

# DACUM RESEARCH CHART: CNC Technician

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## DACUM PANEL

### **ALI SANTIAGO**

Machine Operator  
Picut Manufacturing

### **CÉSAR AUGUSTO CAMARGO**

Apprentice Tool Maker/CNC Technician  
Weiss-Aug, Inc.

### **DAVID WILLIAM VANHORN, JR.**

CNC Machinist/Programmer  
Emergency and Critical Care  
Custom Alloy Corp.

### **GARY D. SLAWIK**

Apprentice & Training Manager/  
Tool & Die Maker  
Bihler of America

### **MAXWELL PICUT**

Operator  
Picut Manufacturing

### **RICHARD E. HAYES**

Tool Maker  
Bihler of America

### **VINNY KHAN**

Manufacturing Manager  
G & J Steel and Tubing, Inc.

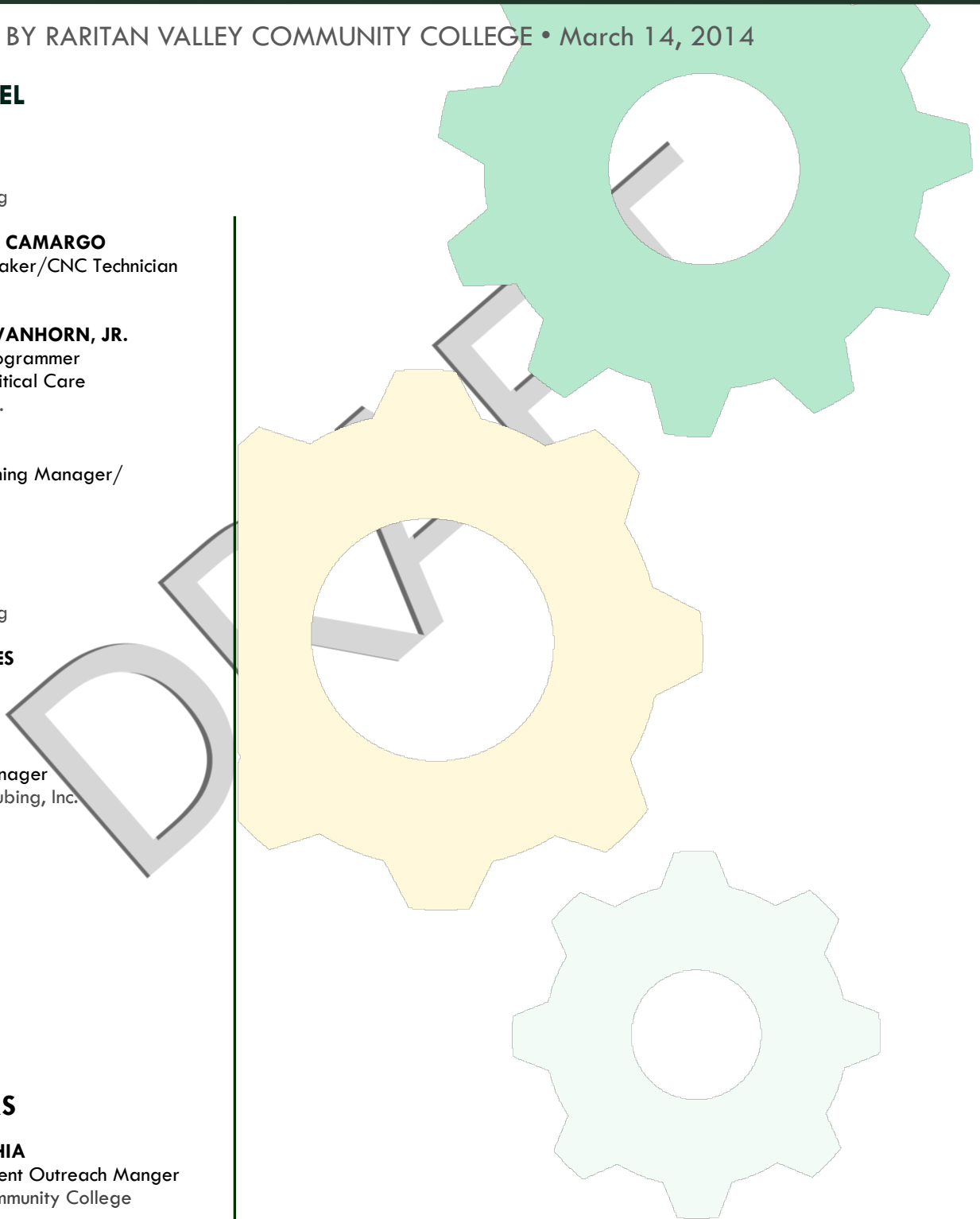
## FACILITATORS

### **REBECCA FRACCHIA**

Business Development Outreach Manger  
Raritan Valley Community College

### **SHAUNNA JAGNEAUX**

Director, Workforce Delivery Project  
Raritan Valley Community College



# DACUM Research Chart for CNC Technician

Duties	Tasks					
<b>A Maintain Safe Work Environment</b>	A1 Clean work station after each job and at end of day 4 2 1	A2 Dispose of hazardous waste	A3 Separate scrap material	A4 Check lifting equipment (e.g., slings, straps)	A5	A6
	B1 Perform vertical mill job setup 7 4 4 1	B2 Run simulation and first part using vertical mill 2 1	B3 Make part according to job specifications using vertical mill 4 1	B4 Run production using vertical mill 3 1	B5	B6
<b>C Perform Lathe Operations</b>	C1 Perform CNC lathe job setup 5 3 2	C2 Run simulation using CNC lathe 3 1	C3 Make part according to job specifications using CNC lathe 2	C4 Run production using CNC lathe 4 1		
	D1 Maintain proper fluid levels 2 1 1	D2 Change machine oil/coolant	D3 Maintain proper machine pressures 2	D4 Assess coolant concentrations 1 1	D5 Service coolant tank 1	D6 Replace worn blades (saws) 1
<b>D Maintain CNC Machines</b>	D7 Check collet/guide bushing	D8 Perform lockout/tag out procedures	D9 Clean CNC machines 1 2	D10 Maintain cutting tool(s) 2 2 2	D11 Replace machine filters (e.g., oil, coolant, air)	D12 Clean cooling fans
	D13 Grease zerk fittings	D14 Clean machine filters (e.g., oil, coolant, air)	D15 Respond to machine failure			
	E1 Perform Grinder job setup 3 2	E2 Perform simulation using Grinder	E3 Make part according to job specifications using Grinder 1	E4 Run production using Grinder 3 1	E5	E6
<b>E Perform Grinder Operations</b>	F1 Perform Wire EDM job setup 1 1 1	F2 Run simulation using wire EDM 1	F3 Make part according to job specifications using Wire EDM	F4 Run production using Wire EDM 2	F5	F6
	G1 Perform CNC Drilling job setup 3 2 1	G2 Run simulation using CNC Drill 3 1 1	G3 Make part according to job specifications using CNC drilling 1	G4 Run CNC Drill	G5	G6
<b>F Perform Wire EDM Operations</b>	H1 Perform Tool Sharpeners job setup 3 2 2	H2 Make part according to job specifications using Tool Sharpeners	H3	H4	H5	H6
<b>G Perform Drilling Operations</b>						
<b>H Perform Tool Sharpening Operations</b>						

**Occupational Definition:** A quality performing CNC Technician works with a team to efficiently convert raw materials into durable goods by using and maintaining machines and tools to increase company productivity and profitability.

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**Duties**

**Tasks**

Duties	Tasks	Tasks	Tasks	Tasks	Tasks	Tasks
<b>I Perform Job Tear Down</b>	I1 Remove excess stock	I2 Remove cutting tools	I3 Backup CNC program	I4 Clean machine interior	I5 Remove material clips	I6
<b>J Perform Water Jet Operations</b>	J1 Perform Water Jet job setup	J2 Run simulation using Water Jet	J3 Make part according to job specifications using Water Jet	J4 Run production using Water Jet	J5	J6
<b>K Perform Bending Operations</b>	K1 Perform CNC Bending job setup	K2 Run simulation using CNC Bending	K3 Make part according to job specifications using CNC Bending	K4 Run production using CNC Bending	K5	K6
<b>L Perform Sawing Machine Operations</b>	L1 Perform Saw job setup	L2 Saw part to job specifications				
<b>M Forward Internal Product</b>	M1 Verify part count	M2 Palletize product for internal shipment				
<b>N Perform Laser Operations</b>	N1 Perform Laser job setup	N2 Run simulation using Laser	N3 Make part according to job specifications using Laser	N4 Run production using Laser		
<b>O Perform Administrative Operations</b>	O1 Prioritize job schedule	O2 Complete on-the-job training	O3 Track discrepant parts	O4 Provide process improvement feedback	O5 Track tooling inventory (stock, tooling)	O6 Document in-process inspection

**Legend**



..... Critical Duty



.....Training Most Needed by New Workers



..... Critical Task



.....Training Most Needed by Veteran Workers

Note: Numbers represent total votes from 7 of the panelists.

# Occupational Profile: CNC Technician

## Knowledge & Skills

- Basic design skills (nice to have, helpful)
- Basic Programming, G-codes, M-codes **1 1**
- Blue Print Reading **6**
- CAD/CAM
  - ◇ Programming- G-codes in codes
  - ◇ Conversational Coding
- Calipers
- Communication skills **1**
  - ◇ Good listening skills
  - ◇ Verbal and non-verbal
  - ◇ Write notes in common language (as a means to retain knowledge)
  - ◇ Coordinate with job designer regarding job
- Computer Skills **6**
  - ◇ Drawing on computer (Using CAD, Solid works) **1 1**
  - ◇ Navigate internet
  - ◇ Locate resources online
  - ◇ Adjust read ahead
  - ◇ Windows file management
  - ◇ Send email
  - ◇ MS Word- write up/documentation, use spell check, ignore grammar check **3**
  - ◇ MS Excel- use spreadsheets
  - ◇ CAD/CAM (solid works) **1 6**
  - ◇ 3D
  - ◇ Converting files (rendering)
  - ◇ E-drawings- view AutoCAD, but not edit **1**
- Gages **1**
- G-code **1**
- Geometric dimensioning and tolerancing (GD&T)
- Grammar/Spelling Skills
  - ◇ Spell check
- Keyboarding skills (Hunt and peck)
- Machine knowledge
  - ◇ Manual lathe
  - ◇ Knowledge of parts of machines
- Manual dexterity
- Math **1**
  - ◇ Basic shop math
    - \* Add/Subtract
    - \* Multiple/Divide
    - \* Fractions and Decimals Conversion
    - \* Standard/ metric conversion
  - ◇ Units of Measure
  - ◇ Geometry: Lines & Angles
  - ◇ Geometry: Triangles
  - ◇ Geometry: Circles
  - ◇ Geometry: Polygons
  - ◇ Alegbra: Solve Equations **1**
  - ◇ Trig: Pythagorean Theorem
  - ◇ Trig: Sin, Cos, Tan **2**
  - ◇ Basic Measurements (e.g., dial calipers, micrometers, thread go and no-go gauges) **1**
  - ◇ Surface Measurement
    - Mechanical skills
- Metals **1**
  - ◇ Metal Manufacturing **1**
  - ◇ Structure of Metals
  - ◇ Mechanical Properties of Metals
  - ◇ Physical Properties of Metals
  - ◇ Machine Properties of Metals
  - ◇ Metal Classification
  - ◇ Non Ferrous Metals
  - ◇ Ferrous Metals and Alloys
  - ◇ Heat Treatment of Steel
  - ◇ Metal Removal Processes
- Organizational skills **1**
  - ◇ Keep a clean and well organized work area **1 4**
  - ◇ Tools **3**
- Problem solving skills **1**
- Process planning **1**
  - ◇ Job order
- Programming **1**
- Quality control **3**
- Recognize signs of where and when to change tool **1**
- Reading skills
  - ◇ Blueprints-hard time for many
  - ◇ Job travelers
  - ◇ MSDS sheets
  - ◇ Operator manuals
  - ◇ Read and document control plans/ instructions
  - ◇ Set-up sheets **1 2**
- Safety knowledge **1 2**
  - ◇ OSHA
  - ◇ Hazardous Waste Handling
  - ◇ Machine Guarding
  - ◇ Lockout/ Tag Out
  - ◇ Lifting
  - ◇ Hand and Power Tool Safety
  - ◇ Fire Safety & Prevention
  - ◇ Flammable/ Combustible Liquids
  - ◇ MSDS & Hazard Communication
  - ◇ Metalworking Fluid Safety
  - ◇ Safety for Metal Cutting
  - ◇ Noise Reduction/Hearing Conversation
  - ◇ Laser requirement spec. safety training
- SPC
- Specs of parts
- Speeds and feeds **3**
- Time management skills **2 2**
  - ◇ Maintain efficient production schedule
  - ◇ Use time wisely **2 1**
  - ◇ Prioritize tasks
  - ◇ Polish parts
- Use tools competently
- User maintenance manual per machine
- Visualization
- Writing skills
  - ◇ Legible
  - ◇ Write documentation to be understood
  - ◇ No sentences or paragraphs
  - ◇ Write in common language (as a means to retain knowledge) **1**

\* Please refer to Legend on pg. 3

## Machines Used

- Band Saws
- CNC Bending
- CNC Cutting
- CNC Drilling
- **Grinder**
- Laser
- **Lathe**
- Tool Bits
- Tool Sharpeners
- **Vertical Mill**
- Water Jet
- Wire EDM

\* Bolded items are core for CNC Technician.

## Certification/Licenses

### Mandatory

- N/A
- College credentials not necessary
- Valid driver's license (for some)

### Helpful/Useful

- OSHA 10 hour cert.
- NIMS (a plus for hiring, not a requirement for new hires)
- Forklift certification required at some shops (training provided on site)

### Traits & Behaviors

- Ability to listen and retain information
- Accepts constructive criticism
- Accountable
- Accurate
- Analytical/logical
- Assertive - positively adds ideas to process, but not rude
- Confident
- Continuous improvement
- Cooperative
- Customer oriented
- Dependable
- Detail-oriented
- Diligent
- Efficient
- Engaged
- Enthusiastic
- Ethical
- Flexible (accommodate work schedule needs)
- Focused
- Functions under pressure
- Humble
- Innovative
- Inquisitive
- Mechanically inclined
- Not lazy
- Patient
- Positive attitude
  - ◊ "Can do it" attitude
  - ◊ "Hit the ground running kind of attitude"
- Professional
- Punctual
  - ◊ Attendance
  - ◊ Start & stop times
- Reliable
- Respectful (for chain of command)
- Responsible
- Self-motivated
- Sense of urgency
- Strong work ethic
- Team Player
- Thick-skinned
- Thinks outside the box
- Willing to go above and beyond (if you want to move up)
- Willing to learn
- Willing to share knowledge with co-workers proactively
- Works safely

### Tools & Equipment

- 1-2-3 blocks
- Adjustable parallels
- Allen Wrench
- Belt grinder
- Bridgeport (Manual mill)
- Calipers
- Chucks
- Clamps
- Cleaning equipment (including sandblasters)
- CNC lathe
- Comparator (Surface-provide own)
- Compasses
- Cooling plate
- Cutting tools
  - ◊ Indexable cutting tools
  - ◊ End mills
  - ◊ PAPS
  - ◊ Reamers
- Cylindrical grinder
- Dead blow hammer
- Degreaser
- Depth micrometer Dial indicator
- Honing
- Drill bits
- Drill press
- Drop indicator
- Edge finder
- Engine lathe
- Eye-loupe
- Feeler Gauges
- Files
- Gage pin
- Grinding tools (e.g., blocking body)
- Grinding/polishing spindle
- Hand tools common (e.g., screw driver)
- Hardware/arbore press
- Height gage (not food-for heating parts)
- Machinist microscope (shop provided)
- Magnetic base
- Boring machining
- Material Handling equipment
- Fork lift
- Cranes-overhead and chain fall
- Measuring tools
- Depth Gauge
- Micrometer (1/10,000 or 1/1000)
- Microscope 30 X (shop provided)
- Mirror
- Miter saw
- Multi-meters
- Optical comparator (Shop provided)
- Palletizers
- Parallels
- Pedestal grinder
- Precision gage blocks
- Press brake
- Production monitoring equipment
- Profilometer (type of comparator-shop provided)
- Protractor
- Punch press
- Radius gages
- Saw ( & wet saw), Band saw
- Scale
- Scientific calculator
- Scribes
- Sine plate
- Manual lathe
- Thread gage
- Manual mill
- Drill press
- Grinder
- Software
  - ◊ CAD/CAM
  - ◊ MS Word, Excel
- Square
- Stones
- Surface grinder
- Surface plate (shop provided)
- Test indicator
- Tool box (some still bring own tools)
- Tool pre-setter (shop provided)
- Tooling balls
- Torque wrenches (shop provided)
- Torx bits
- V block
- Washer

### Hiring Barriers

- Failed drug test
  - ◊ Failed within 2 weeks
  - ◊ Declined to take drug test (either of the above are grounds for dismissal)
- No reliable transportation
- Poor attendance
  - ◊ No call/no show
  - ◊ Not working to expectations (either of the above are grounds for dismissal)

### Hiring Requirements

- NIMS Certification (helpful, npt required)
- H.S. Diploma/GED (some businesses)
- Background check - convictions- any felonies (no armed robbery, assault, fraud, theft)
- Must pass drug test- Pre-employment & random (some when warranted)
- Good positive attitude (employers looking for it)
- Must pass basic skills, aptitude test, mechanical test

### Workplace Needs & Expectations

- Utilize proper PPE
- Workers are expected to stay at their assigned work area and focus on the "job at hand"; not wander around and waste time talking and distracting work associates.
- Phone use should be limited to emergency calls only
- No digital music players/ear jacks/ headphones allowed in a manufacturing setting.
- Workers are expected to know their job description and understand their duties
- Some companies provide training/ tuition reimbursement
- Some companies start new employees in QC to learn parts, inspection in order to move into machining/CNC
- Expected to work way up
- "Can't make a good machinist out of a programmer, can make a good programmer out of a machinist."
- Need to know manual machining before you can move to CNC
- Expected to maintain tools
- Expected to keep machine clean during run process
- Expected to stay until job is done, in spite of when shift ends
- Need to be able to keep up with changes in technology

### Physical Attributes

In order to perform the necessary functions of the job, the worker must be able to:

- Stand for minimum of 8 hrs
- Lift up to 50 lbs. without help

The following factors would hinder a person's ability and/or prevent them from being able to perform the job:

- Wheelchair bound - it would be physically impossible to perform the duties of the position from a wheelchair. The exception to this would be CNC Programmer because the position does not require the same physical demands.
- Color Blind - Not an issue unless the position includes electrical work. Need to be able to differentiate colors of wires.
- Deaf - Safety issue, need to hear the machines to detect and prevent problems. Depending the company, they can make accommodations.
- Blind - Cannot perform the duties of the position without the ability to see.
- Missing limb - Depends on the limb, arm could be a problem
- Hand mobility - Essential to perform the duties of the position.
- Hand sensitivity - Need to be able to feel for smoothness, feel for measuring
- Dexterity - Essential to perform the duties of the position.

### Appearance

- Personal hygiene-"don't hide it with perfume"
- Shower everyday
- Dress
  - ◇ No baggy/loose clothing
  - ◇ No jewelry (Safety hazard)
  - ◇ Proper PPE (Steel toe for some)-Safety hazard
- No facial hair- for some (if wearing a respirator, or welders)
- Hair up, if long.
- No shorts
- Steel toed shoes

### As new CNC Technicians, the panelists felt unprepared for:

- Setting up raw forging - need to learn process on beveling
- Learning lifting straps
- Pure knowledge on how to work with big pieces and the process of manufacturing
- Terminology - vocabulary related to the work expected
- Programming
- Geometry
- Attendance expectations
- Safety needs of the job - how to work in a safe manner, observing all safety regulations
- Being able to perform complex operations/tasks on expensive work pieces with tight time constraints
- Working with gauges and mics.
- Performing the task at hand

### Mismatch in Employment Expectation

As new technicians on the job, the panelists were initially disillusioned by the following:

- Inability to perform the job hired for due to lack of personnel, working on machines longer than intended
- The notion that "everyone cleans up" was not honored equally by all workers

### Acronyms Used

CAD: Computer Aided Design  
CAM: Computer Aided Machinery  
CDC: Center for Disease Control and Prevention  
CMM: Computerized Maintenance Management Systems  
CNC: Computer Numerical Control  
DOT: Department of Transportation  
EPA: United States Environmental Protection Agency  
FAA: Federal Aviation Administration  
FDA: United States Food and Drug Administration  
GLP: Good Laboratory Practice  
GMP: Good Manufacturing Practice  
ISO: International Organization for Standardization  
MS: Microsoft  
MSDS: Material Safety Datasheet  
NFPA: National Fire protection Agency  
OSHA: Occupational Safety & Health Administration  
PLC: Programmable Logic Controllers  
PPE: Personal Protective Equipment  
SOP: Standard Operating Procedure  
SPC: Statistical Process Control  
USDA: United States Department of Agriculture

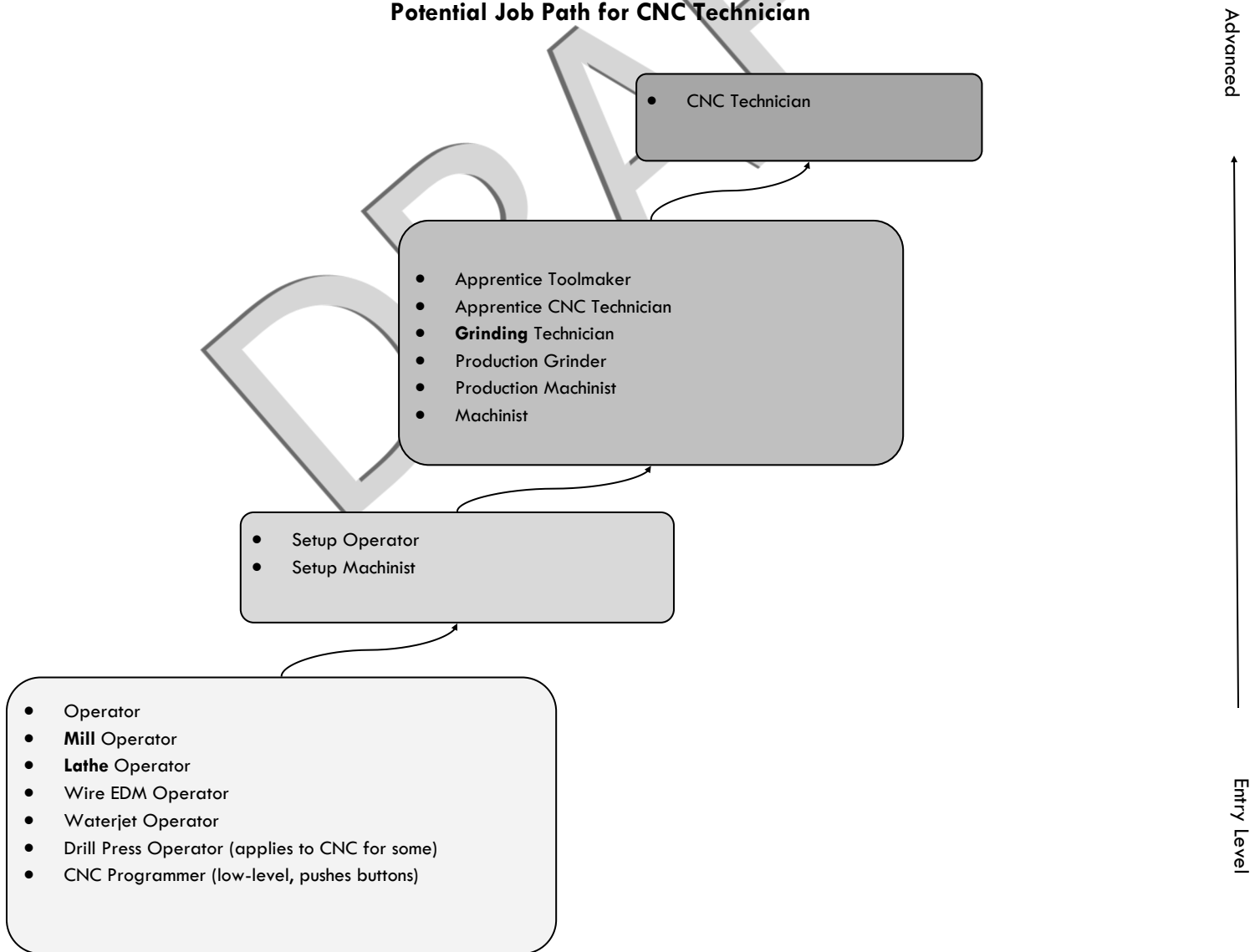
### Attendance/Work Shifts

- Show up before scheduled time (10-15 min)
- Show up everyday
- Stay until shift is done, return from breaks on-time
- Expected to be highly flexible and available for overtime- no whining

## Future Trends & Concerns

- Trend for people particularly between the ages of 20-30 years old not passing drug test
- Communication effecting quality control/cost
  - ◊ There is a tendency of workers to not pay attention to written control plans and instructions
  - ◊ Workers need to understand the importance of revising control plans to reflect any requested changes from the customer or quality control
  - ◊ Paperwork mistakes cost money
- Cost of living concern
  - ◊ One employer said "I spend 6 or more years training people only to have them move to places that have a lower cost of living- how do we fix that?"
- There is a stigma surrounding manufacturing jobs and people don't understand the reality of the work or opportunity. People need to understand that college isn't for everybody- there are other viable pathways in manufacturing
- Manufacturing is trending towards more automation and is becoming more high speed/high tech
- Benefits are being provided competitively - tuition reimbursement/retirement plans
- Workers concerned about benefits
- ESL is an issue for some- language barrier presents an issue communicating job needs. Workers need to be able to read, speak, and communicate effectively in English.
- Overall decline in manufacturing nationwide is a concern.
- Competing with China—its standard of living that makes the difference
- "You need the basics first"

## Potential Job Path for CNC Technician



Please note: Positions that utilize core (most common) machines for CNC Technicians are noted in bold. It is not necessary for a person to move through each of these phases of advancement to reach a particular position level. The titles and levels indicated are a measure of jobs typically performed from entry level (little to no experience and/or training) to more advanced skill level.

Raritan Valley Community College wishes to extend a special “thank you” to the following businesses for sponsoring their worker(s) for the one-day workshop in order to develop this occupational profile for CNC Technicians, and to all of the expert workers who served on the DACUM panel. Our program will be better because of your direction and guidance.



This occupational profile was validated by local expert workers based upon the *DACUM Validation for CNC Machine Operator* research chart sponsored by Maricopa Skill Center, 2010, and the *Employability Skills: Manufacturing* profile sponsored by RVCC in December 2013. RVCC's CNC Machinist Program has been funded under a United States Department of Labor TAACCT Grant whose purpose is to facilitate greater employment by improving education. For more information visit <http://bit.ly/rvccdolgrant>.

