

**AC 2008-1651: A PROCESS MAP FOR STATE-WIDE ENGINEERING  
TECHNOLOGY /MANUFACTURING TECHNOLOGY CURRICULUM REFORM**

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# **A Process Map for Statewide Engineering Technology /Manufacturing Technology Curriculum Reform**

## **Abstract**

Over the period of three years, FLATE, the National Science Foundation-funded Florida Advanced Technological Education Center for Manufacturing, has undertaken reform of Florida's Associate in Science (A.S.) and Associate of Applied Science (A.A.S.) degrees associated with manufacturing and related technologies. This reform has resulted in a statewide degree in Engineering Technology with a common technology core, based on a national certification, and five specialization tracks to meet local needs.

There are a number of benefits to this change or consolidation of Engineering Technology 2-year programs in Florida. These include: 1) A degree program that meets manufacturers' skills and knowledge competencies related to foundational skills in engineering technology. 2) All Community Colleges in the State can market jointly to students and industry employers with a common degree program and certification; 3) Completion of the common technology core creates a portable completion point that allows students to transfer within the community college system to an institution with their desired specialization; 4) The national certification utilized, MSSC's Certified Production Technician (CPT), assesses a student/worker's foundational skill and knowledge in four broad areas common to all manufacturing sectors: Manufacturing Processes and Production; Quality Assurance; Maintenance Awareness; and Safety. This certification is portable across manufacturing sectors and has been defined by industry; 5) Selecting the MSSC competencies to inform and anchor the curricular frameworks of the degree core allows currency, precision, relevance and abundant competencies; and, 6) The utilization of a national certification to inform the as a curricular framework common technology core has enabled the creation of a statewide articulation pathway from the secondary system, technical schools and incumbent worker training programs into the new degree.

The multi-year process through which FLATE worked to outline, analyze, evaluate, and change the statewide system based on national standards and assessments, as well as students' abilities and needs required engagement of essential stakeholders through out the state, including but not limited to: Florida's Community Colleges, Florida Department of Education, Manufacturers, Workforce Florida, State and Regional Manufacturers Associations, and Economic Developers. Presented herein is the process map for facilitating this reform via review of existing frameworks, coordinating the statewide curriculum team, hosting workshops, soliciting industry input, selection of national certification, developing the new frameworks for the engineering technology core courses, and institutionalization within the Department of Education. The process for conducting this reform could be applied to any technical career cluster to facilitate relevant degree programs and articulation pathways.

## **A Need for Change**

When speaking at the Advanced Manufacturing Workforce Conference at Los Angeles Valley College in Los Angeles, California, in October 2007, Northrop Grumman Corporate Vice President and Chief Human Resources and Administration Officer Ian Ziskin stated “The future is a high tech one. But it’s a double edged sword for companies like mine and many others you work with every day. Our dependence on trained, educated, technical workers will only grow, but the demographic trends indicate the supply of such workers is going to shrink.”<sup>1</sup> Throughout the nation workforce trends are indicating that the need for a skilled workforce is on the rise. Looking at the policy information report from ETS, “America’s Perfect Storm, Three Forces Changing Our Nation’s Future”<sup>2</sup> the following trends are drastically going to change our workforce unless we take action to address them:

- Inadequate literacy and numeracy skills among large segments of our student and adult populations,
- An ongoing shift in the demographic profile of our population, powered by the highest immigration rates in nearly a century,
- The continuing evolution of the economy and the nation’s job structure, requiring higher levels of skills from an increasing proportion of workers.

These national trends align with what is occurring at the state level. In Florida, Nancy Stephens the Executive Director of the Manufacturers Association of Florida presented the following statement to the state’s legislature, “Addressing the needs for skilled workers is a required, competitive and survival strategy for most manufacturers.” If these needs are not met we will see the

- Eventual erosion of our manufacturing base,
- Losing billions in business to other countries,
- Decline of middle class,
- Loss of economic diversification.

Based on this type of demand, the educational community is at a crossroads that prompts a call for action, much like the quote from Horace Mann, “We can either stand by and wait to see what will happen or we can take decisive actions to make the right things happen.” In Florida, FLATE, the National Science Foundation-funded Florida Advanced Technological Education Center for Manufacturing, has responded by undertaking the reform of Florida’s Associate in Science (A.S.) and Associate of Applied Science (A.A.S.) degrees associated with manufacturing and related technologies. When analyzing the state of programs that should be providing the advanced manufacturing workforce FLATE determined the following issues<sup>3</sup>:

- Some of the curricular frameworks that, in principle, inform the outcomes of manufacturing related A.S. and A.A.S. degrees, which may potentially address many of the high skills required by manufacturers, are outdated, some by 15-20 years.
- Manufacturers are concerned about the lack of a qualified labor force in the State of Florida. They have voiced their concerns to the State. This is also a national crisis. “Eighty-one percent of the respondents to the 2005 Skills Gap Survey of the American Manufacturing Workforce (Deloitte and the Manufacturing Institute, 2005<sup>4</sup>) said they couldn’t find qualified employees to fill their open positions.”

- Community Colleges are not currently addressing all of the needs of manufacturers for qualified personnel (for lack of communication, inadequate offering or inadequate timing or limited graduates).
- There is limited or, at best, inefficient communication between the manufacturing sector and the community college sector at a state-wide level on workforce education and training issues.
- It seems difficult for manufacturers to know what competencies community college graduates bring, given the nine different manufacturing related degree options, varying course names and descriptions.
- There does not appear to be clearly defined positions (and career pathways) for A.S. and A.A.S. graduates to assume in the industry, and therefore, the level of compensation for such graduates is also unclear and/or unknown.
- New guidelines from both the Federal (Perkins IV) and the State (Florida Department of Education and Workforce Florida) levels are moving technical programs in alignment with nationally recognized industry certification.

### **Break Down the Silos**

The Florida Community College system is representative of an educational system in which each college is independent, but at the same time, affiliated by a statewide governing board and operating within a geographically defined service area. Although within such a structure there is greater institutional significance, there also exist challenges associated with independence. The state sets a low limit for resources to the community college system and fails to strongly support collaborations among institutions/faculty. Additionally, industry does not recognize the politically set geographic boundaries of school and college districts when looking for its skilled and trained workforce. As a result, individual community colleges fall short of meeting the expectations of local industry.

In order to effect statewide change, in these geographically disperse silos of education, a mechanism was needed to gather the colleges together in a non-competitive collaborative environment. Fortunately for the Florida process, there was an existing organization of community colleges focused on technical education, the “Florida Engineering Technology Forum” (ET Forum). A cohort of community colleges formed the ET Forum in 1996 as an outgrowth of a statewide review of all engineering technology related programs. Following this activity, the participants agreed to meet periodically to network, exchange ideas, discuss issues, share professional development opportunities, and review policy and procedure updates from the Florida Department of Education Division of Career and Technical Education. This existing statewide forum provided platform FLATE needed to morph the group from a loosely connected group without a strong mission to a focused and organized vehicle for change in career and technical education in Florida. This was accomplished by respecting the need for individual colleges local needs while focusing on the statewide outcomes, continually involving professionals from the Department of Education and industry, requesting information on upcoming policy and procedural changes and making sure that the Forum had a chance to submit its position on such issues.

## The Process

First a core team of subject matter experts was formed from the ET Forum participants. This core group of educators from the partner community colleges formed the basis of the team that worked with FLATE to undertake the reform. The team started by adopting the following set of guiding principles: The educational system must create a rigorous and relevant curriculum that:

- Meets industry competency requirements,
- Aligns with industry certification,
- Presents consistent offerings,
- Contains articulation pathways,
- Includes true business involvement,
- Addresses employability & life skills.

Based on these principles the team set out to determine the stakeholders program requirements, evaluate the existing program frameworks, establish a list of national industry recognized certifications relevant to the programs, and write a new framework that could be adopted statewide. The process map in Figure 1 presents the workflow required to accomplish these tasks.

In the first task as a team (first decision block in Figure 1), the team sought stakeholder input to determine desired program competencies and then cross referenced them verses the existing program frameworks. This task served two purposes: 1) it allowed the partner colleges to understand where industry felt the existing programs were working and where they fell short. 2) It allowed the industry stakeholders to see how competencies are formatted and serve to inform program frameworks. To accomplish this task, each of the existing frameworks were reformatted into a survey instrument and distributed to the industry stakeholders statewide. Each company was asked to respond to one or more of the framework surveys as they applied to their particular business and employee needs. FLATE compiled all of this information and data to guide the rest of the reform process and to use as the validation for the final state curriculum framework proposal for the new degree.

Next the relevant industry certifications were determined (second decision block in Figure 1). Here the team assembled a list of relevant industry certifications that aligned with the post-secondary academic programs and the state's targeted occupation list. First the industry stakeholders were surveyed to identify occupations critical to their industry and cross industries. Then by considering these occupations, industry representatives were asked what certifications are most relevant to their business and why. If no industry certifications exist, are there other existing state or association certifications that might serve as a basis for the development of a nationally-recognized industry credential? These certifications were then compiled into a ranking and the top 2 were chosen to move forward for analysis and alignment.

Next the results from the industry stakeholders' framework analysis were mapped into the identified industry certifications and where there was alignment; competencies were compiled into a degree core (decision blocks 3 & 4). The most relevant industry certification was determined from this mapping process and future program definition was aligned with this certification. By selecting an industry certification to inform and anchor the program core

allowed for currency, precision, relevance, abundant required competencies, and possible articulation pathways. In this specific reform process, the Manufacturers Skills Standards Council (MSSC) Certified Production Technician (CPT) certification was chosen. This certification assesses a student/worker's foundational skill and knowledge in four broad areas common to all manufacturing sectors: Manufacturing Processes and Production; Quality Assurance; Maintenance Awareness; and Safety. It was determined to be the certification in greatest alignment with the core needs identified by the industry stakeholders. Next, having identified the certification, the team then carefully mapped the certification's core competencies into a program framework. This program framework defined the common technical core of the new degree, the Engineering Technology Core (ET Core). By establishing this core as a foundation, the new degree meets the needs of diverse industries in geographically dispersed areas of the state and provides the community colleges the opportunity to present a truly statewide program.

The next phase required that the community colleges define the core classes (actions aligned with decision block 5). These core courses would be required of all the degree specializations. Additionally, it was desired that the ET Core not only provide a strong technical background, and be exciting to new students, but that it also provide sufficient instruction in the certification competencies that a student taking the ET Core would be well prepared to pass the certification's exams. Completion of the common ET Core creates a portable completion point that allows students to transfer within the community college system to an institution with their desired specialization. Following the definition of the core courses, the actual student proficiencies had to be defined in the state format for curriculum frameworks. FLATE developed a draft of the core frameworks that it reviewed with the curriculum team. The group made suggestions that were incorporated. The revised Core frameworks were reviewed again by the working group and then incorporated in the final program.

The next stage requires that one community college or a team of colleges prepare the frameworks for the specializations (actions aligned with decision block 6). This required grouping of the remaining stakeholder-defined competencies into specific program tracks. These program tracks allow a community college to offer advanced education degree specializations and certificates that meet the needs of their local stakeholders while building on the common ET Core. While defining the degree specializations, the team considered that the specializations needed to be different enough to warrant their own degree track, but common enough to fit under one unified degree. Upon consensus of the specialization tracks, the team members with the most expertise in those disciplines undertook the drafting of the specific frameworks and recommendation of the courses that could be used to meet them. In this specific reform process, the following specialization tracks were created: Advanced Manufacturing, Advanced Technology, Electronics, Mechanical Fabrication and Design, and Quality. Each specialization track's framework were reviewed by the working group and then finalized.

Lastly to meet the requirements of the State Department of Education, the ET Core frameworks were married with the specialization tracks' frameworks and submitted as a package. This multi-track format was new to the Department of Education and by working with the administrators in the Division of Career and Technical Education; FLATE has developed a strategy for organizing the program application in a format that was acceptable to the FL DOE. The resulting degree in

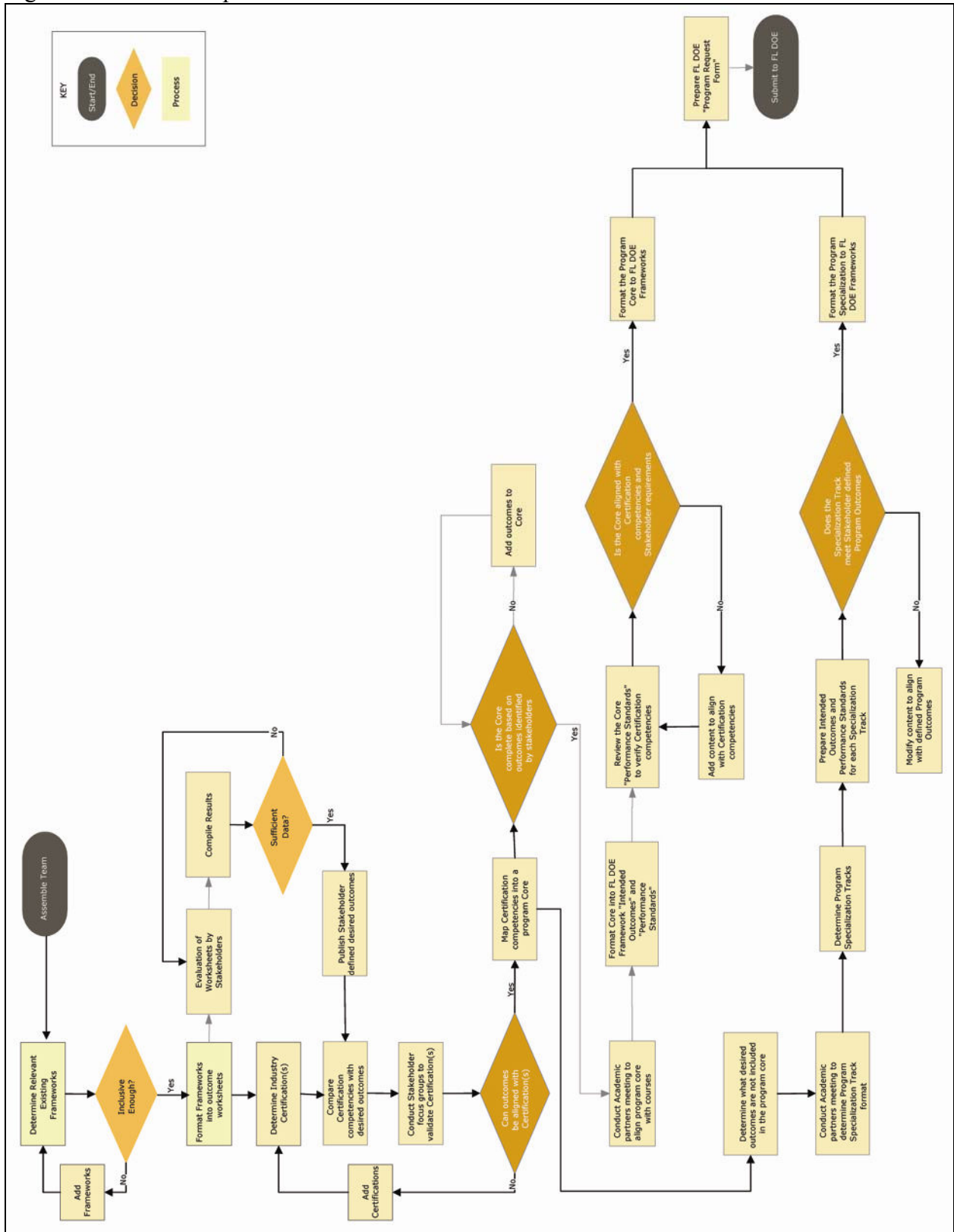
Engineering Technology is truly a statewide degree, with a common technology core, based on a national certification, and five specialization tracks to meet local needs. Students have multiple entry and exit points, the opportunity to earn college certificates aligned with the specializations, and ultimately earn an A.S. or A.A.S. degree in Engineering Technology with a specialization in their area of interest.

## **Conclusion**

There are a number of benefits to this change or consolidation of Engineering Technology 2-year programs in Florida. These include: 1) A degree program that meets manufacturers' skills and knowledge competencies related to foundational skills in engineering technology. 2) All Community Colleges in the State can market jointly to students and industry employers with a common degree program and certification; 3) Completion of the common technology core creates a portable completion point that allows students to transfer within the community college system to an institution with their desired specialization; 4) The national certification utilized, MSSC's Production technician Certification, assesses a student/worker's foundational skill and knowledge in four broad areas common to all manufacturing sectors: Manufacturing Processes and Production; Quality Assurance; Maintenance Awareness; and Safety. This certification is portable across manufacturing sectors and has been defined by industry; 5) Selecting the MSSC competencies to inform and anchor the curricular frameworks of the core allows currency, precision, relevance and abundant competencies; and, 6) The utilization of a national certification to inform the as a curricular framework common technology core has enabled the creation of a statewide articulation pathway from the secondary system, technical schools and incumbent worker training programs into the new degree.

The multi-year process through which FLATE worked to outline, analyze, evaluate, and change the statewide system based on national standards and assessments, as well as students' abilities and needs required engagement of essential stakeholders through out the state, including but not limited to: Florida's Community Colleges, Florida Department of Education, Manufacturers, Workforce Florida, State and Regional Manufacturers Associations, and Economic Developers. The process map presented above for facilitating this reform utilized: review of existing frameworks, coordinating the statewide curriculum team, hosting workshops, soliciting industry input, selection of national certification, developing the new frameworks for the engineering technology core courses, and institutionalization within the Department of Education. This process for conducting this reform was applied in Florida to create the new Engineering Technology degree in support of manufacturing and related industries, but could be applied to any technical career cluster to facilitate relevant degree programs and articulation pathways.

Figure 1 – Process Map





## References

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