



AUVSI 's Unmanned Systems North America 2009

*Washington, DC
August 10 – 13, 2009*





Certified Robotics Production Technician

The Super Technician



Background



Photo courtesy of the Department of Defense



Photo courtesy of the Department of Defense



Photo courtesy of the Department of Defense



Vision

To be the premier provider of manufacturing technology to the robotics industry through partnership with government and industry.

Mission

Our mission is to provide customers with strategic training and manufacturing technology solutions that optimize workforce productivity and throughput in advanced manufacturing environments.



Industry Need

Small technology development companies have no experience in or method of transitioning a device from design to production.

Many companies do not have a method for locating qualified production technicians.

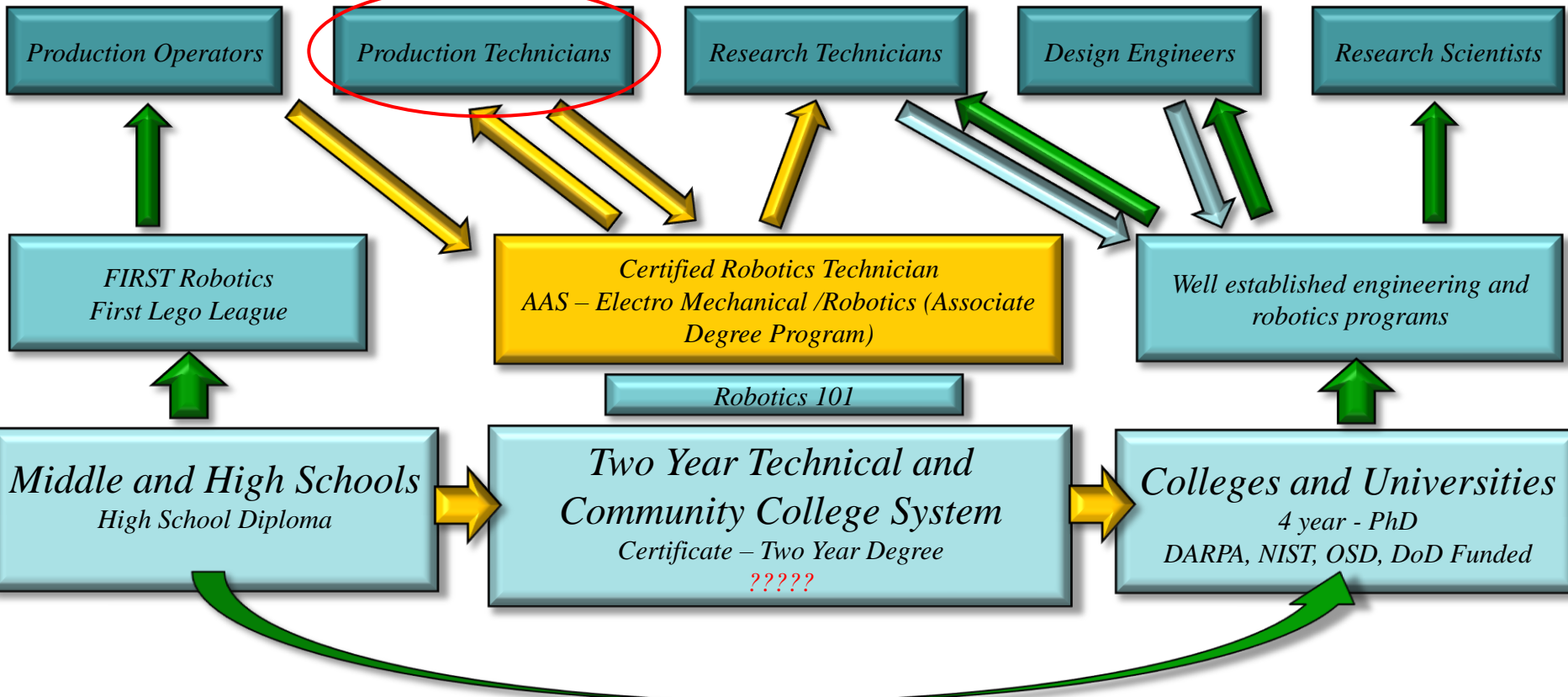


Advisory Committee

- Derek Daly – Committee Chairman - Foster-Miller
- Terry Downing - Raytheon
- Joe Dyer – iRobot
- Don Jones – Mesa Robotics
- Charles Maidens – Kuchera Def. Syst.
- Bill Munslow – Lockheed Martin
- Jon Maynell – Lite Machines Inc.
- Paul McDuffee – Insitu, a subsidiary of Boeing
- Kyle Synder - AUVERSI



Robotics Workforce



US Educational System



Objectives

1. Develop and promote a **Robotics Technician Certification program** and a **two year Robotics degree program** and make it available throughout the United States
2. **Provide assistance** to small businesses to **transition products** from design prototypes into a production environment and develop a production transition guide



Objective 1
Education Program



Photo courtesy of the Department of Defense



Photo courtesy of the Department of Defense



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Robotics Technician Certification

- Job profiling
- DACUM
- Curriculum development
- Writing of training modules
- Incorporate MSSC base manufacturing modules
- Editing, graphics
- Program review



DACUM Chart

DUTIES		1	2	3	4	5	6	7
A	(A) Comply with Safety Procedures / Policies	(A1) Attend Safety Orientation	(A2) Learn Safety Requirements for Work Area / Job	(A3) Obtain PPE / Safety Equipment	(A4) Obtain Necessary Certifications (NFPA 70E / Forklift)	(A5) Inspect Work Area for Hazards	(A6) Use Electrical Safety Equipment (e.g. Anti-Static Mats, Wrist Straps)	(A7) Use ESD Safe Tooling
B	(B) Assemble to Manufacture Specs	(B1) Receive Certification Training	(B2) Obtain Document Procedures Meeting Customer Requirements	(B3) Obtain Approved Workstation	(B4) Confirm Tool Calibration is Current	(B5) Obtain Required Tools	(B6) Draw Proper Parts from Supply	(B7) Assemble to Current Requirements / Specs
C	(C) Operate Robotic System / Station	(C1) Check System Free of hazards	(C2) Perform Start Up Safety Checks (e.g. E-Stops)	(C3) Power Up System	(C4) Install System Running Software	(C5) Make Mechanical Adjustments	(C6) Perform Functionally Test	(C7) Perform Vacuum Test
D	(D) Conduct On-The Job (OJT) Training	(D1) Complete "Train the Trainer" Training	(D2) Obtain Demo Materials as Training Aids	(D3) Conduct Classroom Training	(D4) Share Information on New Technology	(D5) Perform OJT Sequence	(D6) Document Training Completion	(D7) Receive Feedback from Trainer
E	(E) Keep Skills Current	(E1) Maintain Re-Certification Requirements	(E2) Participate in "In House" Training	(E3) Conduct Cross Training	(E4) Rotate Company Assignments	(E5) Read Technical Publications	(E6) Conduct Internet Searches (e.g. Course, Research, Web Conferences)	(E7) Apply Customer Feedback (from Customer Needs & Visits)
F	(F) Verify Quality Workmanship	(F1) Obtain Components	(F2) Establish Test Environment	(F3) Use Current Test Procedures	(F4) Use Current Operational Procedure	(F5) Check Calibration Limits	(F6) Gather Required Witnesses	(F7) Verify Pedigree of Component



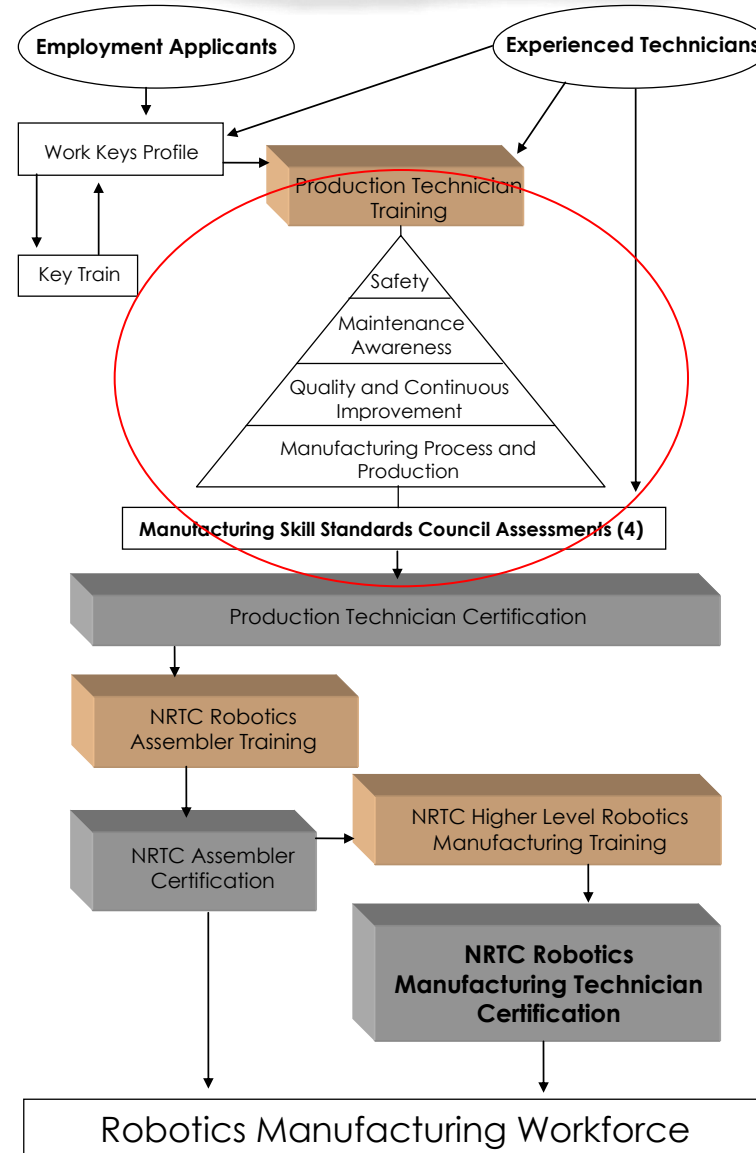
Curriculum Chart

Topic	Detail	Module #
<u>Robotic Arm</u>	Basic machines Center of gravity	MSSC OM12 MSSC OM13 MSSC OM14 MSSC OP1
<u>Navigation device</u> (GPS, inertia compass)	Overview Activity with GPS device Value/limitations of technologies	NRTC Mod 4
<u>Cameras</u>	Near infrared thermal infrared CCD Zoom Analog vs digital	NRTC Mod 3
<u>Sensors</u>	Infrared x-ray biological nuclear ultrasonic (overview options)	NRTC Mod 1 NRTC Mod 3
<u>LED, light sources, lasers</u>	Uses in robot for camera Alignment with mounting Distance sensing	NRTC Mod 3
<u>Gears</u>	ratio	MSSC OP3
<u>Quality</u>	Tolerances Measurement Lean manufacturing - six sigma (data charts) Non-conforming parts SPC Ethics	MSSC OQ3 MSSC OQ4 MSSC OQ7 MSSC OQ8 MSSC OQ9
<u>Troubleshooting</u>	Electrical systems Mechanical systems	MSSC OM1 MSSC OM2 MSSC OM5 MSSC OM6

Topic	Detail	Module #
<u>Electronics</u>	Printed circuit board component handling component identification basic electronics AC/DC diagnostic testing equipment anti static soldering de-soldering	MSSC OM1 MSSC OM2 MSSC OM3 MSSC OM4
<u>Control systems</u> (joystick)	Purpose; test; troubleshoot; control and feedback Closed vs open loop system	NRTC Mod 1
<u>Operating systems</u> (software)	Basic computer skills Microprocessors –basic function	NRTC Mod 1
<u>Power Source</u> (battery)	Chemistry safety Test under-load	NRTC Mod 1
<u>Motors and motor control systems</u> (electrical)	Microprocessors	MSSC OM15
<u>Basic Mechanics and Mechanical systems</u>		MSSC OP1 MSSC OP2
<u>Communication systems</u>	Transceiver RFID SWR (standing wave ratios) Analog vs digital RF Electrical signal over copper Pulses of light over fiber Modulation vs demodulation Coding & decoding Antennas	NRTC Mod 2
<u>Mechanical linkages</u>		MSSC OP2



Pre-employment Training and Certification Process



Education Program

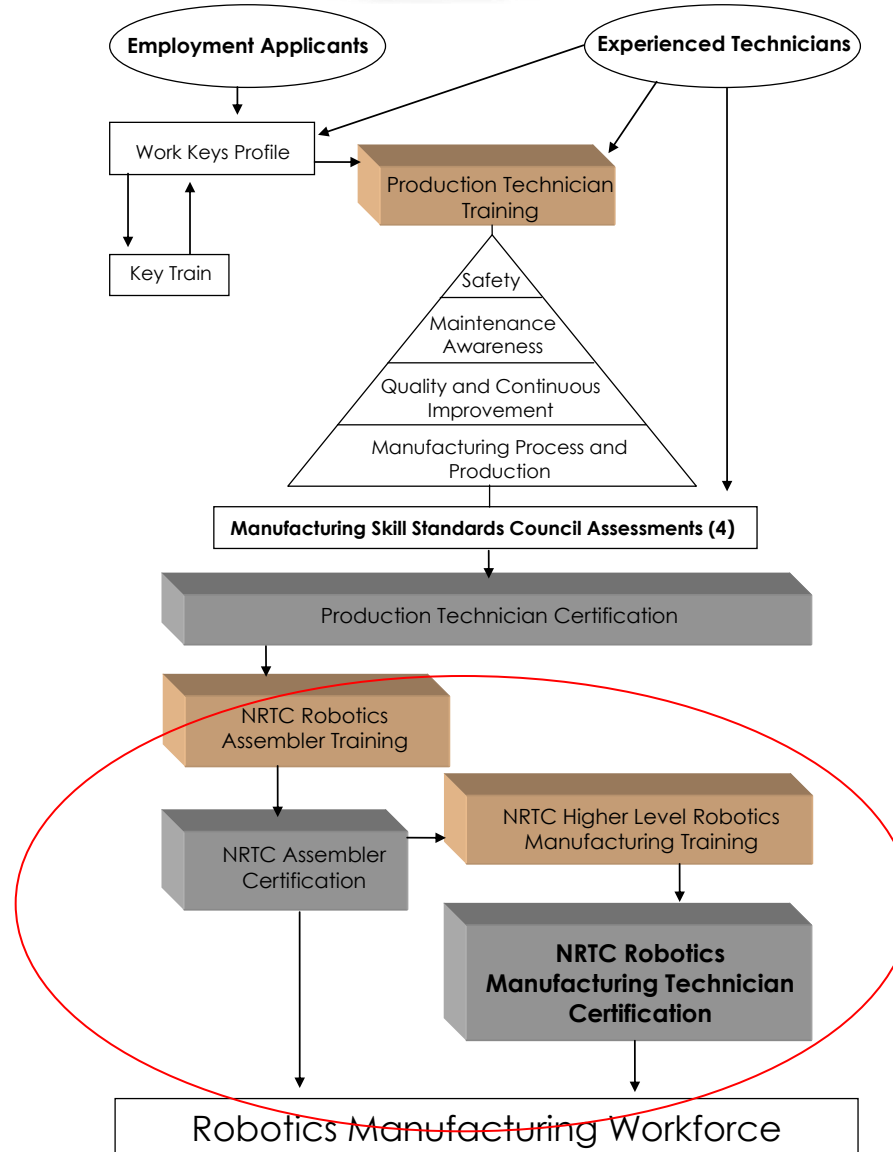


MSSC Core Modules

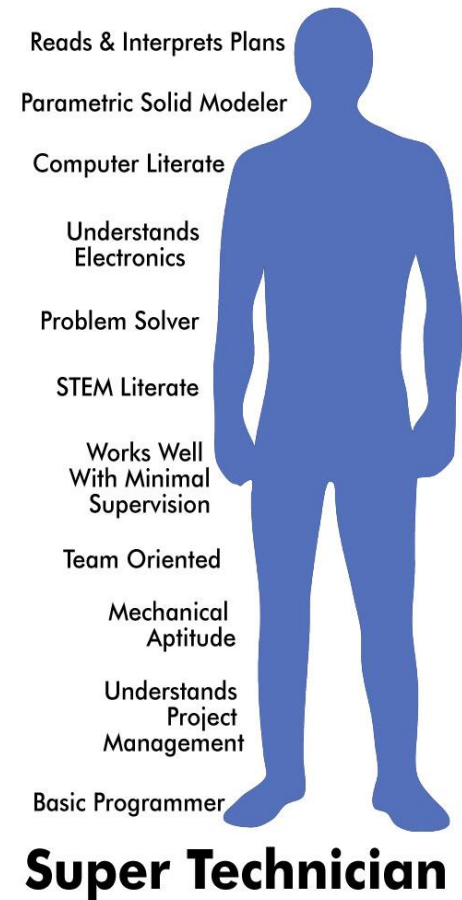
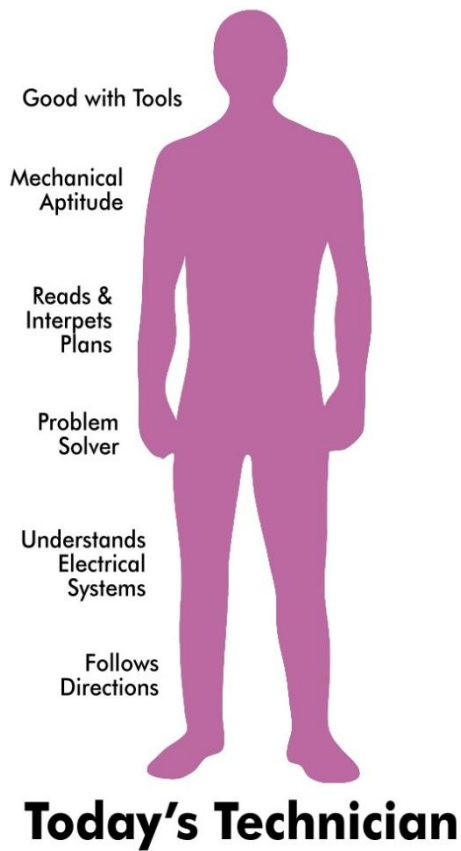
- ***Safety***
- ***Quality Practices & Measurement***
- ***Manufacturing Processes and Production***
- ***Maintenance Awareness***



Pre-employment Training and Certification Process



Education Program



Technician Vs Robotics Technician

Manufacturing Technician

- Mechanic
- Basic Electronics
- Reads Blueprints
- General Toolset
- Works Under Direction

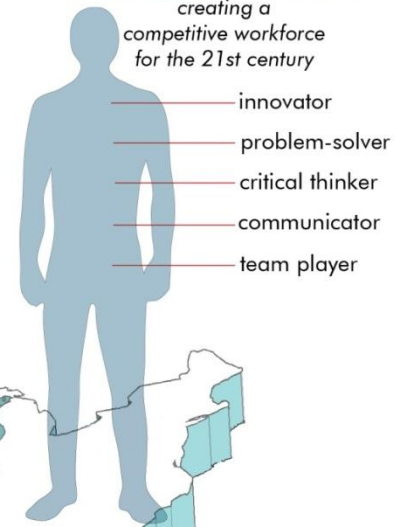
Robotics Technician

- Basics Skills plus
- Innovator
- Problem-solver
- Critical thinker
- Communicator
- Team Player



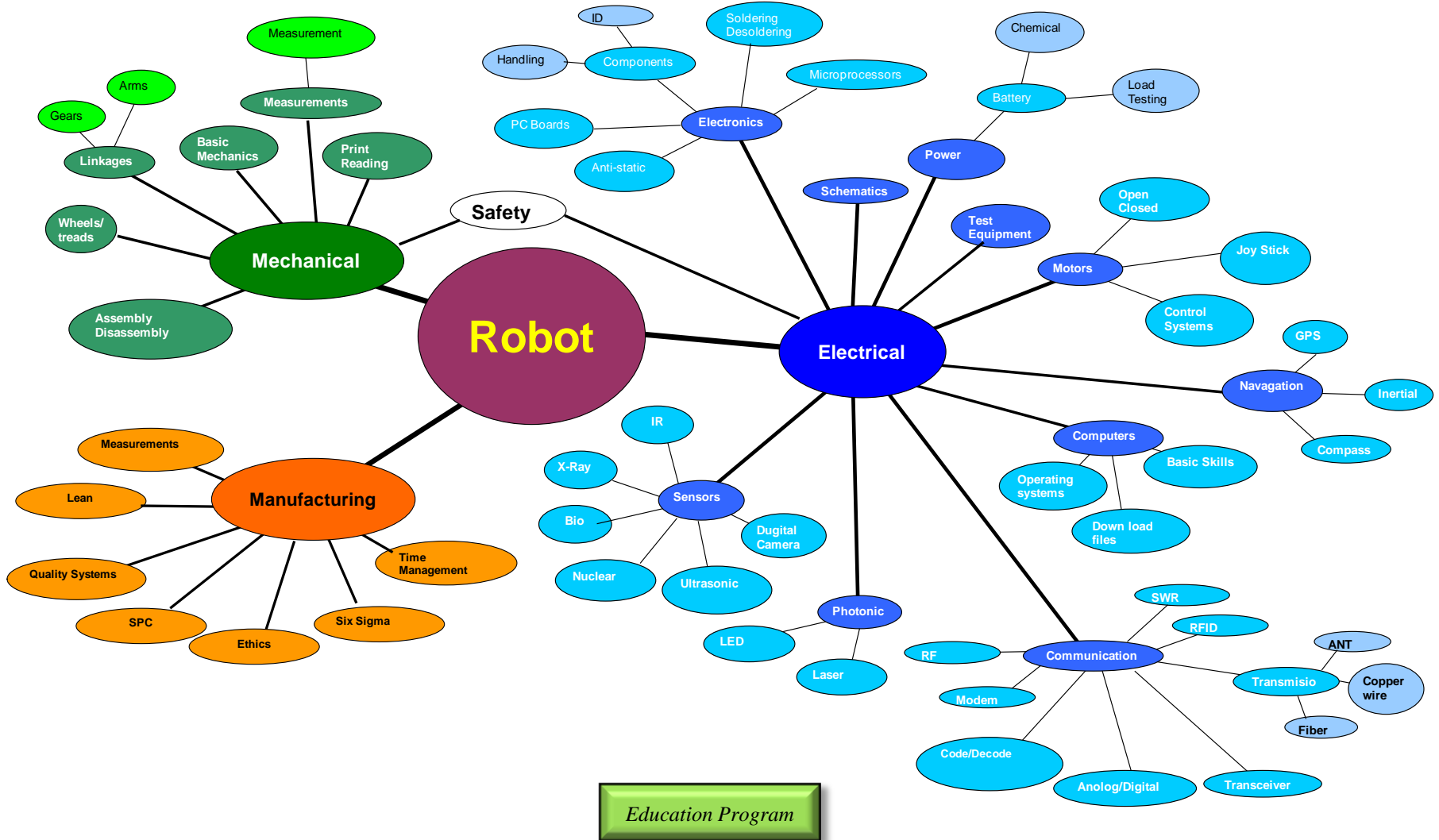
ROBOTICS EDUCATION

creating a
competitive workforce
for the 21st century



- innovator
- problem-solver
- critical thinker
- communicator
- team player

For National Defense and Economic
Security the United States must lead the
world in this emerging technology.



Education Program



Robotics Module Content

- Introduction and Overview of Training Program
- Module 1: Computer Systems and Sensors
 - Unit 1: Operating Systems
 - Unit 2: Control Systems
 - Unit 3: Power Sources
 - Unit 4: Sensors
- Module 2: Communication Systems
- Module 3: Cameras, Photonics, and Light Sources
- Module 4: Robot Mobility and Navigation
- Module 5: Lean Manufacturing



National Robotics Training Center Certified Robotic Production Technician (Certification Program)

<i>Course</i>	<i>Contact Hours</i>
• <i>Tier One</i>	
• <i>Manufacturing Skill Standards Council Certified Production Technician</i>	
• <i>Principles of Safety (MSSC-CPT)</i>	45
• <i>Principles of Maintenance (MSSC-CPT)</i>	45
• <i>Principles of Quality & Continuing Improvement (MSSC-CPT)</i>	45
• <i>Principles of Manufacturing Processes & Production (MSSC-CPT)</i>	45
• <i>Subtotal</i>	180
• <i>Tier Two</i>	
• <i>National Robotics Training Center Certified Robotics Production Technician</i>	
• <i>Computer Systems and Sensors (NRTC-CRPT)</i>	45
• <i>Communications Systems (NRTC-CRPT)</i>	15
• <i>Cameras, Photonics, and Light Sources (NRTC-CRPT)</i>	15
• <i>Robot Mobility and Navigation (NRTC-CRPT)</i>	15
• <i>Lean Manufacturing (NRTC-CRPT)</i>	15
• <i>Subtotal</i>	105
• <i>Total Contact Hours</i>	285



Associate in Applied Science Degree in Electro-Mechanical Engineering Technology: Major in Robotics Manufacturing Technology (MSSC's CPT & NRTC's CRPT)

•	Semester 1 (Fall)				
•	Course		Class	Lab	Credit
•	CPT XXX	Computer Systems and Sensors (CRPT)	2	3	3
•	COL 103	Colleges Skills	3	0	3
•	EGT 110	Engineering Graphics I	2	6	4
•	MAT 110	College Algebra	3	0	3
•	PHY 201	Physics I	3	3	4
•			13	12	17
•	Semester 2 (Spring)				
•	Course		Class	Lab	Credit
•	EET 113	Electrical Circuits I	3	3	4
•	MET XXX	Principles of Safety (MSSC)	3	0	3
•	EET XXX	Communications Systems (CRPT)	1	0	1
•	EET 131	Active Devices	3	3	4
•	ENG 260	Advance Technical Communications	3	0	3
•	CHM 110	College Chemistry I	3	3	4
•			16	9	19
•	Semester 3 (Summer)				
•	Course		Class	Lab	Credit
•	EGR 194	Statics & Strength of Materials	3	3	4
•	MET XXX	Principles of Maintenance (MSSC)	3	0	3
•	EET XXX	Cameras, Photonics, & Light Sources (CRPT)	1	0	1
•	EGT 151	Introduction to CAD	2	3	3
•			9	6	11



AAS EME Robotics Manufacturing Cont.

- Semester 4 (Fall)

Course		Class	Lab	Credit
MET XXX	Prin. of Quality & Cont. Improvement (MSSC)	3	0	3
MET XXX	Robot Mobility and Navigation (CRPT)	1	0	1
EET 145	Digital Circuits	2	3	3
EGR 170	Engineering Materials	2	3	3
MET 213	Dynamics	2	3	3
MET 214	Fluid Mechanics	2	3	3
		12	12	16

- Semester 5 (Fall)

Course		Class	Lab	Credit
EGR 175	Prin. of Manufac. Processes & Production (MSSC)	2	3	3
MET XXX	Lean Manufacturing (CRPT)	1	0	1
MET 231	Machine Design	3	3	4
ECO 201	Economics Concepts	3	0	3
XXX XXX	Elective: Humanities/Fine Arts	3	0	3
		12	6	14

- Minimum Total Credit Hours: 77



Certification Program – Next Steps

- Peer review
- Field testing
- Exam validation
- Transition to on-line program
- Professional Association endorsement
- Finalize two year robotics degree programs
- Develop two + two program with four year institutions



Industry Needs Assessment Results

- Current jobs
- Needs over next 3 years
- Need for the certification
- National emphasis



SURVEY RESULTS

- **Robotics Production Technician Needs Survey Summary May 2009**
- Surveyed Robotics Division of NDIA
- Manufacturing Membership of AUVSI
- *77 Responses*



1. Currently, how many Robotic Technicians does your company employ?

- Total: 684

Salary Distribution

Range: \$11.54/hr. or \$35.00/hr.
\$24,000/yr. or \$72,800/yr.

Mean: \$17.71/hr. or \$36,840/yr.

Median: \$16.00/hr. or \$33,280/yr.

Mode: \$19.23/hr. or \$40,000/yr.

16. Name of Company

$N = 42$

- 4Frontiers Corporation
- AAI Corporation / Textron
- Aerotonomy, Inc
- Applied Perception
- ARIES Ingeniería y Sistemas S.A.
- Army
- BAE Systems
- BFA Systems
- Boston Engineering
- Chatten Associates, Inc.
- COLSA Corporation
- CSC
- CYCOGS
- Engineering Services Inc.
- EOIR Technologies
- Exploitation Sciences
- Foster-Miller Inc
- iRobotCorp
- Kuchera Defense Systems
- Lite Machines Corporation
- Mesa Associates
- Mesa Robotics
- North Carolina Central University
- Northrop Grumman
- Northrop Grumman
- Northrop Grumman Corporation
- Northwest UAV Propulsion Systems
- OPTEC Solutions
- Orion Interaction Pty Ltd - AUSTRALIA
- Phoenix International
- Radiance Technologies
- Raytheon
- Reflexx Robotics
- SAIC
- SeaBotix Inc.
- Soar Technology
- Staff of Commander Third Fleet
- Surveyor Corporation
- Technisa
- USAF/AFRL/RXQ Robotics Group and JRRF
- Virginia Tech
- XPM Technologies

17. Your location

City	State	Response Frequency
Huntsville	AL	3
Madison/Huntsville	AL	1
Tucson	AZ	1
Yuba City	CA	1
San Diego	CA	3
Riverside	CA	1
Camarillo	CA	1
Santa Clara	CA	1
San Luis Obispo	CA	1
Tyndall AFB	FL	1
New Port Richey	FL	1
Lithia Springs	GA	1
West Lafayette	Indiana	1
Waltham	MA	1

$N = 44$

	MA	2
Bedford	MA	1
Hunt Valley	Maryland	1
Annapolis	Maryland	1
Largo	Maryland	1
Sterling Heights	Michigan	1
Ann Arbor	Michigan	1
Sydney	New South Wales	1
Durham	North Carolina	1
Toronto	Ontario	1
McMinnville	Oregon	1
Cranberry Township	Pennsylvania	1
West Conshohocken	Pennsylvania	1
Windber	Pennsylvania	1
Madrid	Spain	1
Oak Ridge	TN	1
Knoxville	TN	1
Clinton	TN	1
Arlington	Virginia	2
Blacksburg	Virginia	1
Charlottesville	Virginia	1
Virginia Beach	Virginia	1
Sauk City	WI	1
	Not trading in the United States	1



Summary & Conclusions Continued

- the robot product type of the respondents were:
 - Ground – 38.9%
 - Air – 23.6%
 - Water – 12.5%
 - Industrial – 18.1%
 - Consumer – 6.9%.



Summary & Conclusions

- Currently there are 684 technicians employed by the respondents,
- the majority of companies (66%) responding to the survey find too few well-qualified technicians,
- the majority of prospective technicians (98.1%) require additional training,
- according to the respondents (83.4%) two year colleges are not meeting the demand for this type of technician,



Summary & Conclusions Continued

- the majority (87.2%) believe there is a need to improve technician education at two year colleges,
- the majority (59.6%) of companies responding believe that a certification program would make hiring easier,
- the majority (78.9%) would have more confidence in a technician's skills if they had a credentialing certification when hired,
- the majority (61.5%) believe a certification program would increase availability of technicians,



Summary & Conclusions Continued

- the majority (80.7%) believe that there will be steady to rapid growth in the development, manufacture, and use of robotics in the United States over the next decade,
- within the companies responding there will be a need for 683 new technicians over the next three years,
- there will be a need for 185 replacements over the next three years,



Summary & Conclusions Continued

- there will be a need for 1,886 new engineers, scientists, and other new jobs at the 4-year baccalaureate degree or higher degree level,
- there will be a need for 1,682 replacement engineers, scientists, and other new jobs at the 4-year baccalaureate degree or higher degree level,



Q & A



Photo courtesy of the Department of Defense



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