, engage learners, and contextualize topics. Tooling U-SME courses can augment the courses available through Charter Oak State College, the Connecticut College of Technology, and other online skills refreshers offered by Connecticut's five WIBs.

Coaching and Supports. CAMI partners offer tools to support self-assessment, career exploration and research, experiential learning opportunities, career decision-making, and active career management. The literature, and the burgeoning field of coaching products and services, demonstrates the potential impact.[32] [33] [34] CAMI draws upon an existing pre-manufacturing pipeline developed through TAACCCT Round 1 funding, and online career planning resources available from CTDOL Labor Market Information and the American Job Centers. A special web portal exists to support career planning for Veterans. CAMI will apply a maximum faculty to student ratio of 1:20; structured laboratory courses will use a ratio of 1:10 Educational Assistants to students. Students will access tutoring, remedial assistance, and mentoring on practical life issues. This approach incorporates aspects of the "emporium" style delivery model used successfully in other subjects (e.g., math, literacy).[35] Internships and work-based experiences create bridges with

[32] Washington State's Integrated Basic Education and Skills Training Program (I-BEST): New Evidence of Effectiveness; Community College Research Center, September 2010.

[33] "Research in the State of Washington found that low-skilled adults who complete at least one year of college with a technical certificate can expect a measurable boost in earnings." *One-Stop Career Centers Must be Re-invented to Meet Today's Labor Market Realities*. Corporation for a Skilled Workforce, March 2012.

[34] Karp, M. M. (2011). Toward a New Understanding of Non-Academic Student Support: Four Mechanisms Encouraging Positive Student Outcomes in the Community College. CCRC. Teachers College, Columbia University; Eyster, L., et al. (2009). Characteristics of the Community-Based Job Training (CBJTG) Program. The Urban Institute Center on Labor, Human Services, and Population; Data from a USDOL grant to the Connecticut Community College System for Career Pathways in Health Care used career coaches to support participants. Earnings for students in the targeted degree programs increased 114% from $23,626 in 2005 to $57,740 in 2008.

[35] Visit www.thencat.org for extensive literature and archives related to learning re-design using the emporium models.

employers; CAMI placement staff will provide ongoing career development supports.

2.b. Career Pathways. The strategies in the proposed CAMI Career Pathways Project (see Supplementary Materials) augments the CAMI career pathways activities described below.

Contextualized, Accelerated Remedial Coursework. CAMI will expand a range of contextualized, accelerated remedial manufacturing programs currently offered by Consortium colleges. These programs align with an intensive system-wide effort to accelerate remediation driven by Public Act No. 12-40, which directs Connecticut Community Colleges to increase student success by offering remedial support embedded with corresponding entry-level courses, or an intensive college readiness program, by the Fall of 2015, and by working with public high schools to align curriculum so graduates are ready for college-level work.

Each AMC offers a "Manufacturing Math Boot Camp" to students with Accuplacer scores slightly lower than the minimum score needed to qualify for immediate entry into AMC certificate programs. Boot Camps teach students to apply basic math concepts to measurements, blueprint reading, and more advanced operations through course modules including math for manufacturing, basic AutoCAD, measurement, computer basics, and safety and career awareness. CAMI provides a vehicle to evaluate Boot Camps and systemically replicate successful models at other colleges.

The BOR/ConnSCU Round 1 TAACCCT grant (the Connecticut Manufacturing, Energy & Transportation (CT-MET) Initiative) enhanced a non-credit, 300-hour Pre-Manufacturing Certificate (PMC) program that prepares students for entry-level employment or manufacturing credit certificate programs. PMC programs offer associated math and English relative to manufacturing.

Addressing Barriers to Retention and Completion. An Advanced Manufacturing Recruitment and Retention Coordinator hired by each WIB will lead student recruitment activities at American Job Centers and college campuses. Coordinators will develop success plans for each student, and will assist college faculty and support staff to ensure students receive needed support.

Based on an assessment of each student's academic needs and learning style, students will receive individual tutoring and/or use of online blended learning modules that complement classroom and lab instruction. Each college will utilize a specific mix of Educational Assistants, teacher's assistants, and/or industry mentors to provide live and/or virtual tutoring. CAMI will leverage each community college's participation in a multi-state e-tutoring consortium so students can interact virtually with tutors from their own college or another college, including CAMI tutors with expertise in specific manufacturing areas.

Two Internship and Employment Coordinators shared by the colleges statewide will provide career guidance and match students and employers for the purposes of internships, Registered Apprenticeships, and employment.

Prior Learning Assessment (PLA). The BOR/ConnSCU TAACCCT Round 2 grant project (the Health and Life Sciences Career Initiative (HL-SCI)) includes a significant effort led by Charter Oak State College (COSC) to increase the use of PLA as a strategy to assist TAA workers and other candidates by: 1) centralizing PLA protocols and standards for all Consortium colleges; 2) reinforcing American Job Centers and Veterans' Centers as orientation portals for PLAs through videos and workshops; 3) expanding the Connecticut Credit Assessment Program (CCAP) to recognize credits earned in other institutions and settings; and 4) promoting PLAs in workplaces. CAMI will leverage HL-SCI PLA best practices, focusing on increasing the use of PLA for manufacturing. CAMI's competency-based education PLA efforts will focus in particular on assessing the skills of Veterans and military personnel with experience working with machinery that may have produced manufacturing related skills and competencies. CAMI will align PLA efforts across all 12 Community Colleges with the College Credit for Veterans/Military Training program.[36]

[36] This program offers credit for military coursework using American Council on Education (ACE) guidelines and is currently in place at all twelve CT community colleges.

COSC will determine the competencies needed in each CAMI program. COSC will assess non-credit programs for possible college credit, and develop an online process for students to earn credit through portfolio assessment and align these competencies to accelerate completion and job placement. This effort dovetails with work completed recently to award college credit (along with a high school diploma) to Technical High School students who earn Level I NIMS credentials.

Competency-Based Programs. All CAMI programs are competency-based, with exit competencies established based upon employer skill requirements collected through statewide and regional industry advisory councils, employer surveys, company visits, faculty externships, and local, state, and national labor market research. Producing students with exit competencies that meet employer needs drives curriculum development, instructor preparation, and classroom and lab presentation of program material. Program syllabi and post-competency reports reflect current skill requirements as expressed by industry partners. All students must demonstrate exit competencies, typically through capstone projects. The six CAMI colleges that earn institutional NIMS certification will require students to meet analogous standards as well as local and State standards.

Modularized Curricula. CAMI colleges will use modularized curricula for remediation and reinforcement of particular skill concepts, employing two types of modularized curricula based on need and circumstances: a) instructor-developed coursework; and b) online blended learning modules such as those offered by Tooling U-SME. CAMI colleges will develop and share modularized curricula in metrology, CNC machining, and geometric dimensioning and tolerancing, as well as audio/visual presentations that reinforce challenging concepts. CAMI students will have access to up to 140 online, self-paced math/science booster modules developed by the HL-SCI.

Stacked and Latticed Credentials. CAMI will enhance its existing matrix of stacked and latticed credentials valued by Connecticut manufacturers. All students will earn one or multiple industry-recognized credentials. CAMI will expand the instructional and student support capacity of

the four AMCs (Asnuntuck, Housatonic, Naugatuck Valley, Quinebaug Valley) and will add training capacity and expand the geographic reach of credentialing opportunities to the three other primary CAMI community colleges to produce a more robust statewide system: 1) Manchester will renovate its manufacturing facilities, increase the capacity of its Machining and Quality Control programs, and convert non-credit programs to credit; 2) Middlesex will modernize and expand its Machining certificate program; and 3) Three Rivers will create a Metal Fabrication Certificate program.

After completing a PMC program or Manufacturing Math Boot Camp, each CAMI student will spend two (full-time) semesters earning a certificate in Manufacturing Machine Technology; Advanced Welding Technology; Advanced Electronics Technology; or Metal Fabrication. Six colleges will complete certification as NIMS centers, and Asnuntuck will gain American Welding Society (AWS) certification, providing students the option to earn nationally-recognized credentials through NIMS and AWS while pursuing their certificates. Table 2.2 shows the current AMC credentials and the proposed credentials.

Table 2.2: CAMI Consortium College Existing and Planned Credentials

E = Existing credential P = Planned credential

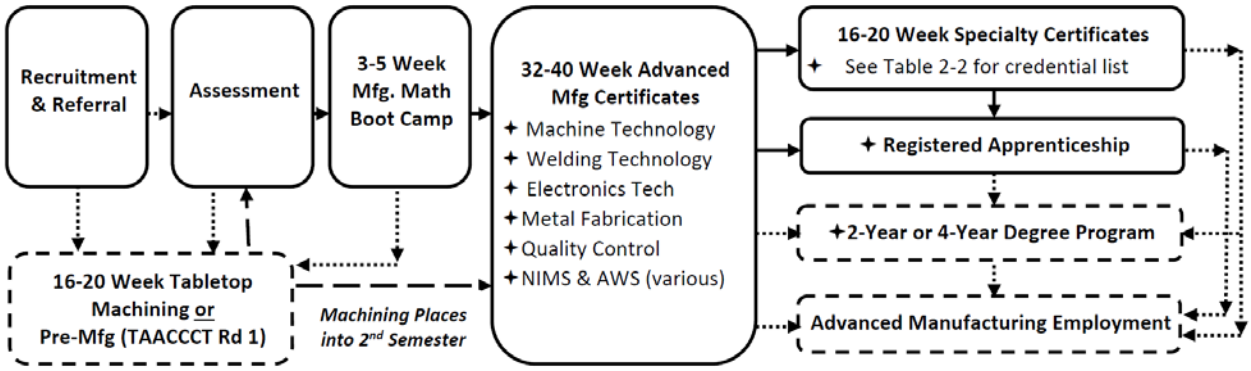
Current AMC Model – First Two Semesters							
Credential	**ACC (AMC)**	**HCC (AMC)**	**NVCC (AMC)**	**QVCC (AMC)**	**MxCC**	**MCC**	**TRCC**
Manufacturing Machine Technology	E	E	E	E	E	E	
Welding Technology	E						
Electronics Technology	E						
Metal Fabrication							P
Quality Control						E*	
NIMS Machining Level 1 *(11 credentials)*	E	P	P	P	P	P	
NIMS Machining Level 2	P						
NIMS Machining Level 3	P						
AWS	P						
Third Semester Specialty Certificates and Registered Apprenticeships (AMC Model Enhancements)							
Advanced Machine Technology	P	P	P	P		P	
Additive Manufacturing	P			P			
Tool & Die		P	P				
Metrology	P	P	P	P			
Metal Fabrication	P						P
Electro-Mechanical Technology	P						
Manufacturing Principals and Practices				P			

*MCC will convert an existing Quality Control non-credit program into a credit-bearing certificate

After earning their two-semester advanced manufacturing certificate, CAMI students will have four options: 1) enroll in a third-semester advanced manufacturing specialty certificate program that builds on their credential (e.g., Advanced Machine Technology); 2) enter a competency-based or hybrid manufacturing Registered Apprenticeship that results in a Certificate of Apprenticeship and may qualify for additional college credit; 3) matriculate in an advanced manufacturing Associates or Bachelor's degree program at a two- or four-year college; or 4) secure full-time employment in an advanced manufacturing occupation. Figure 2.1 shows the CAMI career pathway.

Figure 2.1: CT Advanced Manufacturing Initiative (CAMI) Career Pathway

Dashed box = non-CAMI activities; Dashed line = CAMI entry; Dotted line = CAMI exit; ✦ = Credential



Industry Engagement. The BOR/ConnSCU convenes a Statewide Advanced Manufacturing Advisory Committee (SAMAC). SAMAC oversees community college advanced manufacturing efforts statewide and advises on the strategic direction of the four AMCs at Asnuntuck, Housatonic, Naugatuck Valley, and Quinebaug Valley, meeting monthly to discuss policy, program, accountability, and continuous improvement. SAMAC contains crossover representatives from industry leaders such as the Connecticut Center for Advanced Technology (CCAT)[37], Connecticut Business and Industry Association (a long-time partner of the National Association of Manufacturers), and the Connecticut Employment and Training Commission (CETC) Advanced Manufacturing Work Group.

[37] CCAT has received numerous U.S. Department of Defense grants to support the defense industry.

Each of the seven primary CAMI colleges maintains existing regional Industry Advisory Councils. Manufacturers provide input on all aspects of the programs[38] (e.g., priorities for certificates, credentials, courses, equipment). Participating employers offer work-based learning experiences and parlay these experiences into job offers – reducing their recruitment and training costs. TAACCCT funds will support two Internship and Employment (I/E) Coordinators (shared by all colleges), augmenting the colleges' current capacity to engage employers. I/E Coordinators will strengthen existing relationships with employers and build new relationships, documenting employers' current and projected hiring needs.

Transferability and Articulation. CAMI will strengthen articulation among – and develop seamless transitions between – advanced manufacturing training programs to support career pathways. CAMI will expand the dual-credit "College Connections" program model currently operated by two AMCs in partnership with local high schools. College Connections involves a manufacturing machining program in which high school juniors and seniors participate in a series of employer-responsive courses in machine shop practices and related subject matter. Training occurs in classroom and manufacturing lab settings, and college credits earned through the program count towards college manufacturing certificates and degrees. CAMI will also support related efforts to develop early college (e.g., P-TECH) programs focused on manufacturing.

CAMI will expand the role of Connecticut's 16 Technical High Schools (THS) (13 of which offer manufacturing technology programs, and three of which offer NIMS certifications) as feeders to the colleges, and will strengthen relationships between colleges and individual THSs.

CAMI will streamline and strengthen the transition between non-credit pre-manufacturing programs developed through the TAACCCT Round 1 grant and credit certificate programs.

[38] For example, Three Rivers convened a committee comprised of regional employers to conduct the initial design of the proposed Sheet Metal Fabrication Certificate program.

Regional CAMI Recruitment and Retention Coordinators will assist with recruitment, assessment, and enrollment to facilitate seamless student transitions from PMC programs to CAMI programs.

The CTDOL Office of Apprenticeship Training (OAT) supports a statewide effort to increase Registered Apprenticeship in the manufacturing sector by devoting more staff capacity to developing, promoting, and overseeing manufacturing Registered Apprenticeships.[39] In 2013, the CTDOL OAT approved manufacturing course curricula at six community colleges[40] as providers of the Related Instruction component of Registered Apprenticeship in manufacturing, allowing classroom training to count towards the completion of Registered Apprenticeship training. CAMI will continue this work for new, third-semester specialty certificate programs, producing Education Schedules for competency-based and hybrid apprenticeships. Pursuing competency-based and hybrid models will enable apprentices with a high level of relevant competencies to complete their apprenticeships with an observable, measurable pattern of skills, knowledge, abilities, behaviors and other characteristics that an individual needs to perform work roles or occupational functions successfully. Using the principles of the Registered Apprenticeship-College Curriculum Articulation Framework, workers who complete Registered Apprenticeships may earn 16-34 college credits that apply towards the attainment of an Associates or Bachelor's degree via articulation agreements.

In 2011, Connecticut consolidated governance of the Community College System, the State University System and Charter Oak State College under the Board of Regents for Higher Education. The resulting Connecticut State Colleges and Universities facilitates system-wide improvements in transferability and articulation. In 2012, the BOR/ConnSCU approved a Transfer and Articulation Policy (TAP) that established transfer Associates degrees that include a common general education core based on competencies rather than courses. Completion of a transfer

[39] USDOL awarded CTDOL a Job-Driven NEG in June 2014 to "implement a manufacturing-focused State Registered Apprenticeship Development Model" to increase the number of manufacturing registered apprentices.
[40] Asnuntuck, Housatonic, Manchester, Middlesex, Naugatuck Valley, and Quinebaug Valley

Associates provides: a) guaranteed admission and junior status to the receiving university without "course by course" transfer; b) a guarantee that at least 30 credits of general education requirements at the four-year institution will be considered completed; and c) articulation of remaining credits following a major pathway determined by the faculty of all 17 institutions. This policy incentivizes students to complete an Associates degree and accelerates completions of Bachelor's degrees.

A comprehensive faculty committee established the common general education core ("TAP Framework") in 2012 based on a competency-based model. Faculty governance bodies at BOR/ConnSCU institutions ratified the TAP Framework in 2013. Articulation of the first five major pathways began in 2012-13, with most of the remaining pathways planned for articulation in 2014-15, including shared governance review and approval processes at each institution. Faculty committees from the community colleges, universities, and COSC review the major program articulations on a five-year cycle. BOR/ConnSCU will publicize the transfer agreements major by major and will offer students an interactive web-based vehicle to access these specific degree requirements and to confirm transferability of completed courses.

2.c. Online and Technology Enabled Learning. CAMI Consortium members all use online and technology-enabled learning, including simulations. COSC operates as one of the nation's premier distance learning institutions. The seven primary CAMI community colleges offer online and hybrid courses, and will augment their courses with online blended learning modules. "Wi-Fi hotspots" across CAMI campuses and high bandwidth connections enable distance learning. The five Connecticut WIBs offer technology-based learning (e.g., Metrix Learning). This approach, designed for incumbent and dislocated workers, aligns with efforts to award credits toward community college programs through PLA or ACE testing.

Incorporation of Technology into Program Design and Delivery. In 2013, BOR/ConnSCU launched an online Introduction to Manufacturing course to provide an overview

of manufacturing in a concise, interactive learning environment.[41] This free, cloud-based course features modules including an overview of manufacturing in Connecticut and the U.S.; types of manufacturing; industrial materials used in manufacturing; manufacturing processes; quality control processes; blueprints and diagrams; safety in manufacturing; supply chain contractors; and types of careers found in manufacturing. College and partner staff, including CAMI Recruitment and Retention Coordinators and employer partners, will utilize this engaging, interactive course to recruit youth and adults to advanced manufacturing programs, increasing the number of CAMI applicants, and their level of preparedness.

A COSC Online Course Coordinator will work with college manufacturing coordinators, faculty, and employers to convert at least ten core courses into hybrid or fully online courses, and to develop new hybrid and online courses for new, third-semester specialty certificate programs.[42] Courses identified as candidates for hybrid delivery include CNC I and II, Lathe, Milling I, Introduction to Additive Manufacturing, and Fanuc Controls. Candidates for online delivery include Blueprint Reading I and II, Blueprint Reading for Welders, and Metrology with Kit. Hybrid and online courses will particularly benefit adult learners by increasing scheduling flexibility. Increasing online training capacity will also facilitate greater utilization of incumbent worker training by industry partners[43] by lowering training costs and reducing the need to pull incumbent workers off the job.

CAMI students will complete an online module that provides an introduction to manufacturing entrepreneurship. The CAMI Online Course Coordinator will work with college manufacturing coordinators, faculty, the Community College faculty Entrepreneurial Team, and employers to identify or develop a non-credit, online manufacturing entrepreneurship course offered as a co-

[41] http://www.charteroak.edu/bb/manufacturing/ This course features a Quick Response (QR) Code that makes it available on a mobile device.
[42] A thorough review of existing online courses will take place before online courses are developed to prevent duplication and to utilize existing online training curriculum.
[43] The Aerospace Components Manufacturers (ACM), a consortium of 80 aerospace-related companies, represents one long-term incumbent worker education partner. AMCs have provided 125 classes to 20 ACM companies statewide.

requisite to advanced manufacturing certificate programs. This course will cover manufacturing entrepreneurship fundamentals to ensure that all students enter the manufacturing workplace with an entrepreneurial mindset, and to plant a seed for students who may consider pursuing an entrepreneurship capstone project. Students seeking to learn more will participate in outcomes-based approaches to entrepreneurship training in the form of capstone projects in which students explore entrepreneurial factors such as patents, materials costs, scalability, and prototypes.

All hybrid and online courses will incorporate summative and formative assessments such as technology-enhanced classroom assessment techniques (CATS) (e.g., remote control response cards). The BOR/ConnSCU Manager of Technological Tools & Training will provide guidance to CAMI leaders on implementing technology-enhanced CATS. BOR/ConnSCU will publically license all curricula and training materials created or developed with the support of the grant under a Creative Commons Attribution 3.0 License using a shared learning object repository.

Innovation in Technology. TAACCCT funds will support advanced training technologies that improve student learning and engagement and enable instructors to establish flexible classrooms through the use of kits in classroom or lab settings. The use of virtual simulations (e.g., for blueprint reading, CNC programming, and CNC coordinates) reinforces theory and reduces classroom and lab time. Virtual and portable training technologies will facilitate increased incumbent worker training, as workers will utilize virtual or portable training equipment at the worksite or at home, allowing learning to occur with less time away from the job. (See the Budget Narrative for more details on CAMI technology investments that will enable more flexible, engaging, and interactive learning.)

See page 16 for a description of CAMI tutoring supports, including an e-tutoring platform that supports synchronous student-tutor sessions and asynchronous student questions to improve retention and completion rates by providing greater access to expert tutors.

CAMI will expand the successful use of online blended learning modules such as those offered by Tooling U-SME, currently utilized by two AMCs. These modules will complement classroom and lab work, helping students prepare for specific machine operation and applications theory and labs, and other related manufacturing disciplines, on their own schedules. Students will take a monitored test after completion of each module to ensure mastery of the material and to provide immediate feedback on the effectiveness of the module for each student. Modules used to complement Machining courses will include CNC, CNC Controls with GE Fanuc, Work-Holding guides, Metal Cutting, Abrasives, Shop Safety, Inspection, Quality, and Shop Essentials, CNC Controls, Inspection, Materials Metal Cutting, Shop essentials, and Stamping, among others. Tooling U-SME modules are enhanced with interactive tools designed specifically to engage the learner and reinforce key concepts, such as video, audio, and real-world photos and illustrations to communicate essential theory; interactive exercises throughout the class to prompt the user and reinforce key information; interactive labs at the end of the class designed to contextualize the knowledge and prepare the user for the exam; and CNC simulators that mirror brand-specific CNC control and enable the user to practice the specific steps required for common machine tasks.

2.d. Strategic Alignment. A recent history of substantial public and private investments in advanced manufacturing training initiatives demonstrates the importance of continuing to develop the manufacturing talent pipeline. The community colleges have collaborated with employers and industry groups, the public workforce system, CTDOL and other state agencies, and philanthropic partners on numerous USDOL grants.[44]

Coordination with Governor's Economic Development Plan and WIA-WP State Workforce Plan. Governor Dannel Malloy has prioritized Connecticut's advanced manufacturing

[44] Recent examples of statewide USDOL grants involving community colleges, WIBs, and industry partners include four Community-Based Job Training Grants, a STEM Opportunities in the Workforce System Grant, a State Energy Sector Partnership Grant, and two TAACCCT grants, among others.

sector since taking office in 2011. Malloy's 2011 Jobs Bill included $17.8 million in state bond funding through FY 2013 to develop three additional Advanced Manufacturing Centers. In 2013, Malloy announced a second round of bond funds to upgrade AMC equipment and physical space. See the attached letter from Governor Malloy for further evidence of his support.

Connecticut's *Economic Development Strategy,* released in Spring 2014, names Advanced Manufacturing as one of the top three priority business clusters for investment to "drive Connecticut's economy" (p. 6), and lists working "to ensure companies [in priority clusters] within the state retrain and grown their workforce" as an action step (p. 13). The *Economic Development Strategy* also says that, "A strong partnership amongst education, the training delivery system and market-driven players is essential," and highlights the three new AMCs as an illustrative success story (p. 14). The *Strategy* lists as a specific action step: "establish/expand manufacturing technology programs and grow engineering capacity in community colleges." (p. 16)

Connecticut's *Strategic Five-Year State Workforce Investment Plan* for 2012-2017 lists manufacturing as a "key growth sector," a "priority sector" and a "strategically vital sector." The SAMAC and regional Industry Advisory Councils align with the *State Workforce Investment Plan* emphasis on employer involvement in workforce development in key sectors including manufacturing: "To increase the likelihood of success in developing worker skills that are genuinely valued by employers, employers' voices must be heard, their insights acknowledged, their guidance sought." (p. 25)

The CAMI Apprenticeship Workgroup responds directly to the *State Workforce Investment Plan* recommendation that Connecticut "move to the cutting edge in making apprenticeship an integral component of a comprehensive career development system" by "develop(ing) a plan to implement expansion of the apprenticeship model responsive to selected occupations in targeted industry sectors….includ(ing) selected occupations in manufacturing." (p. 34-35)

CAMI responds to the *State Workforce Investment Plan* recommendation for the "infusion of key

industry expertise as part of the permanent staffing in the service delivery model of the CTWorks One-Stop Career System" (p. 35) by having each regional WIB hire a Recruitment and Retention Coordinator to promote manufacturing careers and CAMI training opportunities. The CAMI Employment Scorecard aligns with the *State Workforce Investment Plan* recommendation to "do a better job of communicating with and educating the public about the practical realities of jobs and career opportunities that are critical to state economic growth." (p. 35)

Several additional CAMI strategies align with *State Workforce Investment Plan* recommendations specific to the AMCs, including: a) recruit local manufacturers for leadership roles on AMC Advisory Boards; b) build employer linkages between community college and technical high school advisory groups; and c) implement articulation agreements between technical high school Manufacturing Technology programs and community college AMCs. (p. 36)

Collaboration with Public Workforce System. See attached letters from all five Connecticut WIBs for evidence of their support for and commitment to CAMI. Regional WIBs participated in CAMI planning sessions and assisted with employer outreach. The WIBs will: a) provide professional development opportunities for American Job Center (AJC) staff to attend advanced manufacturing conferences and workshops; b) bring manufacturing professionals to the AJCs to inform staff about occupational technical requirements and workplace issues; c) provide effective placement strategies: d) share best practices regarding preparation for entering the workforce; e) provide services to all TAA-eligible individuals and appropriate companies; f) lead the identification of state, federal and grant resources to maximize student support; and g) provide over $1 million in leveraged resources such as administration, facility space, and Individual Training Accounts.

CAMI aligns the State WIB (CETC) Advanced Manufacturing Work Group with the SAMAC. The CETC charged the Work Group to "Develop a set of specific short-term strategy recommendations and long-range strategy and policy proposals to address the workforce

challenges confronting the growth of advanced manufacturing in Connecticut." The BOR/ConnSCU Director of AMCs sits on this Work Group; several SAMAC members serve on both groups. CAMI addresses Work Group priority areas (e.g., apprenticeships).

CAMI will fund an Advanced Manufacturing Recruitment & Retention Coordinator hired by each WIB to support advanced manufacturing efforts across all 12 Connecticut Community Colleges in order to build the statewide pipeline of students who are: a) aware of education, training and career opportunities; b) introduced to basic advanced manufacturing concepts; c) assessed for competencies related to advanced manufacturing; and d) prepared to enter – and succeed in – community college advanced manufacturing certificate programs. Coordinators will split their time between the AJCs and the colleges in their service areas, and will: a) recruit and assess potential students at the AJCs and community colleges; b) provide potential students with information about admission and enrollment processes, career pathways, and PLA opportunities; c) develop success plans for each student, and assist college faculty and support staff to ensure students receive needed support; d) expand industry relationships; e) train other AJC staff on advanced manufacturing training and career opportunities, and f) serve as the point person for all AJC customers interested in advanced manufacturing. This shared staffing and oversight structure builds on successful sector-specific recruiting, coaching, and advising models utilized in several previous statewide initiatives by the community colleges and WIBs.

Coordination with Other Organizations. CAMI will expand and formalize the new BOR/Technical High School (THS) Work Group created through an Educational Success Compact approved by the THS Board, strengthening relationships and opportunities for students between systems to accelerate student advancement along advanced manufacturing degree pathways. BOR/ConnSCU and the THS System will pursue a system-to-system memorandum of agreement to formalize relationships related to the utilization of THS facilities for community college

manufacturing training.

The CTDOL Office of Apprenticeship Training (OAT) commits to promoting the implementation of competency-based and hybrid manufacturing Registered Apprenticeships in partnership with the Apprenticeship Workgroup. Employer-sponsors will be surveyed as to the efficacy of these models to continuously improve registered apprenticeship programs.

Through the SAMAC, CAMI leaders will continue to participate in Connecticut's *Dream It Do It* initiative, which brings together manufacturers, business and trade associations, educational institutions, economic development and workforce organizations to enhance Connecticut's manufacturing workforce. A BOR representative also serves on the National Education Council of The Manufacturing Institute.

CAMI leaders will systematically engage philanthropy, including the Workforce Solutions Collaborative of Metro Hartford[45], to promote CAMI's expansion and sustainability.

2.e. Alignment with previously-funded TAACCCT projects. CAMI will align with, and leverage resources from, Connecticut's two previous statewide TAACCCT grants: a) the CT-MET Initiative (Round 1); and b) the HL-SCI (Round 2). BOR/ConnSCU will utilize best practices from the start-up and implementation of both of these grants, as well as several previous statewide USDOL grant efforts, to ensure effective administration of CAMI.

The CT-MET Project Director participated in planning CAMI to ensure alignment with CT-MET pre-manufacturing (PMC) programs and to incorporate CT-MET lessons learned (e.g., utilizing a specific online academic refresher during program orientation, collaborating with technical high schools on NIMS certification and shared facilities) into the CAMI program design. CAMI and

[45] The Workforce Solutions Collaborative is a funders' collaborative and network of public/private stakeholders that convenes employers, educators, government, service providers, and philanthropic organizations to collaboratively address workforce development needs. Funding is provided by a public private partnership including the National Fund for Workforce Solutions.

CT-MET leaders will work together to ensure seamless transitions between CT-MET PMC programs and CAMI certificate programs.

CAMI will leverage specific resources from the HL-SCI, including best practices related to the statewide use of PLA, and a Recruitment and Placement Workgroup that forms an alliance among the State TAA Coordinator, the WIBs, the Connecticut Veterans' Affairs Office, and Consortium colleges. CAMI will also use self-paced online math/science booster modules developed by HL-SCI.

CAMI leaders will also reach out to TAACCCT grantees nationwide that have focused on manufacturing to collect and incorporate best practices into program design and implementation, to explore the use of specific grant products (e.g., classroom and Registered Apprenticeship curriculum, advanced training tools) and to develop models with national implications (e.g., apprenticeships, additive manufacturing certificates and NIMS credentialing). For example, three TAACCCT Round 2 projects[46] sought to develop advanced manufacturing Registered Apprenticeships, including models that accelerate program completion, and one Round 3 project (Colorado Helps Advanced Manufacturing Program) included Additive Manufacturing training.

2.f. Sector Strategies and Employer Engagement. The sector-based approach to education and training established by the Asnuntuck AMC and replicated by the three AMCs created in 2012 represents a driver of the success of the AMC model. A SWOT analysis of advanced manufacturing in Connecticut conducted by Ernst & Young in April 2014 named the community colleges' partnerships with industry as a strength, noting that each of the AMCs "have advisory boards that meet on a regular basis to advise and counsel as well as provide internships, mentoring, scholarships, and career opportunities."[47]

[46] Regional Advanced Manufacturing Re-Training from Minnesota, Earn and Learn Advanced Manufacturing Career Lattice Program from Illinois, and Multi-State Advanced Manufacturing Consortium from Michigan.
[47] Ernst & Young. *Strengths, Weaknesses, Opportunities, and Threats: Aerospace and Marine Shipbuilding in Connecticut's Advanced Manufacturing Communities Region*. Prepared for the CT Department of Economic & Community Development. April 2014.

The Statewide Advanced Manufacturing Advisory Committee (SAMAC) that oversees AMC efforts statewide will serve as the CAMI leadership team. The SAMAC meets monthly to discuss policy, program, accountability, and future directions. The SAMAC is comprised of representatives from 10 Connecticut manufacturers, the WIBs, industry associations, state agencies including CTDOL, BOR staff, representatives from each of the AMC colleges, and other stakeholders. The SAMAC will expand representation to include all seven primary CAMI colleges. Regionally, each college's Industry Advisory Council includes 10-35 manufacturers that provide guidance on all aspects of the college's advanced manufacturing programs.

CAMI will support the scaling up of this model, as Middlesex and Manchester will strengthen their regional Industry Advisory Councils. The Eastern Advanced Manufacturing Alliance (EAMA)[48] will serve as the regional Industry Advisory Council for Three Rivers. In many cases, Councils will strengthen long-standing relationships between colleges and employers, such as the partnership between Three Rivers and Electric Boat.[49]

Forty-two manufacturers and 10 industry associations submitted letters (see attachments) in which they document their need for workers with the skills, competencies, and credentials to be provided by CAMI training programs. Letters document employers' commitment to support the success of CAMI in a variety of ways: a) identify the skills and competencies needed by advanced manufacturers through participation on regional Industry Advisory Councils and/or the SAMAC, as well as through ongoing communication with Consortium colleges, BOR/ConnSCU, and the CAMI Project Director; b) further define CAMI strategies and goals and ensure their responsiveness to employer needs; c) identify internship, Registered Apprenticeship, and placement strategies and

[48] EAMA is advised by a board comprised of 33 manufacturers that employ more than 11,000 people and generate more than $1 billion in annual revenue.. The primary mission of the EAMA is to promote manufacturing as a career option and ensure that training and employee development education is available at the local level.
[49] For example, since 2008 Three Rivers and Electric Boat have had a partnership that enables designer apprentices to earn six different associate's degrees in engineering technology at Three Rivers while Electric Boat pays the cost.

protocols for CAMI Consortium members, and identify specific work-based training opportunities; d) serve as NIMS employer sponsors for CAMI students pursuing NIMS certification, including reviewing student projects; e) provide access to resources that support education and training activities, including guest speakers and lectures, plant tours, job shadowing, equipment, advanced training, simulation programs, facilities, instructors, course development support, and related training; f) refer promising applicants in need of additional competencies to CAMI colleges and AJCs for education, training and career coaching; g) retain and promote incumbent workers who complete CAMI education and training programs, and provide tuition reimbursement for these workers; h) create paid internships for qualified CAMI students; i) hire qualified participants, including veterans and individuals with disabilities, who complete CAMI programs; j) participate in feedback processes about program outcomes for the purpose of continuous quality improvement; and k) contribute to the purchase of equipment needed to establish or upgrade programs.

The Asnuntuck AMC will work with its partners at UConn and Pratt & Whitney[50] to develop a third-semester credit certificate program to prepare students as Additive Manufacturing (AM) production technicians. Asnuntuck will deliver the AM certificate program, which will be evaluated and adjusted with the goal of becoming a NIMS certified credential for national dissemination.

Currently, 75% of AMC students complete on-site internships (a mix of paid and unpaid) during their second semester of training. Student interns generally work (and learn) for an average of 16 hours per week for 6-12 weeks, as their time at the worksite replaces their lab-based instruction while their academic work remains intact. AMCs report multiple benefits of internships: a) classroom performance improves as participants gain heightened appreciation for the relevance of subject matter; b) career competencies (e.g., punctuality, problem solving) improve; and c) feedback

[50] Asnuntuck's AMC has formal agreements with UConn and Pratt & Whitney to train and educate staff and students in the area of 3D Printing emphasizing both plastic and metal materials.

from students, internship staff, and work supervisors lead directly to program enhancements to better respond to current workplace needs. Ninety percent of AMC interns typically earn permanent employment offers from internship sponsors. CAMI will invest in Internship and Employment Coordinators to build relationships with regional employers and to scale up internship placement rates and work-based opportunities. Employer outreach efforts will dovetail with competency-based and hybrid Registered Apprenticeships in selected advanced manufacturing occupations.

The attached letters from employers demonstrate strong current and projected demand for students completing CAMI training. Employers who quantified their projected hiring needs (many expressed interest in hiring but did not quantify their needs) estimate needing more than 250 students completing CAMI programs. Although most employers did not assign a dollar value to their contributions to CAMI, those who did committed to providing more than $270,000 in leverage between wages to student interns ($71,700), cash match for equipment ($31,000), scholarships for CAMI students ($42,000) and in-kind contributions ($127,400). This represents an extremely conservative estimate given the level of anticipated support from employers.

2.g. Project Work Plan. Table 2.3 (pages 34-36) shows the detailed CAMI work plan.

Feasible and Realistic Activities and Timeframes. CAMI expands, enhances and strengthens an existing AMC model currently in operation at four colleges. CAMI will leverage this infrastructure and begin immediately upon receipt of the grant award. BOR/ConnSCU leaders, including the Director of Advanced Manufacturing Centers, will provide statewide leadership, along with the Asnuntuck AMC Coordinator, who will continue to coach the other colleges on issues such as designing lab schedules to maximize enrollment. Manufacturing Coordinators in place at each college will provide local leadership. See Table 2.3 for anticipated timeframes for each key activity.

Table 2.3: Connecticut Advanced Manufacturing Initiative Work Plan (all dates assume a grant performance period of 10/1/14 to 9/30/17)

Strategy 1: Expand the capacity of college manufacturing facilities to support more students and new certificate programs *Associated costs* – Equipment, instructional supplies, renovation*							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 1.1	Renovate lab facilities to accommodate new equipment and programs	Project Director; BOR and college (MCC; TRCC) facilities staff; Finance staff	**Total:**	$1,311,190	**Start Date:**	11/1/14	Renovated lab facilities
			Equipment:	$0	**End Date:**	7/31/15	
			Year 1:	$1,275,539	**Milestones:**	Renovations completed by October 2015	
			Year 2:	$35,651			
			Year 3:	$0			
Activity 1.2	Purchase and install equipment and instructional supplies to support new programs	Project Director; College Mfg. Coordinators	**Total:**	$1,936,381	**Start Date:**	11/1/14	New equipment + instructional supplies
			Equipment:	$792,860**	**End Date:**	3/31/16	
			Year 1:	$917,392	**Milestones:**	Equipment (including new 3rd semester equipment): purchased by 12/31/15; installed by 3/31/16	
			Year 2:	$760,128			
			Year 3:	$258,861			
Strategy 2: Scale up industry-driven training programs resulting in credentials *Associated costs – Instructors, EAs, Online Course Coordinator, Credentialing Coordinator, professional development, curriculum development, tech HSs*							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 2.1	Develop curricula and scale up delivery (e.g., third-semester certificates)	Project Director; Asnuntuck Mfg. Coordinator; Instructional Designers; College Faculty	**Total:**	$4,972,360	**Start Date:**	12/1/14	10 3rd-semester certificate curricula NIMS-certified AM certificate
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$1,028,416	**Milestones:**	Faculty + EAs hired (ongoing); All new curricula complete by 12/31/15; Colleges increase # of cohorts by 2015-2016	
			Year 2:	$1,917,442			
			Year 3:	$2,026,502			
Activity 2.2	Develop competency-based and hybrid manufacturing Registered Apprenticeships	CTDOL OAT; State Dept of Ed; Apprentice WG (Employers)	**Total:**	$105,120	**Start Date:**	10/1/14	Education Schedules for 10 new competency-based and hybrid manufacturing Registered Apprenticeships
			Equipment:	$0	**End Date:**	9/30/15	
			Year 1:	$24,484	**Milestones:**	Apprenticeship WG formed 12/1/14; 1st R.A. Education Schedules by 12/31/14; RA training begins by 6/30/15	
			Year 2:	$35,651			
			Year 3:	$44,985			

Strategy 2: Scale up industry-driven training programs resulting in credentials (continued)							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 2.3	Complete certifications (NIMS, AWS) for CAMI colleges	Credentialing Coordinator; College Mfg. Coordinators	**Total:**	$249,530	**Start Date:**	12/1/14	5 (additional) colleges NIMS certified Anuntuck AWS certified
			Equipment:	$0	**End Date:**	12/31/15	
			Year 1:	$58,795	**Milestones:**	6 colleges NIMS certified by 9/30/15; Asnuntuck AWS certified by 9/30/15	
			Year 2:	$88,500			
			Year 3:	$102,235			
Activity 2.4	Migrate courses to online and hybrid delivery	Project Director; Online Course Coordinator; Asnuntuck Mfg. Coordinator; College Faculty	**Total:**	$332,353	**Start Date:**	1/1/15	6+ new hybrid + 4+ new online courses Online entrepre-neurship course
			Equipment:	$0	**End Date:**	9/30/16	
			Year 1:	$113,937	**Milestones:**	Online Coordinator hired by 1/1/15; All hybrid/online courses complete by 3/31/16; Evaluate + improve through 9/30/16	
			Year 2:	$173,431			
			Year 3:	$44,985			
Strategy 3: Increase participant retention and accelerate participant completion with student supports *Associated costs – Recruitment/Retention Coordinators, EAs, tutors, Internship/Employment Coordinators, online course modules, marketing*							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 3.1	Recruit and orient participants to CAMI programs	WIBs (RR Coordinators); College Mfg. Coordinators	**Total:**	$1,452,073	**Start Date:**	10/1/14	1,531 students served
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$365,793	**Milestones:**	RR Coordinators hired at each WIB by 1/1/15	
			Year 2:	$542,799			
			Year 3:	$543,481			
Activity 3.2	Provide tutoring and online course modules that complement core courses	Tutors; EAs; College Mfg. Coordinators	**Total:**	$2,739,041	**Start Date:**	12/1/14	1,100 students receive tutoring 825 students use online course modules
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$558,116	**Milestones:**	First tutors + EAs hired by 12/1/14; online course module licenses purchased by 1/1/15	
			Year 2:	$1,053,567			
			Year 3:	$1,127,358			
Activity 3.3	Provide PLA to participants (especially veterans)	COSC PLA Coordinator (from TAACCCT Rd 2)	**Total:**	$57,635	**Start Date:**	10/1/14	50 students receive 400 PLA credits
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$8,161	**Milestones:**	PLA Coordinator continues from Rd 2 grant from 10/1/14	
			Year 2:	$23,768			
			Year 3:	$25,706			

Strategy 3: Increase participant retention and accelerate participant completion with student supports (continued)							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 3.4	Provide internship and job placement support	College Mfg. Coordinators; Internship & Employment (IE) Coordinators; Employers	**Total:**	$515,426	**Start Date:**	1/1/15	600 students do internship + 573 students placed (during grant period)
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$116,932	**Milestones:**	IE Coordinators hired by 1/1/15	
			Year 2:	$191,301			
			Year 3:	$207,193			
Strategy 4: Strengthen and scale up the AMC sector-based approach to employment and training *Associated costs – Internship & Employment Coordinators*							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 4.1	Increase employer involvement in all aspects of college manufacturing programs	Project Director; Employers (in-kind); College Mfg Coordinators; IE Coordinators	**Total:**	$478,177	**Start Date:**	10/1/14	120 employers participate on SAMAC and/or Regional Industry Advisory Councils
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$114,993	**Milestones:**	IE Coordinators hired by 1/1/15	
			Year 2:	$174,372			
			Year 3:	$188,812			
Project Management & Evaluation *Associated costs – Third party evaluator, review of grant deliverables*							
Activities		**Implementer(s)**	**Costs**		**Time**		**Deliverables**
Activity 5.1	Develop a plan to sustain the Initiative after the grant ends	Project Director; SAMAC (employers)	**Total:**	$190,195	**Start Date:**	1/1/16	Sustainability Plan
			Equipment:	$0	**End Date:**	9/30/17	
			Year 1:	$40,806	**Milestones:**	Plan completed by 1/1/17, with early implementation in 2017	
			Year 2:	$59,419			
			Year 3:	$89,970			
Activity 5.2	Complete performance and financial reports and evaluation activities	Project Director; Research Analyst; Evaluator	**Total:**	$660,519	**Start Date:**	10/1/14	Performance reports; Financial & MIS reports; Employment Results Scorecard; Evaluation reports
			Equipment:	$0	**End Date:**	9/30/18 [for evaluation]	
			Year 1:	$104,601	**Milestones:**	Project Director hired by 12/1/14; Project Assistant hired by 1/1/15; Finance staff assigned by 12/1/14; Evaluator selected by 12/31/14; Reports + Scorecard completed by federal deadlines	
			Year 2:	$129,606			
			Year 3:	$162,382			
			Year 4:	$263,930			

*Administrative costs (e.g., Project Director, Project Assistant, indirect costs) are spread across all activities

**Equipment costs (Activity 1.2) appear in both the Equipment row and in Years 1 and 2.

Costs. The CAMI Consortium requests $15 million for its TAACCCT proposal. Table 2.3 shows the cost of each strategy, with more detail in the Budget Narrative. This represents a reasonable cost given the number of participants, the level of service received by each participant (i.e., 2-3 semesters of full-time training), the anticipated job placement rate (85%), and the potential for national impact based on innovations including a NIMS-certified Additive Manufacturing certificate program and a competency-based and hybrid manufacturing Registered Apprenticeship model. Leverage contributions from CAMI partners are conservatively estimated at almost $10 million (see Budget Narrative), further stretching the impact of the TAACCCT funding.

Deliverables. Table 3.2 identifies the major deliverables to be developed with grant funds. 1) Renovated lab facilities; 2) New equipment; 3) Curricula for six new third-semester certificate programs (including a NIMS-certified Additive Manufacturing certificate); 4) Education Schedules for 10 new competency-based and hybrid manufacturing Registered Apprenticeships; 5) NIMS certification for 5 additional colleges; 6) 6+ new hybrid course curricula and 4+ new online course curricula; 7) 120 employers participate on SAMAC and/or regional Industry Advisory Councils; and 8) An Employment Results Scorecard, among others (see also Table 3.2 on pages 38-39).

3. OUTCOMES and OUTPUTS

3.a. Analysis of Outcome Projections.

Complete and Accurate Projections. Table 3.1 (page 38) shows anticipated outcomes.

Targets. Outcome projections are based on the assumption that colleges will continue to perform at their current levels in terms of program completion (85% of AMC students completed two-semester programs on time in 2013-2014) and job placement (88% of AMC completers secured employment in 2013-2014). Performance benchmarks established by the Asnuntuck AMC inform program expansion projections for the other CAMI colleges over the 3-year project period.

Table 3.1: CAMI Outcome Measures

Outcome Measures		Targets for TAACCCT Program	
1	Total Unique Participants Served*	Year 1: 405 Year 2: 515 Year 3: 611	Total: 1,531
2.	Total Number of Participants Completing a TAACCCT-Funded Program of Study	Year 1: 22 Year 2: 336 Year 3: 470	Total: 828
3	Total Number of Participants Still Retained in Their Program of Study or Other TAACCCT-Funded Program (cumulative)	Year 1: 330 Year 2: 476 Year 3: 553	Total: 1,359
4	Total Number of Participants Completing Credit Hours	Year 1: 141 Year 2: 417 Year 3: 548	Total: 1,106
5	Total number of participants earning degrees and certificates in grant-funded programs of study	Year 1: 32 Year 2: 346 Year 3: 465	Total: 843
6	Total Number of Participants Enrolled in Further Education After TAACCCT-Funded Program of Study Completion	Year 1: 11 Year 2: 145 Year 3: 164 Year 4 (follow-up only): 134	Total: 454
7	Total Number of Participants Employed After TAACCCT-Funded Program of Study Completion	Year 1: 14 Year 2: 123 Year 3: 280 Year 4 (follow-up only): 148	Total: 565
8	Total Number of Participants Retained in Employment After Program of Study Completion	Year 1: 0 Year 2: 62 Year 3: 181 Year 4 (follow-up only): 193	Total: 436
9	Total Number of Those Participants Employed at Enrollment Who Received a Wage Increase Post-Enrollment	Year 1: 28 Year 2: 63 Year 3: 77 Year 4 (follow-up only): 42	Total: 210

*Assumes a grant start date of 10/1/14. 300+ students who enroll in fall 2014 are not included in outcomes.

Balance of Deliverables and Outcomes. CAMI deliverables, listed below in Table 3.2, reflect the total for the three-year TAACCCT grant term.

Table 3.2: CAMI Deliverables

Deliverable Category	Number
Number of colleges upgrading capital equipment for CAMI	3
Number of additional colleges attaining NIMS certification	5
Number of colleges attaining AWS certification	1
Number of new 3rd-semester certificate programs	6
Number of new competency-based and hybrid manufacturing Registered Apprenticeships	10
Number of new hybrid and/or online course curricula	10
Number of teaching faculty and educational assistants hired	25
Number of employers engaged in industry advisory councils	120

Deliverable Category	Number
Number of students receiving credits through PLA	50
Number of PLA credits awarded	400
Number of students taking online/hybrid courses	750
Number of students completing work-based internships	600
Number of students receiving tutoring	1,100

3.b. System for Tracking and Reporting Outcome Measures.

Existing Tracking Procedures. The Consortium will use existing data systems, metrics, and reporting protocols developed during the implementation of four USDOL Community Based Job Training Grants[51] and two current TAACCCT Grants.[52] For education-related data and measures, the Consortium will use Ellucian's Banner® Unified Digital Campus enterprise resource planning (ERP) solution. Banner® is one of the most widely used collegiate administrative suites of student, financial aid, finance, human resources, enrollment management, and advancement systems. A single instance of the Banner® Unified Digital Campus is centrally administered and maintained for CAMI Consortium members. Banner® captures six (#1-6) of the nine project outcomes.[53]

Sixteen professionals work daily with college staff in the areas of admissions, assessment, financial aid, registration, fee assessment, and continuing education, counseling and career services to support the Banner® system. The Project Director will manage progress reporting with support from the CAMI Research Analyst. Each of the seven primary CAMI colleges (those responsible for producing student outcomes) will designate one of its Educational Assistants (EAs) to assist their college's Manufacturing Coordinator with all data collection and reporting activities.

For employment-related data and measures, the Consortium holds an existing relationship with

[51] The 4 USDOL Community Based Job Training Grants are: 1) Career Pathways Initiative in Nursing and Allied Health (2005); 2) Bridges to Health Careers (2006); 3) Skills for Manufacturing and Related Technologies Initiative (2007), and; 4) Sustainable Operations: Alternative & Renewable (SOAR) Energy Initiative (2008).
[52] The 3 current TAACCCT grants are: 1) CT Manufacturing, Energy & Transportation (CT-MET) Initiative (2011); 2) Health and Life Sciences Career Initiative (HL-SCI) (2012); and 3) New Media Studies Center Initiative (NMSCI) (2012).
[53] The Consortium will create codes to track CAMI participants and participation in specific interventions including math/science boosters and online learning courses.

CTDOL to track employment, retention and earnings (outcomes 7, 8 and 9). The Board of Regents has the ability to receive wage records from CTDOL, thanks to recent State legislation. Grant funding will support additional investments in the P20 WIN (Preschool through 20 and Workforce Information Network) to utilize the P20 WIN framework for secure data sharing between CTDOL, the State Department of Education, and BOR/ConnSCU to track participants post-completion and allow for comparisons of wage data against participation in CAMI program components. CAMI will align tracking efforts with a new CTDOL Workforce Data Quality Initiative grant from USDOL.[54]

Plan to Address Gaps in Tracking. In addition to Banner® and wage match data, CAMI needs support to track deliverables and the progress of participants as they engage with Recruitment and Retention Coordinators, community college advisors, use PLA, begin courses of study, complete their credentials, and re-enter the workforce. CAMI will use grant funds to hire a Research Analyst to: a) design a database (e.g., online or Access) that tracks these project-specific data; b) coordinate data collection by the designated EA at each college (i.e., training EAs to use the database, developing data collection and reporting protocols and standards); and c) produce quarterly and annual reports and customized analyses to answer specific questions on CAMI services, deliverables and outcomes.

3.c. Using Data for Continuous Improvement.

Reviewing Outcome Data. CAMI leaders recognize the significance of operating in a 'results based accountability' climate[55], and have experience with multiple mechanisms and feedback loops to facilitate continuous improvement. Data reports and analyses will facilitate evidence-based decision making about adjusting CAMI initiatives to improve outcomes. Formal data reviews will

[54] The Workforce Data Quality Initiative grant will allow the state to continue work on a longitudinal database that will allow the state to conduct research and analysis to better determine the effectiveness of workforce and education programs and to develop tools that better inform customers about the benefits of the publicly-funded workforce system.
[55] The Connecticut legislature embraces a Results Based Accountability model. See www.raguide.org for details.

take place semi-annually at the level of the SAMAC, as facilitated by the Project Director, Research Analyst, and third-party project evaluator. Information on CAMI participants and progress on CAMI program components will be shared during these reviews. Industry and public workforce system partners will participate in these review sessions and provide perspectives on the development of new certificates, changes in preferred occupational competencies, and industry trends. Each college manufacturing coordinator and an Academic Dean from each primary CAMI college will also participate on the SAMAC, ensuring the immediate implementation of mid-course adjustments resulting from data reviews. Data from Banner®, the CTDOL wage tracking system, and the outcomes tracking database will enable analysis of how CAMI program services impact retention and completion rates, and time to completion. The SAMAC will develop formal recommendations for changes to CAMI components for consideration by the Project Director, BOR/ConnSCU, and Manchester Community College (MCC) President Gena Glickman. The Presidents of the CAMI colleges will receive semi-annual implementation updates.

More frequent informal updates will take place among the grant management team, including the BOR/ConnSCU Director of Advanced Manufacturing Centers, Project Director, Project Assistant, and Research Analyst. The Research Analyst will serve as the point person for the EA at each college assigned to lead their college's data collection and reporting efforts. Students will complete brief evaluation forms at the end of each course, creating a rich stream of feedback to shape the modification of existing and new courses. The Project Director will bring analyses of this data to the formal review sessions. The evaluation work plan also includes a range of mechanisms to facilitate data-driven decision making and program improvement (see Evaluation Plan for details).

Using Data to Inform Sustainability. CAMI leaders will utilize implementation and outcome data to help decide which strategies to sustain and to make the case for sustaining and expanding proven strategies. The deep support for advanced manufacturing training at the state and regional

levels (see section 2.d.) provides a strong foundation for sustaining successful CAMI efforts.

4. ORGANIZATIONAL PROFILE and PROJECT MANAGEMENT

4.a. Qualifications. As the Lead Institution, Manchester Community College (MCC) will hire a Project Director with at least a post-Bachelor's Degree and five years of experience leading large federal grant projects and/or major, publically-funded education institution initiatives. The Project Director will demonstrate supervisory experience and a track record of establishing organizational partnerships and joint ventures resulting in successful outcomes, as well as experience with the manufacturing sector. These qualifications ensure that the Project Director has: 1) direct experience managing the fiscal and performance reporting associated with public funding; 2) capacity to oversee an extended staffing structure; and 3) ability to lead and facilitate the SAMAC, Apprenticeship Workgroup, and diverse partners.

MCC will hire a Project Director within two months of receiving notice of an award, during which time Director of AMCs Tracy Ariel will coordinate grant start-up. Ms. Ariel manages and oversees the four AMCs through administration, strategic planning, outreach, and staff development and training. Through its extensive experience implementing federal grant projects (e.g., four CBJTGs, three TAACCCT grants), the BOR/ConnSCU system can quickly integrate new personnel to oversee grant initiatives.

MCC will hire a full-time Project Assistant and a full-time Research Analyst who will report to the Project Director. The Project Assistant will assist with reporting, meeting logistics and administrative functions, and will have a Bachelor's degree in communications, business management or a related field, and at least one year of experience in marketing, communications or higher education. The Research Analyst will develop data collection and assessment tools and protocols, and analyze outcome data (in collaboration with the third-party evaluator, as appropriate), and will have a Master's degree and at least one year of related experience. Finance staff (paid for

out of indirect funds) will have at least a four-year degree (preferably with a concentration in business, finance or accounting) and experience with federal fiscal reporting requirements.

The four AMC Consortium community colleges (Asnuntuck, Housatonic, Naugatuck Valley, and Quinebaug Valley), Middlesex and Three Rivers have existing manufacturing program coordinators (leveraged resources) who will lead local grant start-up and implementation efforts with substantial support from Academic Deans (who also participate on the SAMAC and regional Industry Advisory Councils). Manchester will hire a manufacturing program coordinator to oversee the expansion of its program. COSC Provost Shirley Adams will oversee COSC grant activities.

MCC will enter into a Memorandum of Understanding with each Consortium member to identify each party's responsibilities, outcomes and deliverables towards the overall success of the grant, as well as provide the Consortium member's grant budget. The MOU will include any federal, state and local regulations that govern the grant such as 29 CFR Part 95 and cost principles identified in OMB Circular A-21. Each Member Institution will submit quarterly reports including narrative information, data and fiscal invoices. The Project Director will provide a schedule and templates for reports. The Project Director and grant staff will use Consortium college reports and data to develop Consortium quarterly and annual narrative and fiscal reports which provide a holistic picture of the Consortium's progress.

The Project Director will communicate with USDOL on behalf of the Consortium, and will share information and technical assistance from the TAACCCT National Office and Federal Project Officer with Member Institutions. The Project Director, working with BOR fiscal staff, will monitor Consortium member sub recipients. The Project Director will track programmatic and fiscal progress and implement continuous improvement strategies involving all Consortium members.

4.b. Management Structures. The CAMI Consortium includes all 12 Connecticut Community Colleges and one Connecticut State College. MCC will serve as the Consortium's lead

programmatic and fiscal agent. See the attached Organizational Chart.

MCC President Gena Glickman will lead overall project implementation, and report to BOR President Dr. Gregory W. Gray. The Project Director will organize daily work flows necessary for the successful implementation of the Initiative, and will report directly to President Glickman. MCC's management team, headed by the President, will collaborate with the other Consortium colleges on programmatic and fiscal matters. MCC will also work with ConnSCU staff to leverage existing expertise in administrative, financial, information technology, procurement, legal, and research/planning functions. This dual management structure, which leverages the capacity and experience of both the lead college and BOR/ConnSCU, replicates a successful approach utilized and refined in several previous statewide grant projects, and will ensure the programmatic, fiscal, and administrative progress of Consortium members during the grant and during the AMC Initiative sustainability phase.

The existing Statewide Advanced Manufacturing Advisory Committee (SAMAC) will serve as the CAMI leadership team to provide high-level oversight. The SAMAC meets monthly and consists of Academic Deans and AMC Coordinators from each AMC college, 10 manufacturers, two WIBs, the Technical High Schools, the CTDOL OAT, and other stakeholders. SAMAC membership will expand to include manufacturing program coordinators and Academic Deans from Manchester, Middlesex, and Three Rivers, and employers involved in new third-semester specialty areas (e.g., additive manufacturing, metal fabrication) to ensure relevant industry input.

The SAMAC will convene an Apprenticeship Workgroup to provide guidance to CTDOL OAT efforts to develop competency-based and hybrid manufacturing Registered Apprenticeships for high-demand manufacturing occupations. This Workgroup will support the completion by CTDOL of the first new Registered Apprenticeships by the end of Year 1, and will work in Years 2 and 3 to develop additional Registered Apprenticeships and to evaluate and recommend adjustments to new

programs with significant input from employers.

4.c. Systems and Processes. As noted above, BOR/ConnSCU institutions use Ellucian Higher Education's Banner® Unified Digital Campus enterprise resource planning (ERP) solution for financial and performance reporting. Banner®, along with a dual management structure that leverages the strengths of BOR/ConnSCU and MCC, will enable timely and accurate financial and performance reporting.

MCC served as the lead institution for two USDOL Community-Based Job Training Grants between 2006 and 2010, *The Career Pathways Initiative in Nursing and Allied Health* ($2.1 million total), and *Bridges to Health Careers* ($2.1 million). MCC submitted all quarterly and final narrative and fiscal reports on time, and USDOL commended MCC on the level of detail in the reports.

All Consortium members will follow established federal procurement standards (29 CFR Part 95), state, and local procurement requirements on behalf of the grant. All purchases will be deemed reasonable, allowable and allocable to the grant and will be procured through an open and transparent process. State and local procurement policies dictate whether an informal or formal bid process will be completed. Consortium member representatives and BOR/ConnSCU will serve on evaluation committees. MCC will transfer this accountability to all Consortium members through terms and conditions stated in internal MOUs. All procured Personal Services Agreements above $3,000 must be approved by the State's Attorney General's Office. All purchases on behalf of the grant must be approved by either the Project Director or an approved signatory at the Member Institutions. All approved purchase orders, coded to a system-wide fund code specifically established for this grant, will be generated in the Ellucian's Banner® Unified Digital Campus Finance module.