Fl Manufacturer & College Technician Expectations

"Conference to Explore the Impact of Future of Work Issues on Technician Education in Florida"

(DUE 1939173)

FLORIDA FLATE
part of the FloridaMakes network
ADVANCED TECHNOLOGICAL EDUCATION CENTER

HI-TEC

FLORIDA DEPARTMENT OF EDUCATION
fldoe.org

FLATE
Advanced Technological Education

NIST
MANUFACTURING EXTENSION PARTNERSHIP

A National Science Foundation Center of Excellence

FLORIDA FLATE
Advanced Technological Education Center

Part of the FloridaMakes network

Marilyn Barger: FLATE

Richard Gilbert: FLATE (USF)

FLORIDA
FLATE
ADVANCED TECHNOLOGICAL
EDUCATION CENTER

part of the
FloridaMakes
network

FLORIDA DEPARTMENT OF EDUCATION
— fldoe.org

FLATE
Advanced Technological Education

NIST
MANUFACTURING EXTENSION PARTNERSHIP

A National Science Foundation Center of Excellence

FLORIDA
FLATE
Advanced Technological
Education Center

Part of the
FloridaMakes
network

Future of Work Issues for Florida 2-Year Engineering Technology Program

tech·ni·cian

Noun:

A person employed to look after technical equipment or do practical work.

An expert in the practical application of a science.

A person skilled in the technique of an art or craft.

Manufacturing Production Technicians:

Use combinations of electrical, electronic, mechanical, hydraulic, pneumatic, or computer technologies to:

Set up, test, adjust, monitor, maintain, and troubleshoot manufacturing machinery or equipment.

Monitor and adjust production processes or equipment for quality and productivity.
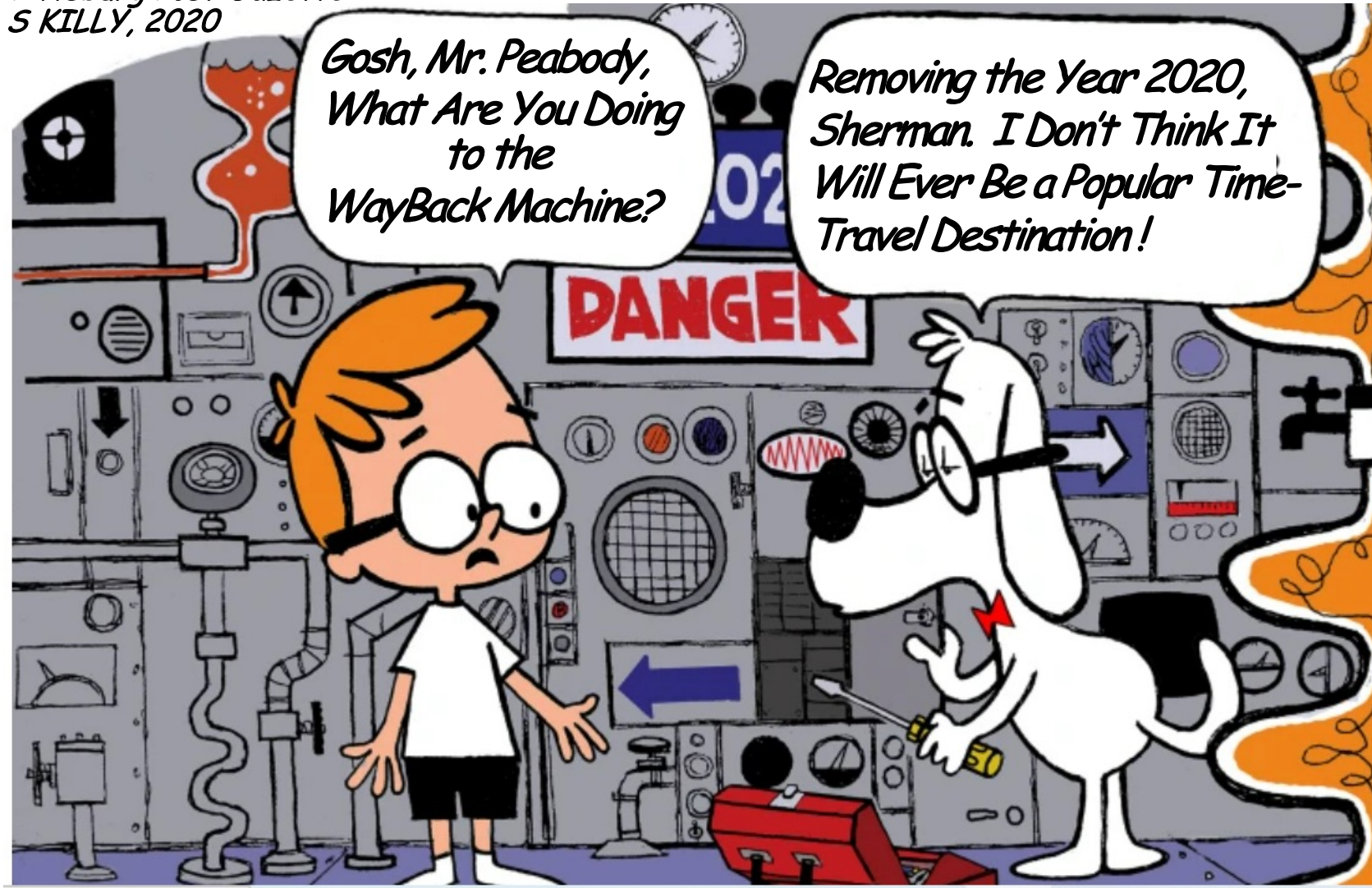
This specific slide was not funded by the National Science Foundation. Its content/opinions are solely those of Mr. Peabody.

"How Ya Gonna Keep 'em Down on the Farm After They've Seen Paree?"

"How Ya Gonna Keep 'em Down on the Farm After They've Seen Paree?"
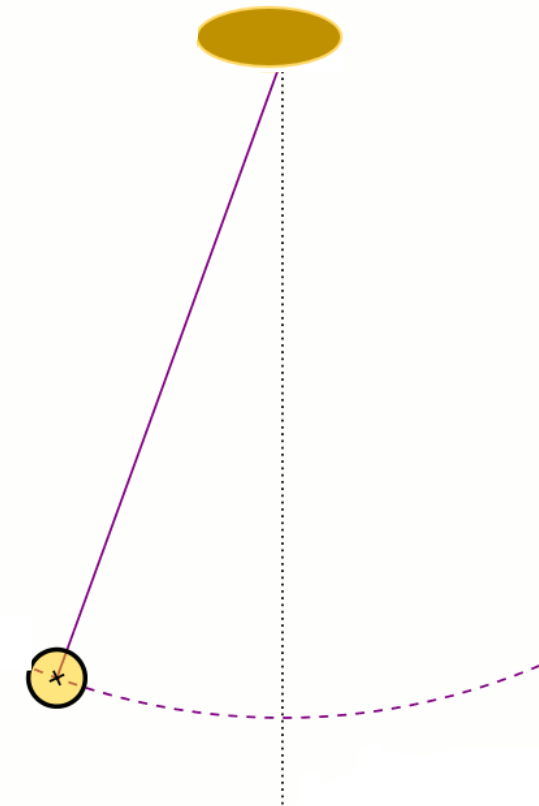
1947

Moving our mind set to Florida, "back on the farm" didn't really come up until after the Korean War.

The Industrial/Military Complex becomes a permanent fixture in Florida's economy.

NASA is established in Florida.
 (thank you! Jules Verne)

State shifts economic incentives to Citrus and Tourist Industries. (late 1970's)

The Industrial/Military Complex becomes a permanent fixture in Florida's economy.
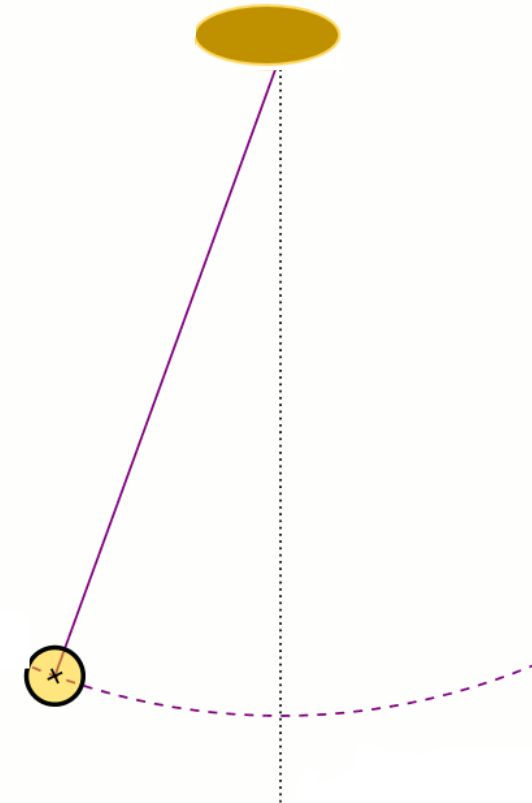
NASA is established in Florida.

State of Florida shifts economic incentive to Citrus and Tourist Industries.

WWII veterans retire (late 1970's)

USF & UF expand Engineering Technology B.S. programs (early 1980's).

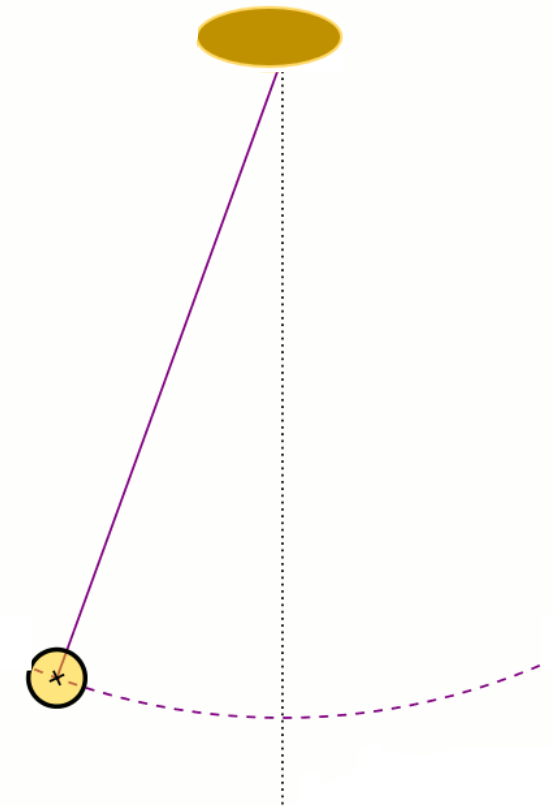**USF & UF Engineering Technology B.S. programs meet demand (early 1990's).**

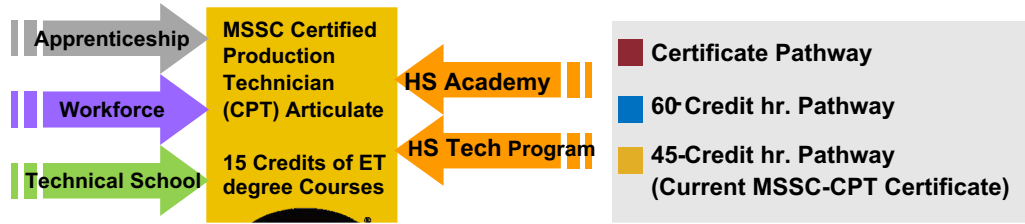**USF & UF shift to research focus & close or deemphasizes ET B.S. programs (mid 1990's).**

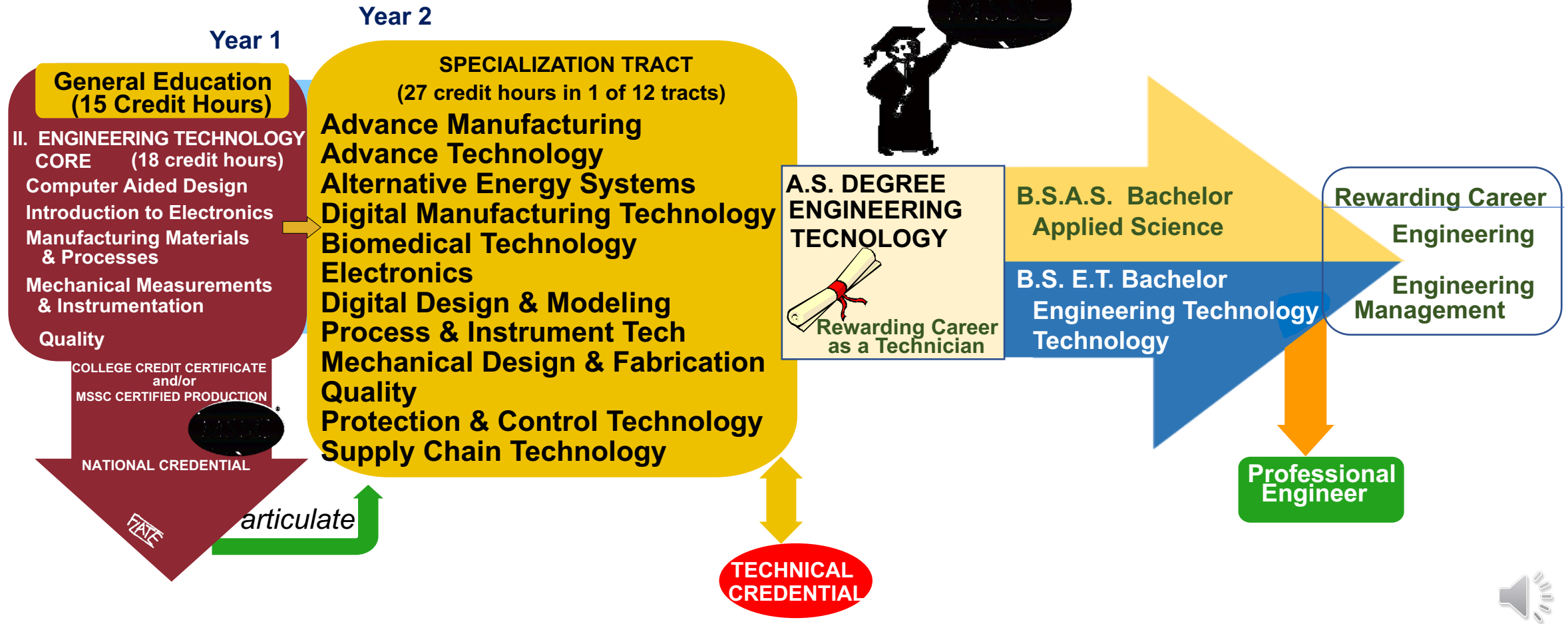**NSF begins to Invest in Rebuilding Fl's ET Education Infrastructure (2004).**

A National Science Foundation Center of Excellence

Engineering & Technology Expectations

ET Specialization	Colleges & Location
Advanced Manufacturing (Mechatronics)	**Broward College- Coconut Creek** **Chipola Sate College- Marianna** **College of Central Florida- Ocala** **Daytona State College- Daytona** **Eastern Florida SC- Cocoa, Palm Bay** **Florida State College- Jacksonville** **Gulf Coast SC- Panama City** **Hillsborough CC- Brandon** **Miami Dade Colleges- Miami *** **North Florida College- Madison** **Palm Beach SC- Palm Beach Gardens** **Pasco Hernando SC- New Port Richey** **Pensacola SC- Pensacola** **Polk SC- Lakeland** **St. Johns River SC- Orange Park** **St. Petersburg College- St Pete** **Seminole SC- Sanford** **South Florida SC- Avon Park** **Tallahassee CC- Tallahassee** **Valencia College- Orlando**

ET Specialization	Colleges & Location
Advanced Technology	**Eastern Florida SC- Cocoa, Palm Bay** **Northwest Florida SC- Niceville** **Palm Beach SC- Palm Beach Gardens**
Alternative Energy	**College of the Florida Keys- Key West** **Gulf Coast SC- Panama City** **Palm Beach SC- Palm Beach Gardens** **State College of Florida- Venice**
Biomedical Systems	**Broward College- Coconut Creek**
Digital Design and Modeling	**Daytona SC- Daytona** **Northwest Florida SC- Niceville** **State College of Florida- Venice** **St. Petersburg College- St Pete**
Digital Manufacturing	**Gulf Coast SC –Panama City** **Miami Dade College- Miami *** **Northwest Florida SC- Niceville**

* Offers College Credit Certificates under ET, but not A.S.ET

ET Specialization	Colleges & Location
Electronics	Broward College- Coconut Creek College of Central Florida- Ocala Daytona SC- Daytona Eastern Florida SC- Cocoa, Palm Bay Gulf Coast SC –Panama City Northwest Florida SC- Niceville Palm Beach SC- Palm Beach Gardens Pensacola SC- Pensacola State College of Florida- Venice St. Petersburg College- St Pete
Mechanical Design and Fabrication	Northwest Florida SC- Niceville Pensacola SC- Pensacola Polk State College- Lakeland
Protection & Control Technology	Lake Sumter SC- Sumterville

ET Specialization	Colleges & Location
Quality	College of Central Florida- Ocala St. Petersburg College- Clearwater
Supply Chain Automation	College of Central Florida- Ocala St. Petersburg College- Clearwater

State Colleges are designated by the white stars in the blue circles.

"Future of Work Issues for Florida Two Year Engineering Technology Program"

- **133 Manufacturers**

- **26 State Colleges**

White star in blue circle
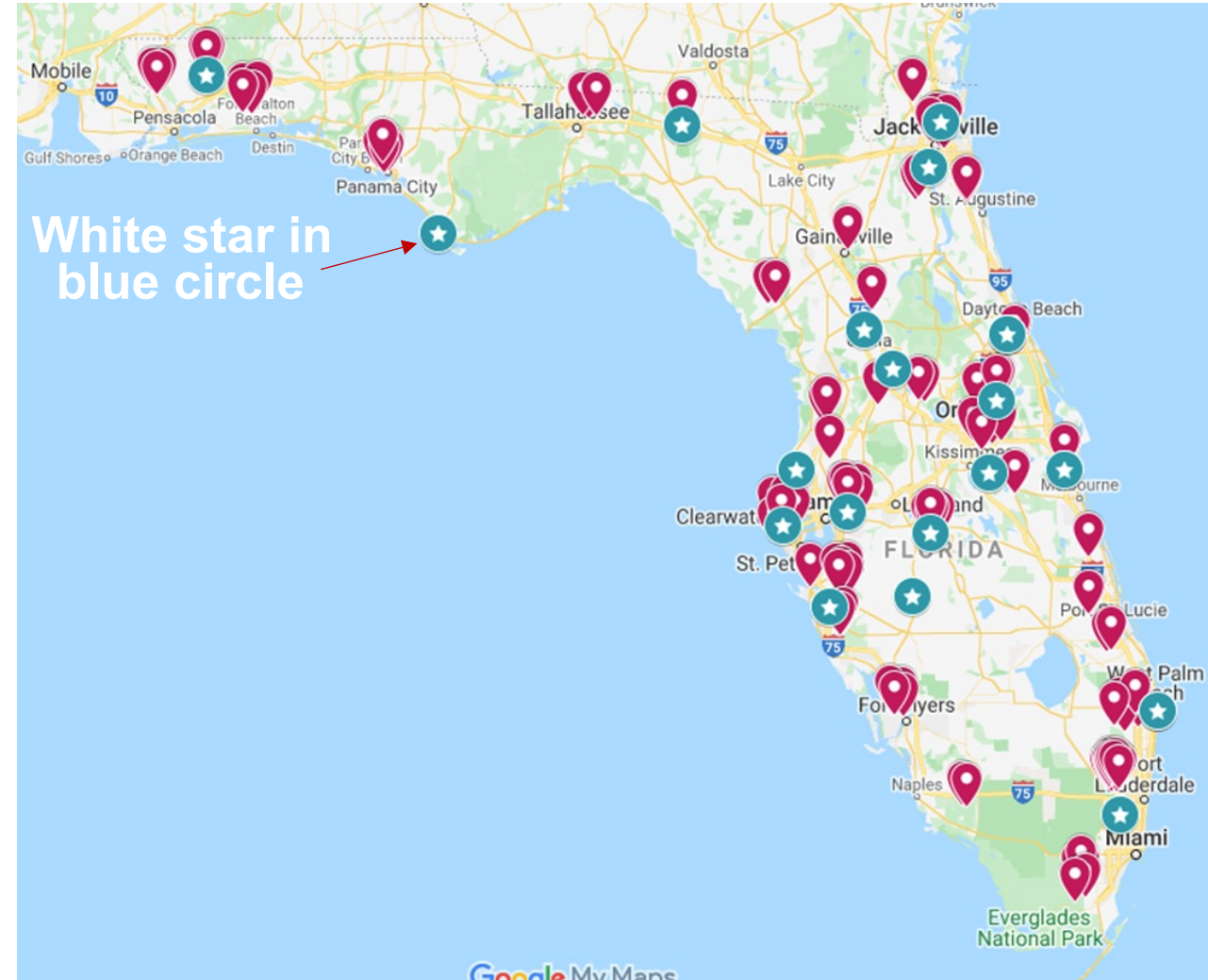
A.S. Engineering Technology Core Courses		A.S. ET Advanced Manufacturing Specialization	
Engineering Graphics	*EGN 1111*	*Automation Process Control*	*ETS 1535*
Industrial Safety	*ETI 1720C*	*Hydraulics and Pneumatics*	*ETS 1700*
Instrument Techniques and Measurements	*ETI 1151*	*Industry Applications Using PLCs and Robotics*	*ETS 1540*
Introduction to Quality Control	*ETI 1117*	*Introduction to PLCs*	*ETS 1542*
Microcomputer Applications	*CGS 1100*	*Mechanical Devices and Systems*	*ETM 2401*
Survey of Electronics	*EET 1084*	*Motors and Controls*	*ETS 1843*

Courses taught at all 23 state colleges offering the A.S. ET degree

Courses taught at the College of Central Florida.

Future of Work Issues for Florida Two Year Engineering Technology Program

Industry 4.0 technologies:

Autonomous Robots

Simulation

Horizontal/Vertical Integration

Industry Internet of Things

Cybersecurity

The Cloud

Additive Manufacturing

Augmented Reality

Big Data and Analysis

Industry 4.0 Technologies
Boston Consulting Group
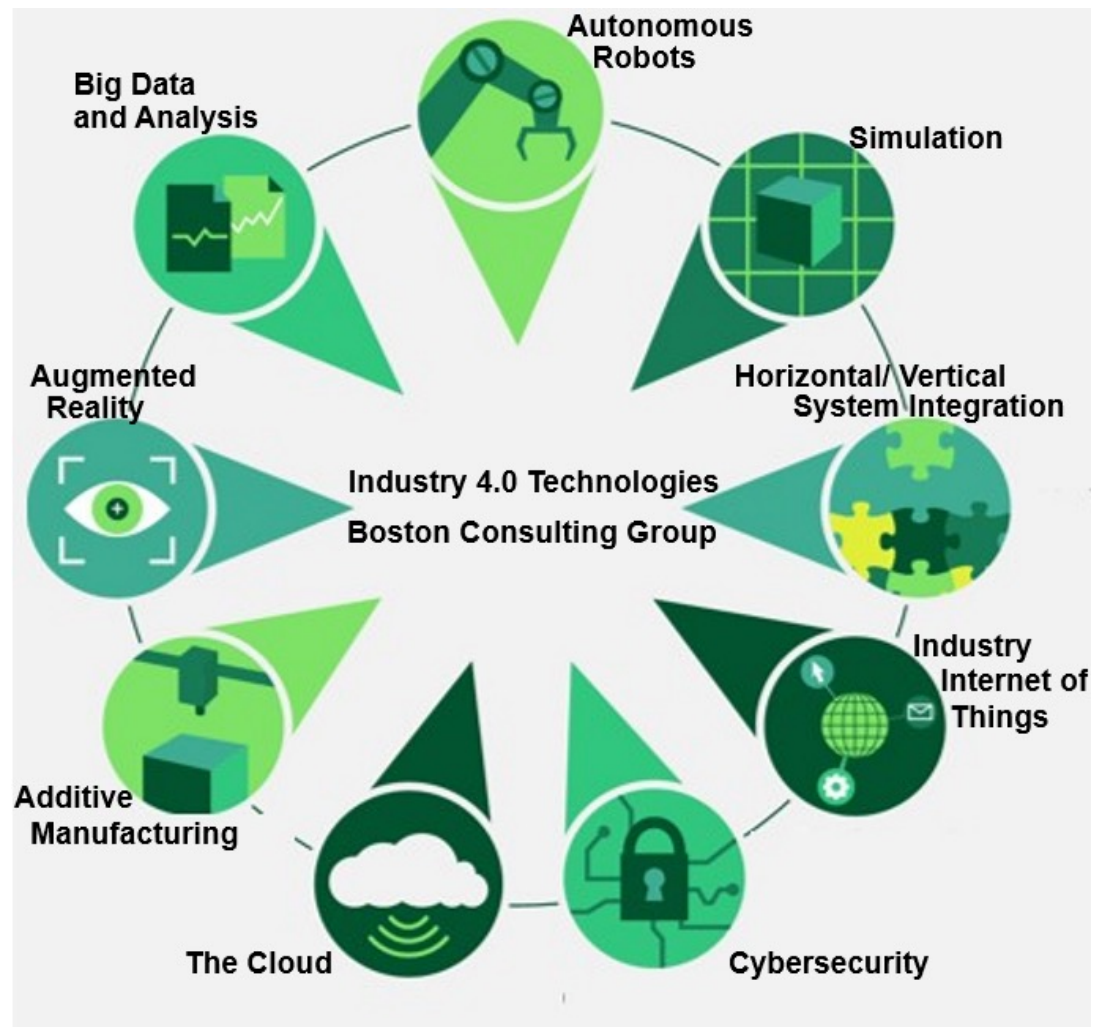
Caucus Identified Boston Consulting Group Technologies
Skills Groupings Important for Technicians

BCG I4.0 Technology	Caucus Identified Skill	Technology	Caucus Identified Skill
Autonomous Robots:	Programming System Integration Repair	**Industry Internet of Things**	Ethernet Communication (M2M) Record and Store Data
Additive/ Subtractive & Advanced Materials	3D CAD & Printing Prototyping CNC Programming Precision Manufacturing Fabrication Testing (destructive/ non-destructive)	**Simulation**	Compare Process Alternatives & Identify Effects on Process Response to Change Participate in Developing Existing New/ Operations

Caucus Manufacturers and Faculty Participant Skill Sets Ranking

Mfg.	Faculty		Boston C Group
51%	12%	Participate in Existing & New Product Development	Simulation
42%	36%	Fabrication	Additive / Subtractive
39%	40%	Perform Root Cause Analysis	Simulation
39%	48%	CNC Programming	Additive / Subtractive
38%	56%	System Integration	Autonomous Robots
36%	60%	3D CAD & Printing, Prototypes	Additive / Subtractive
36%	24%	Participate in Planning & Evaluation Processes	Simulation
34%	52%	Programming	Autonomous Robots
33%	48%	Precision Machining	Additive / Subtractive
30%	20%	Recommend New Situations and their Effects on Process Response	Simulation

Boston Consulting Group:
Technologies Skills

Skill	Manufacturers	Colleges
Programming	34%	52%
System Integration	38%	56%
Repair	15%	24%

Simulation;

Skill	Manufacturers	Colleges
Perform Root Cause Analysis	39%	40%
Participate in Planning & Evaluation Processes	36%	24%
Compare & Contrast Process Alternative	24%	20%
Recommend new situations & their effects on process response to change	30%	20%
Participate in developing existing & new products & operations	51%	12%

Industrial Internet of Things;

Skill	Manufacturers	Colleges
Ethernet Communication (M2M); Record and store data	22%	12%

Additive/Subtractive & Advanced Materials;

Skill	Manufacturers	Colleges
3D CAD and printing/prototyping	36%	60%
CNC programming	39%	48%
Precision Manufacturing	33%	48%
Fabrication	42%	36%
Testing (destructive /non-destructive	30%	20%

% Agreement
% Agreement

(133 Manufacturers)   **(21 Colleges)**

Industry related skills gap

Boston Consulting Group:
Technologies
Skills

Autonomous Robots;
Programming — 34% | 52%
System Integration — 38% | 56%
Repair — 15% | 24%

Simulation;
Perform Root Cause Analysis — 39% | 40%
Participate in Planning & Evaluation Processes — 36% | 24%
Compare & Contrast Process Alternative — 24% | 20%
Recommend new situations & their effects on process response to change — 30% | 20%
Participate in developing existing & new products & operations — 51% | 12%

Industrial Internet of Things;
Ethernet Communication (M2M); Record and store data — 22% | 12%
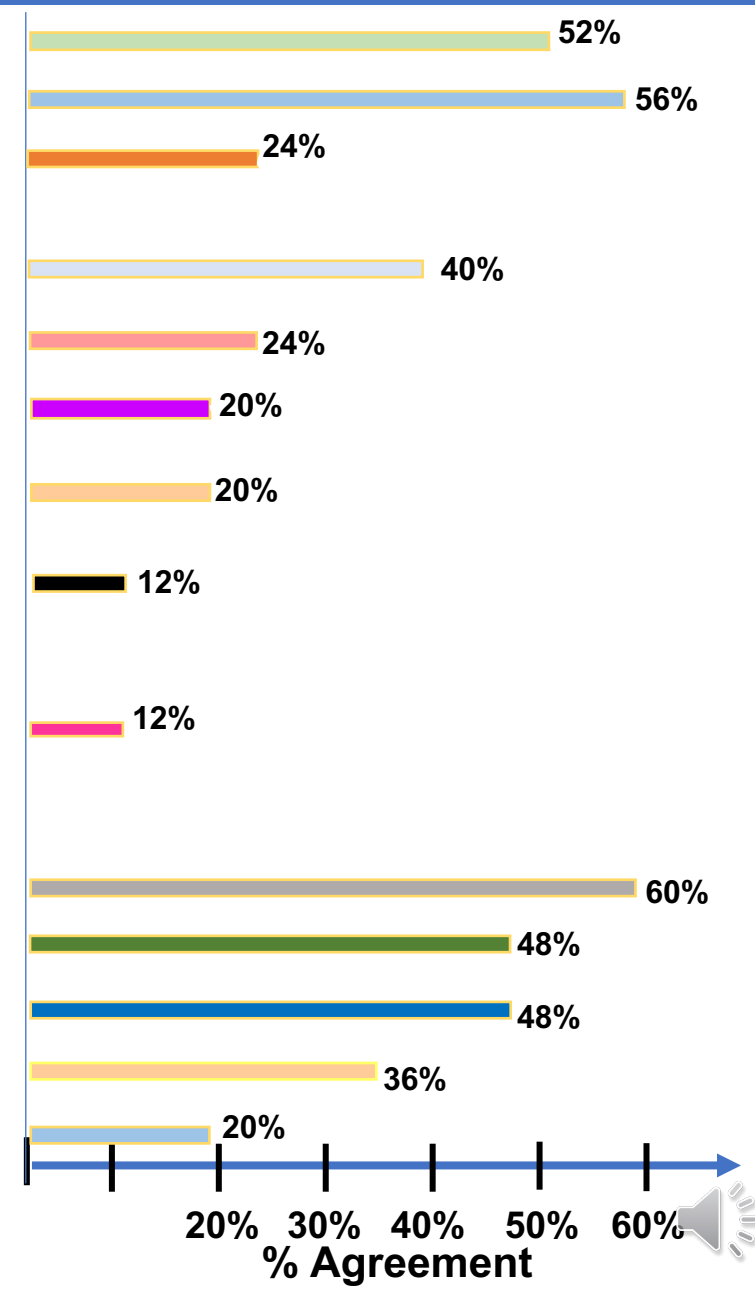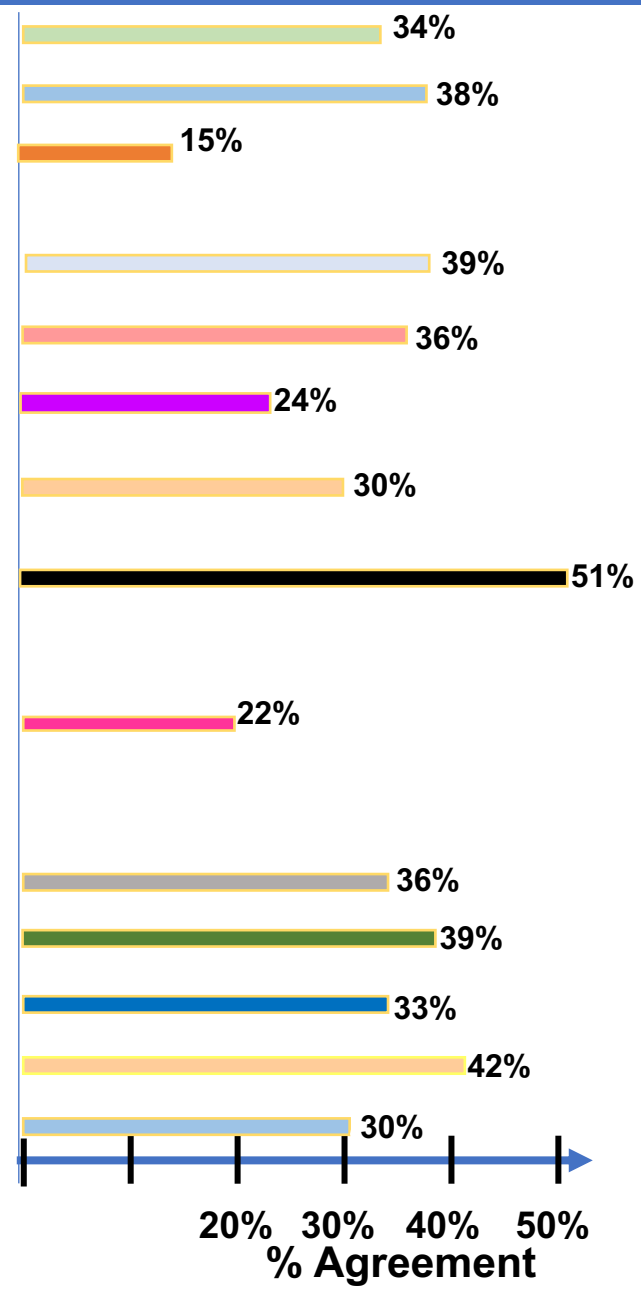
Additive/Subtractive & Advanced Materials;
3D CAD and printing/prototyping — 36% | 60%
CNC programming — 39% | 48%
Precision Manufacturing — 33% | 48%
Fabrication — 42% | 36%
Testing (destructive /non-destructive — 30% | 20%

15% or lower difference in the opinion between manufacturers and colleges groups

% Agreement

Manufacturers' Choice of Vocabulary is always a Challenge

1 Ask 5 Whys
2 Brainstorming
3 Cloud
4 Critical Thinking
5 Data Integrity
6 Programming
7 Prototyping
8 Quality Testing
9 Test & Executing
10 Three D Printing
11 Write SOP

12 Data Interpretation
13 Destructive Testing
14 Fishbones
15 Integrating Systems, PLC
16 Interdisciplinary Skills
17 Material Knowledge
18 Material Testing
19 Provide Design Data
20 Reverse Engineering
21 Support Mockup/Test
22 Troubleshooting
23 Use Root Cause Analysis

24 Awareness of the Security Requirements
25 Basic Understanding of Databases & Networks
26 Building/ Assembling Prototypes
27 CAD Layout for Production Processes
28 Diagnose & Understand Full Process
29 Ensure Meas
30 Human Facto
31 Identify Oppo
32 Integration E
33 Knowledge o
34 Math, Comm
35 Spreadsheet Creation & Manipulation
36 Use Technical Tools to Identify Root Causes
37 Write Technical Reports including Data

Remember, when matching technician education to your manufacturers' needs, the manufacturer's choice of vocabulary has to drive your effort.

Satisfying FI Manufacturer Technician Expectations

1 Ask 5 Whys
2 Brainstorming
3 Cloud
4 Critical Thinking
5 Data Integrity
6 Programming
7 Prototyping
8 Quality Testing
9 Test & Executing
10 Three D Printing
11 Write SOP

12 Data Interpretation
13 Destructive Testing
14 Fishbones
15 Integrating Systems, PLC
16 Interdisciplinary Skills
17 Material Knowledge
18 Material Testing
19 Provide Design Data
20 Reverse Engineering
21 Support Mockup/Test
22 Troubleshooting
23 Use Root Cause Analysis

24 Awareness of the Security Requirements
25 Basic Understanding of Databases & Networks
26 Building/ Assembling Prototypes
27 CAD Layout for Production Processes
28 Diagnose & Understand Full Process
29 Ensure Measurement has Uncertainty Stated
30 Human Factors and Interactions
31 Identify Opportunities for Improved Products
32 Integration Eng. Tech./ Adv. Mfg. / Computing
33 Knowledge of Product Standards and Regulations
34 Math, Communication, Teamwork, Solve Problem
35 Spreadsheet Creation & Manipulation
36 Use Technical Tools to Identify Root Causes
37 Write Technical Reports including Data

Example Florida Department of Education Standard Expectations in A.S. Engineering Technology Degree

1 Ask 5 Whys
2 Brainstorming
3 Cloud
4 Critical Thinking
5 Data Integrity
6 Programming
7 Prototyping
8 Quality Testing
9 Test & Executing
10 Three D Printing
11 Write SOP

12 Data Interpretation
13 Destructive Testing
14 Fishbones
15 Integrating Systems, PLC
16 Interdisciplinary Skills
17 Material Knowledge
18 Material Testing
19 Provide Design Data
20 Reverse Engineering
21 Support Mockup/Test
22 Troubleshooting
23 Use Root Cause Analysis

24 Awareness of the Security Requirements
25 Basic Understanding of Databases & Networks
26 Building/ Assembling Prototypes
27 CAD Layout for Production Processes
28 Diagnose & Understand Full Process
29 Ensure Measurement has Uncertainty Stated
30 Human Factors and Interactions
31 Identify Opportunities for Improved Products
32 Integration Eng. Tech./ Adv. Mfg. / Computing
33 Knowledge of Product Standards and Regulations
34 Math, Communication, Teamwork, Solve Problem
35 Spreadsheet Creation & Manipulation
36 Use Technical Tools to Identify Root Causes
37 Write Technical Reports including Data

However, in Florida Standards and Benchmarks really help!

Example Florida Department of Education Standard Expectations in A.S. Engineering Technology Degree

Advanced Manufacturing Specialization

12.0 Understand, Operate, Troubleshoot and Maintain Pneumatic, Hydraulic Electromechanical Components and/or Systems.

13.0 Identify Lean and Six Sigma Concepts in Manufacturing Environment.

14.0 Understand, Operate, and Maintain Industrial Automation Systems.

15.0 Troubleshoot Industrial Automation Systems.

16.0 Apply the Principles of Robotics to Automated Systems.

17.0 Create and Operate Human Machine Interfaces to Control Automated Systems.

Example Florida Department of Education Benchmark Expectations in A.S. Engineering Technology Degree

Advanced Manufacturing Specialization

12.01 Identify, Classify, and Describe the Function of Pneumatic, Hydraulic,

13.01 Explain Product Manufacturing Requirements.

14.01 Demonstrate Understanding, Operation, and Maintenance of Industrial Automation System.

15.01 Demonstrate Troubleshoot Techniques to Identify Root Causes, Errors, and Faults in a Problem Situation.

16.01 Identify and Describe the Essentials Components and Characteristics Errors, and Faults in a Problem Situation.

17.01 Demonstrate the Application of Appropriate Industry Standards in The development of Human Machine Interfaces

Florida Manufacturer Identified Industry 4.0 Skills Technicians Need

Identify I4.0 Skill Sets Absent from Standards

1 Ask 5 Whys
2 Brainstorming
3 Cloud
4 Critical Thinking
5 Data Integrity
6 Programming
7 Prototyping
8 Quality Testing
9 Test & Executing
10 Three D Printing
11 Write SOP

12 Data Interpretation
13 Destructive Testing
14 Fishbones
15 Integrating Systems, PLC
16 Interdisciplinary Skills
17 Material Knowledge
18 Material Testing
19 Provide Design Data
20 Reverse Engineering
21 Support Mockup/Test
22 Troubleshooting
23 Use Root Cause Analysis

24 Awareness of the Security Requirements
25 Basic Understanding of Databases & Networks
26 Building/ Assembling Prototypes
27 CAD Layout for Production Processes
28 Diagnose & Understand Full Process
29 Ensure Measurement has Uncertainty Stated
30 Human Factors and Interactions
31 Identify Opportunities for Improved Products
32 Integration Eng. Tech. / Adv. Mfg. / Computing
33 Knowledge of Product Standards and Regulations
34 Math, Communication, Teamwork, Solve Problem
35 Spreadsheet Creation & Manipulation
36 Use Technical Tools to Identify Root Causes
37 Write Technical Reports including Data

33 of these technician needed skills are "covered".

Skill Sets Absent from Standards		
	Core	**Adv. Manufacturing Specialization**
Cloud Skills	*none*	*none*
Data Base Skills	*none*	*none*
Data Integrity Skills	*none*	*none*
Integrating Systems (using PLCs)	*none*	*12.0, 14.0, 15.0, 16.0, and 17.0*
Data Interpretation	*Vague Connection*	
Interdisciplinary	*Vague Connection*	
Security Requirements	*Vague Connection*	

Two Questions:

- **Why no standard?**

- **What to do about it?**

Two Questions:

- **Why no standard?**

- **What to do about it?**

Industry 4.0 Technology Needs that Technician Skill, but the Colleges have not Caught Up with that Demand.

or

The Skill in Question is Beyond a Reasonable Expectation of a New Technician.

Identified I4.0 Skill Sets Absent from Standards		
	Core	**Adv. Manufacturing Specialization**
Cloud Skills	*none*	*none*
Data Base Skills	*none*	*none*
Data Integrity	*none*	*none*
Integrating Systems (using PLCs)	*none*	*12.0, 14.0, 15.0, 16.0, and 17.0*
Data Interpretation	*Vague Connection*	
Interdisciplinary	*Vague Connection*	
Security Requirements	*Vague Connection*	

If Information Technology and Operational Technology Faculty don't Interact, Developing Appropriate Standards on IT and OT Skill Intersections will be Difficult to Accomplish.

Manufacturers Indicated that Cloud Information Technology Skill Expectations for Manufacturing Technicians Depends on Their Overall Experience with Operational Technology.

Project team is interacting with Daytona State College to use an Advanced Technical Certificate as mechanism to meet both knowledge and "standards" needs.

Two Questions:

- Why no standard?

- **What to do about it?**

- Why no standard?

Industry 4.0 Technology Needs that Technician Skill, but the Colleges have not Caught Up with that Demand.

The Skill in Question is Beyond a Reasonable Expectation of a New two-year Technician.

- **What to do about it?**

The Advanced Technical Certificate is an excellent tool to recruit for the task!

A.S. Advanced Technical Certificate

Applied Data Base I	*COP 4813*
Applied Data Base II	*COP 4834*
Information Technology Project Management	*CIS 4510*
Web Systems I	*COP 4814*
Web Systems II	*COP 4835*

Advanced Technical Certificate (ATC) generates:

Senior technical expertise that meet advanced technician (A.S. ET degree holder) skill expectations.

New B.S. Engineering Technology Degree holder gain higher skill qualifications.

This ATC contains approved Florida Standards and Benchmarks as part of two Bachelor level applied degrees:

Bachelor of Science
Bachelor of Applied Science

The Advanced Technical Certificate is an excellent tool to recruit for the task!

A.S. Advanced Technical Certificate	
Applied Data Base I	*COP 4813*
Applied Data Base II	*COP 4834*
Information Technology Project Management	*CIS 4510*
Web Systems I	*COP 4814*
Web Systems II	*COP 4835*

Advanced Technical Certificate (ATC) generates:

Senior technical expertise that meet advanced technician (A.S. ET degree holder) skill expectations.

New B.S. Engineering Technology Degree holder gain higher skill qualifications.

Faculty in 2-year technician programs can select lessons and student hands-on experiences from this ATC, insert them anywhere in their courses, and automatically satisfy Standards and Benchmark expectations.

I4.0 Crosscutting Skills in All Florida Manufacturer Identified Categories

1 Ask 5 Whys
2 Brainstorming
3 Cloud
4 Critical Thinking
5 Data Integrity
6 Programming
7 Prototyping
8 Quality Testing
9 Test & Executing
10 Three D Printing
11 Write SOP

12 Data Interpretation
13 Destructive Testing
14 Fishbones
15 Integrating Systems, PLC
16 Interdisciplinary Skills
17 Material Knowledge
18 Material Testing
19 Provide Design Data
20 Reverse Engineering
21 Support Mockup/Test
22 Troubleshooting
23 Use Root Cause Analysis

24 Awareness of the Security Requirements
25 Basic Understanding of Databases & Networks
26 Building/ Assembling Prototypes
27 CAD Layout for Production Processes
28 Diagnose & Understand Full Process
29 Ensure Measurement has Uncertainty Stated
30 Human Factors and Interactions
31 Identify Opportunities for Improved Products
32 Integration Eng. Tech. / Adv. Mfg. / Computing
33 Knowledge of Product Standards and Regulations
34 Math, Communication, Teamwork, Solve Problem
35 Spreadsheet Creation & Manipulation
36 Use Technical Tools to Identify Root Causes
37 Write Technical Reports including Data

Skills are not prioritized but are arranged for easy visual review

Caucus Summary

This project, *"Conference to Explore the Impact of Future of Work Issues on Technician Education in Florida",* invested its resources to:

Bring Florida Manufacturers and College Technician Preparation Programs Together to Discuss Industry 4.0 Technology Issues.

Identify Manufacturer Defined I4.0 Technology Driven Technician Skill Needs.

Determine/ Establish Florida Department of Education Standard & Benchmark Status of Identified I4.0 Needed Skills.

Develop/ Implement Mechanism(s) to Insert New I4.0 identified Technician Skills into Technician Development Programs.

Identify for Instructional Emphasis the I4.0 Cross-Cutting Skills.

Caucus Summary

This project, *"Conference to Explore the Impact of Future of Work Issues on Technician Education in Florida",* invested its resources to:

Bring Florida Manufacturers and College Technician Preparation Programs Together to Discuss Industry 4.0 Technology Issues.

Identify Manufacturer Defined I4.0 Technology Driven Technician Skill Needs.

Determine/ Establish Florida Department of Education Standard & Benchmark Status of Identified I4.0 Needed Skills.

Develop/ Implement Mechanism(s) to Insert New I4.0 identified Technician Skills into Technician Development Programs.

Identify for Instructional Emphasis the I4.0 Cross-Cutting Skills.

High Demand
Participate in developing existing & new products & operations

A skill that basically is not being taught at all in surveyed colleges

Lowest Demand
3D CAD and printing/prototyping

A skill that is already taught at 12 of the served colleges across Florida
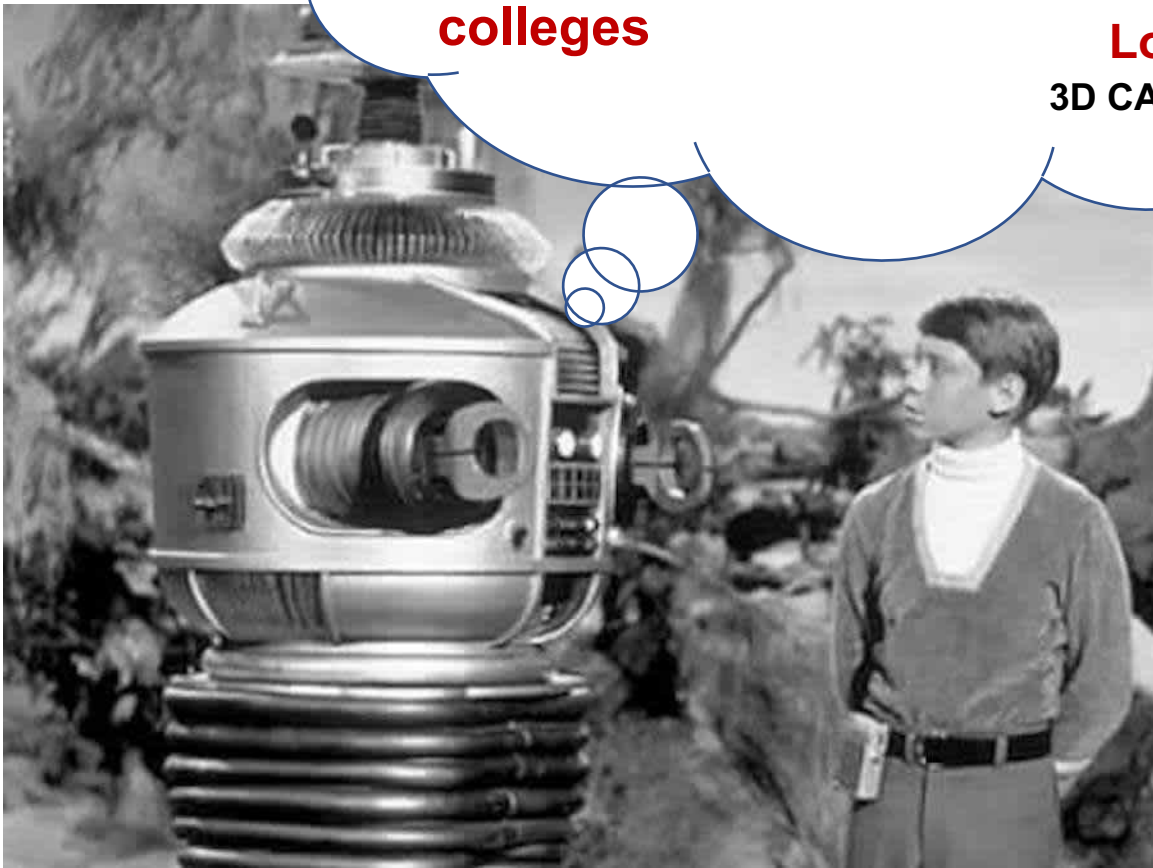
Danger Will Robinson

Marilyn.Barger @FLATE.ORG

gilbert@ usf.edu

Questions? Ideas? Comments?

Thanks for your attention

Thank you for your attention.

Questions:

Now?

Later?

Marilyn Barger, PhD, PE, MSSC-CPT,

Senior Education Advisor,
   FloridaMakes & FLATE

Marilyn.Barger@FLATE.ORG

FLATE
Advanced Technological
Education

Part of the
FloridaMakes
network

"Conference to Explore the Impact of Future of Work Issues on Technician Education in Florida"

(DUE 1939173)