

Future-Proofing CTE

Using DACUM to Translate
Tech Trends into Program Design



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CENTER ON EDUCATION AND
TRAINING FOR EMPLOYMENT

Introductions

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skills.osu.edu

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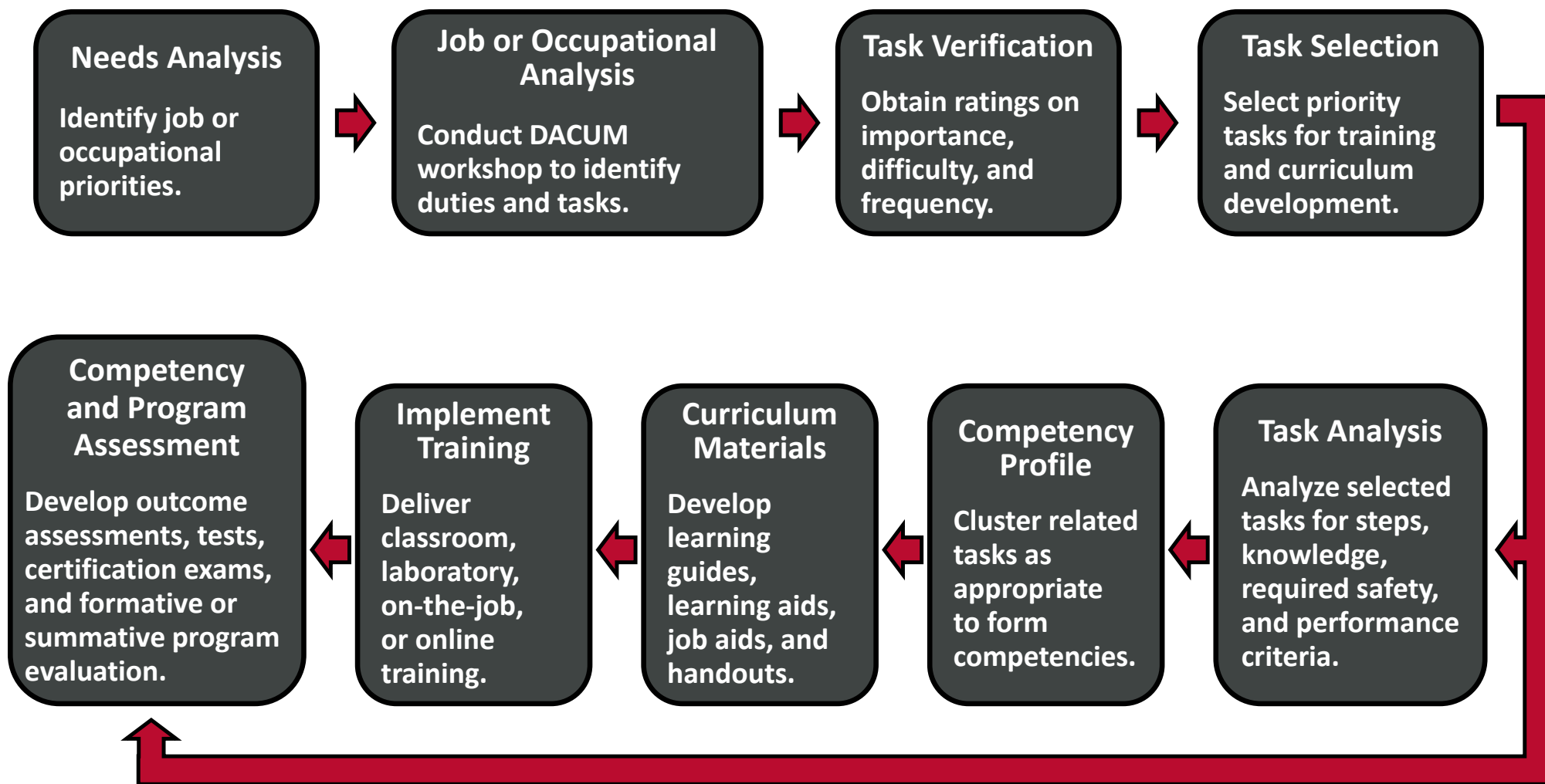
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Analysis to Development Process



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EDUCATION



Cornell University



TUSKEGEE
UNIVERSITY



INDUSTRY



MARS

Medtronic



GOV • MIL • NGO



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

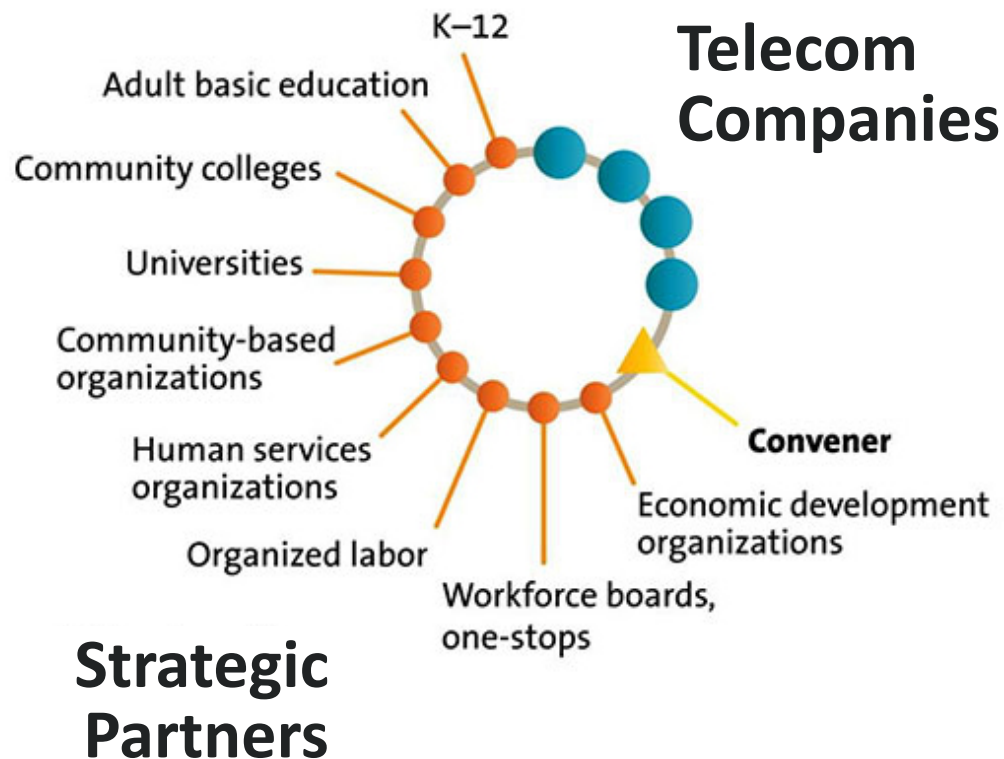


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Industry Sector Partnerships

Ohio Broadband and 5G Sector Partnership



*From the National Governors Association report:
State Sector Strategies Coming of Age: Implications for State Workforce Policymakers*



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How We Meet The Need

Catalyst



Analysis (DACUM)



Impact



Laser Materials Processing Technician

Modeling & Simulation (entry)
Modeling & Simulation (advanced)

Laser Machining Technical
Certificate & AAS

Modeling & Simulation AAS
(BAS in development)



Electromechanical Technician

Electromechanical Technology
Certificate & AAS



Small Cell Broadband Technician

Broadband Infrastructure
Training Program
(four industry-recognized credentials)



DACUM Chart: Industry Input

DACUM Research Chart for Small Cell Technician	
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May 24 & 25, 2023	

DACUM Research Chart		
DUTIES	TASKS	
A. Prepare for Small Cell Construction Projects	A.1 Review project SOW and BOM	A.2 com
	A.10 Test equipment after staging	A.11 equi
B. Maintain Safe Work Environment	B.1 Inspect PPE	B.2
	B.10 Participate in HPI initiatives (e.g., near miss, good catch)	B.11 fore work stru
C. Support Small Cell Structure Installation	C.1 Verify utilities locates	C.2 loca
	C.10 Verify structure installation documentation (e.g., photos, heights)	
D. Install Small Cell Equipment	D.1 Prepare installation equipment and tools	D.2 read
	D.10 Install grounding components (e.g., equipment, cables)	D.11 com HID Con
	D.19 Support commissioning activities	

DACUM Research Chart		
DUTIES	TASKS	
E. Troubleshoot/Repair/Replace Small Cell Components	E.1 Verify cause of service issue and urgency	E.2 stru
	E.10 T/R/R ancillary components	E.11 man com
F. Perform Small Cell Preventative Maintenance	F.1 Perform preventative maintenance on small cell structure	F.2 com NEC
	F.10 Perform preventative maintenance on ancillary components	F.11 prev main com
G. Decommission Small Cell Components	G.1 Verify equipment and associated components to be decommissioned	G.2 ener deco
	H.1 Perform vehicle and lift inspection	H.2 equi
I. Perform Administrative Tasks	I.1 Assist with completion of closeout documentation	I.2 C time
	J.1 Maintain safety certifications (e.g., OSHA 10/30, CPR/first aid, RF)	J.2 prof end aeri DEM

Tools, Equipment, Supplies, and Materials	
Fiber Components Fasteners Fiber Cleaner Fiber Jumpers Fiber Scope Hand Hold (Underground Vault) Knockout Tool Light Meter (VFL) Mule Tape NID OTDR Grounding 1" U-Guard / 1" Conduit Busbar Cadweld Cadweld Kit Earth Ground Tester Electrical Contract Grease Fasteners Ground Lugs Ground Rod(s) Ground Wire - Solid Ground Wire - Stranded Heat Shrink Mechanical Crimp Tool Power Equipment Banding Breaker(s) Conduit / PVC Fasteners Insulated Tools Load Center/Breaker Panel Lock for Load Center Meter Socket Plumbing Glue Power Wire Rectifier Volt Meter Weather Head Wire Strippers Radio & Antenna Components Antenna - Omni Antenna - Panel Antenna Alignment Tool Banding Coax Cable Coax Connectors Coax Supports Color Electrical Tape	Equipment Bracket Fasteners Integrated Radio JMA Compression Tool PIM Equipment Radio SFP(s) Shroud Stand Off Bracket (Radio & Antenna) Sweep Test Equipment Through Bolt U-Guard / Conduit Weather Boots Weather Proof Tape Safety Equipment Electrical Safety Lock (Padlock) Fire Extinguisher First Aid Kit Foreign Voltage Detector Gloves Hard Hat Proper Footwear RF Meter Road Cones Safety Glasses Safety Harness Safety Mask Safety Signs Safety Vest Snow Fence / Caution Tape Underground Hit Kit Structure Installation Equipment Anchor Bolts Concrete Concrete Hand Tools Conduit / PVC Digger Derrick / Crane Ground Rod(s) Hydro-vac Mechanical Tamper Mini Excavator Pea Gravel Pole Owner Guidelines Rebar Cage Rebar Tie Tool Rigging Shovels / Rakes Sonotube Spud Bar Steel Pole Wood Pole / Composite Pole

Program Guide

- Developed with Buckeye Hills Career Center
- 215-hour program, including:
 - Certified Premises Cabling Technician
 - Certified Fiber Optics Technician
 - OSHA 10
 - CPR/First Aid
- Instructor eligibility and preparation
- Curriculum and sequencing
- Materials and equipment costs
- Lab station set up
- CTE standards alignment

Broadband Infrastructure Training Program Guide

created by the Center on Education and Training for Employment at The Ohio State University in collaboration with Buckeye Hills Career Center



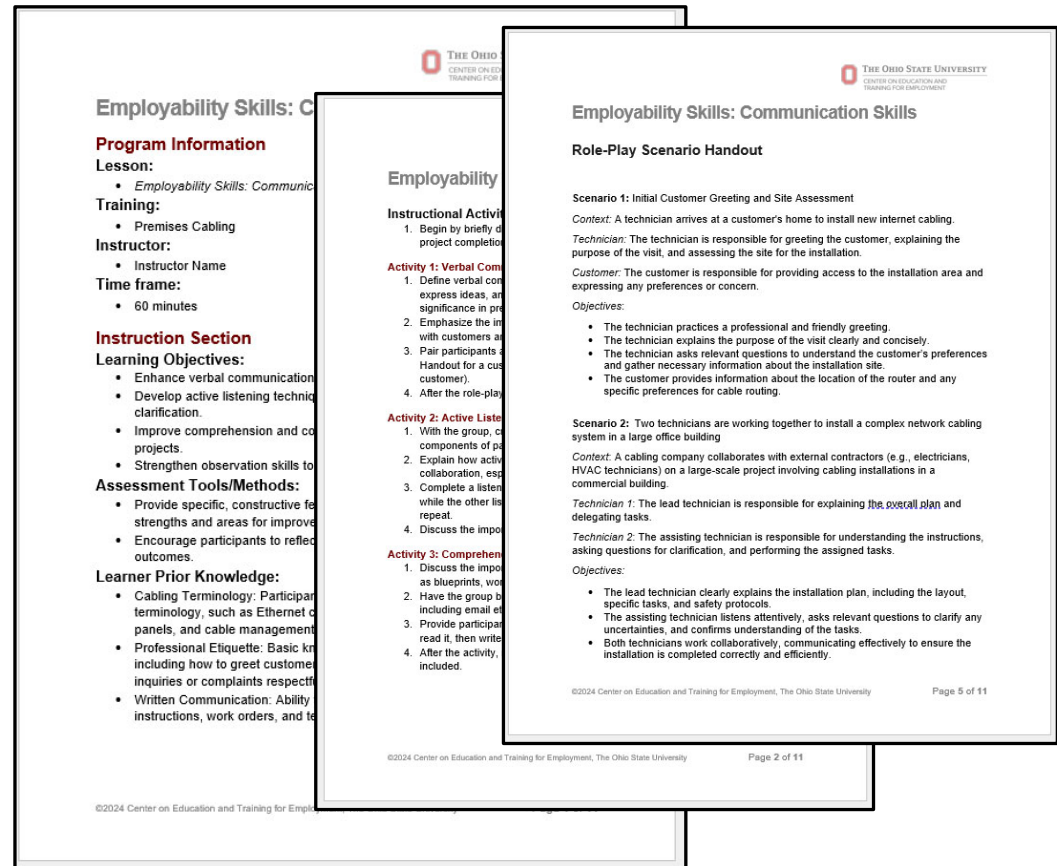
Development of this document was funded by the Governor's Emergency Education Relief funds from the U.S. Department of Education, authorized by the Coronavirus Response and Relief Supplemental Appropriations Act, 2021 grant from the Ohio Department of Higher Education and Governor's Office of Workforce Transformation.

Special thanks to the Broadband Infrastructure Training Program staff at Buckeye Hills Career Center who provided valuable information and support in the development of this guide.

<https://go.osu.edu/ohioBB>

Broadband and 5G Instructor Supports

- Repository of instructor resources
- Over 30 lessons developed to support broadband infrastructure training
 - Premises Cabling
 - Fiber Optics
 - Employability
- Alignment to Ohio Department of Education and Workforce Standards



DACUM (Developing a Curriculum)

Job Analysis Methodology



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What is DACUM?



DACUM is an acronym for
Developing **a** **C**urriculum**u**m



Analysis method using expert workers



Answers the question,
“What do you do?”



A foundation for competency-based
curriculum and training



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Major DACUM Applications



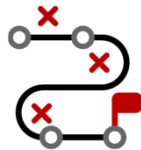
Curriculum development and revision



Assessment and testing



Certification and credentialing



Management and decision-making



Human resources and organizational development



Career advising and counseling



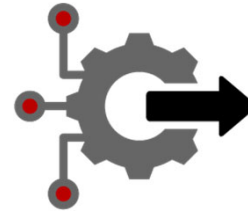
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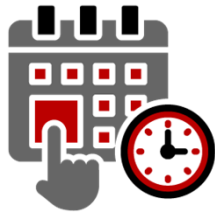
DACUM Process Advantages



Accurate and
credible



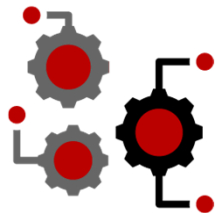
Clear and
structured



Efficient



Engagement
and ownership



Broadly
applicable



Foundation
for continuous
improvement



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DACUM Data for Program Development



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DACUM Chart: Industry Input

DACUM Research Chart for Laser Materials Processing Technician

Produced for



Produced by



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February 9 - 10, 2023

DACUM Research Chart for

DUTIES	TASKS
A. Perform Job Set-Up and Processing	A.1 Obtain work instructions A.10 Establish beam frequency
B. Maintain Production Equipment	B.1 Respond to down equipment B.10 Log equipment issues
C. Conduct Quality Assurance Activities	C.1 Calibrate QA tools C.10 Perform Pareto analysis (e.g., scrap, NCRs)
D. Maintain Safe Work Environment	D.1 Acquire PPE D.10 Participate in safety drills
E. Support Job Status and Traceability	E.1 Perform product identification (e.g., barcode, labels)

DACUM Research Chart for

DUTIES	TASKS
F. Support Production Launch and Improvements	F.1 Define product requirements (e.g., finishing, tolerances, COC) F.10 Support project timeline creation
G. Perform Administrative Tasks	G.1 Manage personal time cards (e.g., PTO, clock-in/clock-out) G.10 Participate in volunteering activities
H. Participate in Professional Development Activities	H.1 Complete personal onboarding activities H.10 Obtain Laser Safety Officer certification

Acronyms Full Form

5-S	Sort, Straighten
AR	Augmented Reality
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CI	Continuous Improvement
CNC	Computer Numerical Control
COC	Critical to Quality
EIS	Enterprise Information System
ERP	Enterprise Resource Planning
EUV	Extreme Ultraviolet
FAI	First Article Inspection
FR	Fire Resistant
GD&T	Geometric Dimensioning and Tolerancing
HMI	Human-Machine Interface
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LAI	Last Article Inspection
LOTO	Lock-out/Tag-out
MSA	Measurement System Analysis

Tools, Equipment, Supplies, and Materials

Lasers

- Ablation
- Additive
- Annealing
- Cutting
- Etching
- EUV
- Hardening
- Laser measuring
- Marking
- Robot
- Welding

Shop Tools

- Acid (hydrofluoric, nitric)
- Alcohol (isopropyl, methanol)
- Angle grinder
- Anti-spatter spray
- Anti-static spray
- Banding equipment
- Basic cleaning equipment
- Basic hand tools
- Breaker bars
- Cranes
- Deionized water
- Die grinder
- Drill press
- Forklift
- Hammers (air, chipping, dead-blow, sledge)
- Hand truck
- Impact tools
- Metric Allen wrenches
- Pallet jack
- Pneumatic metal shear ("nibbler")
- Pry bars
- Saws (band, chop, hand, sawzall)
- Scissor lift
- Spanner wrench
- Torque wrenches
- Wood blocks/shims

Metrology Tools

- Calipers
- CMM
- Dial indicator
- Digital comparator
- Feeler gauges
- Focus cube
- Gauge block
- Go/no-go gauge
- Harness tester
- Height gauge
- Laser micrometer
- Laser scanner
- Micrometer
- Microscope
- Multimeter
- Optical comparator
- Oscilloscope
- Particle counter
- Pin gauges
- Power meters
- Profilometer
- Protractor
- Radius gauges
- Ruler/tape measures
- Scanning electron microscope
- Surface plate
- Tensile testers
- Thread gauge
- Vision inspection equipment
- X-ray diffraction machine

PPE

- Clean room PPE (hairnet, beard cover)
- Cut shield
- Face mask
- Face shield
- Foot protection (steel-toe shoes, metatarsal protection)
- FR shirts
- Gloves
- Hard hat
- Hearing protection
- Laser safety glasses
- Respirator
- Welding apron

Raw Materials

- Glass
- Metals (carbon steel, stainless steel, nitinol, non-ferrous metals)
- Polymers
- Wood

Assist Gases

- Argon
- Carbon dioxide
- Compressed air
- Helium
- Nitrogen
- Oxygen

Additional Machine Equipment

- Consumables (machine-specific: laser optics, fibers, nozzles, hoses)
- Equipment & part holding fixtures (collets, rotaries)
- Machine & laser manuals
- Protective window
- Workstation operating system (software, HMI, PLC)

Additional Supplies & Equipment

- Basic office supplies
- Camera
- Checklists (PM, job)
- Copier
- ID badge
- Internet
- Intranet
- Label printers
- Laminator
- Laptop/tablet
- Phone
- Printer
- Scanner
- VPN
- Work instructions

Software

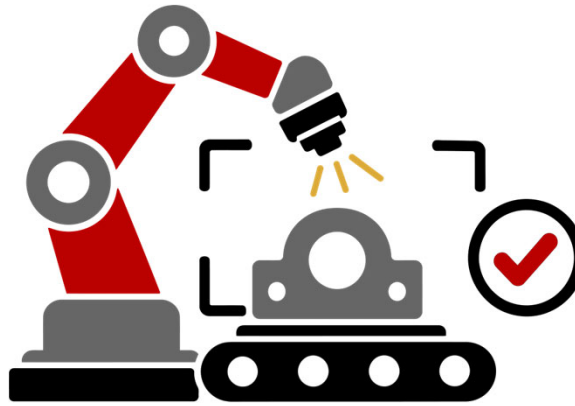
- CAD
- CNC/CAM
- Cybersecurity
- Data analysis
- ERP
- Metrology
- Microsoft Office
- PLM
- QMS
- Team collaboration
- Web conferencing

Future Trends are Now Current Reality

AI is Disrupting the Workforce



**Predictive
Maintenance**



**Quality
Assurance**



**Process
Optimization**



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DACUM Research Chart for Laser Materials Processing Technician

February 9 - 10, 2023

DUTIES	TASKS								
A. Perform Job Set-Up and Processing	A.1 Obtain work instructions	A.2 Perform machine start-up	A.3 Perform line clearance	A.4 Verify raw material quality	A.5 Load machine software and parts program	A.6 Set parameters within part-specific program (e.g., internal power, frequency, gas flow)	A.7 Perform focus check	A.8 Manage power reading	A.9 Establish assist gas type and position
	A.10 Establish beam frequency	A.11 Establish beam diameter and location	A.12 Set-up part fixturing	A.13 Verify machine set-up	A.14 Complete FAIL/AL	A.15 Run parts cycle	A.16 Adjust machine offsets to fit tolerance	A.17 Record job results	
B. Maintain Production Equipment	B.1 Respond to down equipment	B.2 Verify assist gas	B.3 Verify machine power	B.4 Verify machine optics	B.5 Resolve error codes	B.6 Escalate machine issues (e.g., maintenance, applications, engineering)	B.7 Inspect processing unit components (e.g., laser heads, cutting heads)	B.8 Adjust process settings (e.g., power, focus, gas)	B.9 Perform machine PM (e.g., card, checklist)
	B.10 Log equipment issues	B.11 Maintain machine cleanliness (e.g., 5-S, clear debris)	B.12 Maintain consumable inventory (e.g., optics, nozzles, gas)						
C. Conduct Quality Assurance Activities	C.1 Calibrate QA tools	C.2 Maintain QA tools	C.3 Perform visual part inspection	C.4 Perform geometric inspection	C.5 Perform in-process quality checks	C.6 Record inspection data	C.7 Monitor SPC run charts	C.8 Monitor scrap log	C.9 Generate NCR
	C.10 Perform Pareto analysis (e.g., scrap, NCRs)	C.11 Support Gage R&R	C.12 Support PFMEA	C.13 Support part validation process	C.14 Conduct inspection training	C.15 Support change management activities	C.16 Monitor operator SOP adherence		
D. Maintain Safe Work Environment	D.1 Acquire PPE	D.2 Perform 5-S activities	D.3 Perform LOTO	D.4 Perform safety audit	D.5 Perform equipment safety analysis	D.6 Report safety concerns	D.7 Resolve safety concerns	D.8 Support safety protocol development	D.9 Maintain chemical identification (e.g., label, storage, SDS)
	D.10 Participate in safety drills								
E. Support Job Status and Traceability	E.1 Perform product identification (e.g., barcode, labels)	E.2 Maintain status tags (e.g., process, products)	E.3 Develop material traceability report	E.4 Monitor production goals	E.5 Analyze run rates	E.6 Develop product status location	E.7 Support production priorities		



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Trends in the DACUM Data

DACUM Research Chart for Laser Materials Processing Technician

February 9 - 10, 2023

DUTIES	TASKS							
A. Perform Job Set-Up and Processing	A.1 Obtain work instructions	A.2 Perform machine start-up	A.3 Perform line clearance	A.4 Verify raw material quality	A.5 Load machine software and parts program	A.6 Set parameters within part-specific program (e.g., internal power, frequency, gas flow)	A.7 Perform focus check	A.8 Man...
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C. Conduct Quality Assurance Activities	C.1 Calibrate QA tools	C.2 Maintain QA tools	C.3 Perform visual part inspection	C.4 Perform geometric inspection	C.5 Perform in-process quality checks	C.6 Record inspection data	C.7 Monitor SPC run charts	C.8 Mon...
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D. Maintain Safe Work Environment	D.1 Acquire PPE	D.2 Perform 5-S activities	D.3 Perform LOTO	D.4 Perform safety audit	D.5 Perform equipment safety analysis	D.6 Report safety concerns	D.7 Resolve safety concerns	D.8 Support safety protocol development
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E. Support Job Status and Traceability	E.1 Perform product identification (e.g., barcode, labels)	E.2 Maintain status tags (e.g., process, products)	E.3 Develop material traceability report	E.4 Monitor production goals	E.5 Analyze run rates	E.6 Develop product status location	E.7 Support production priorities	

geometric	C.5 Perform in-process quality checks	C.6 Record data
part	C.14 Conduct inspection training	C.15 Support management activities



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Trends in the DACUM Data

Task Verification and Task Analysis



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Task Verification and Selection

Primary Dimensions

Importance

Frequency

Other Dimension Examples

Learning
Difficulty

Proficiency
Needed at Hire



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Task Verification and Selection

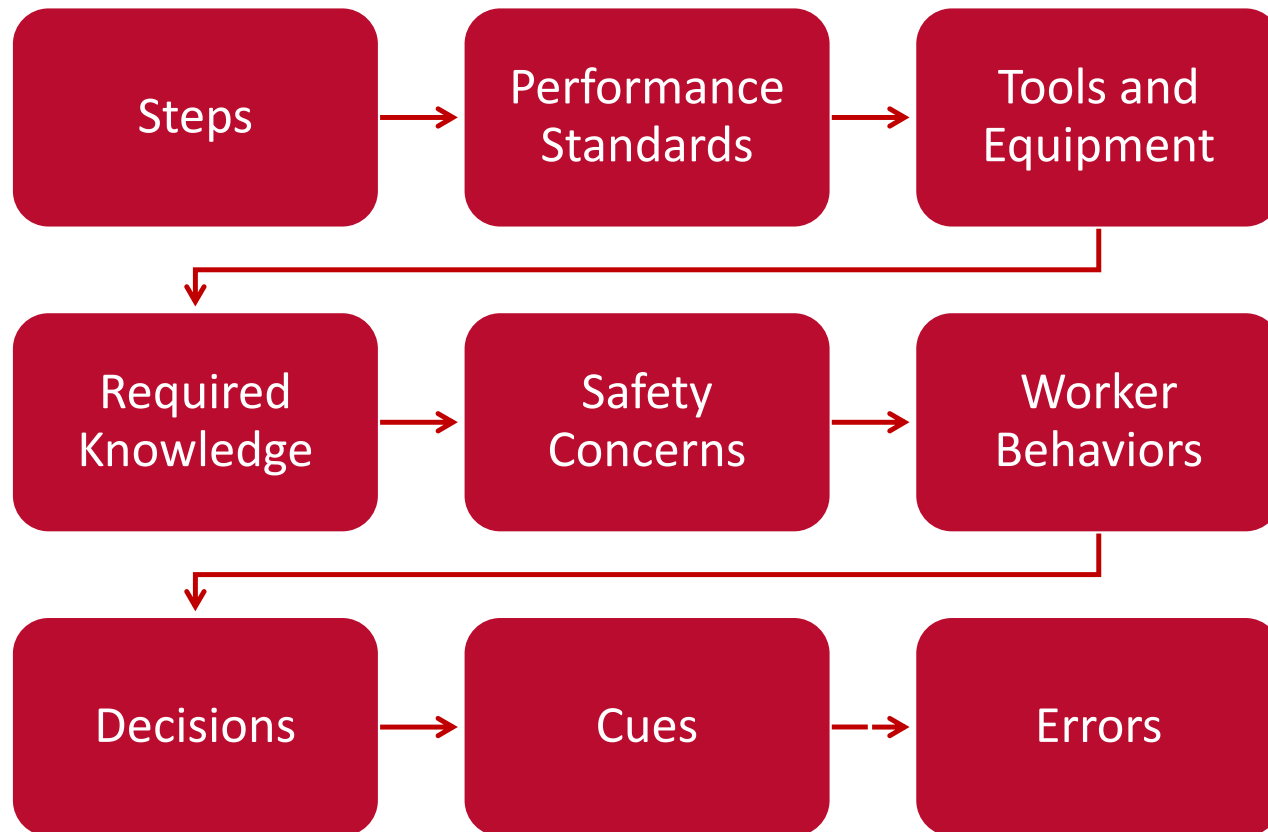
Job: Laser Materials Processing Technician	Task Verification Data				 THE OHIO STATE UNIVERSITY CENTER ON EDUCATION AND TRAINING FOR EMPLOYMENT	
	©2023 Center on Education and Training for Employment, The Ohio State University					
Tasks	Importance	Frequency	Beginner	Expert	Difficulty to Learn	Priority
C-01. Calibrate QA tools	4 (Very Important)	3 (Performed Weekly)	No	Yes	3 (Somewhat Difficult)	Medium
C-02. Maintain QA tools	3 (Important)	3 (Performed Weekly)	No	Yes	3 (Somewhat Difficult)	Medium
C-03. Perform visual part inspection	5 (Critically Important)	5 (Performed Daily)	No	Yes	3 (Somewhat Difficult)	High
C-04. Perform geometric inspection	5 (Critically Important)	5 (Performed Daily)	No	Yes	3 (Somewhat Difficult)	High
C-05. Perform in-process quality checks	5 (Critically Important)	5 (Performed Daily)	No	Yes	3 (Somewhat Difficult)	High
C-06. Record inspection data	3 (Important)	5 (Performed Daily)	No	Yes	1 (Not Difficult)	Low
C-07. Monitor SPC run charts	3 (Important)	5 (Performed Daily)	No	Yes	1 (Not Difficult)	Low
C-08. Monitor scrap log	2 (Somewhat Important)	5 (Performed Daily)	Yes	Yes	1 (Not Difficult)	Low
C-09. Generate NCR	3 (Important)	3 (Performed Weekly)	No	Yes	3 (Somewhat Difficult)	Medium
C-10. Perform Pareto analysis (e.g., scrap, NCRs)	2 (Somewhat Important)	1 (Rarely Performed)	No	Yes	3 (Somewhat Difficult)	Medium
C-11. Support gauge R&R	3 (Important)	1 (Rarely Performed)	No	Yes	3 (Somewhat Difficult)	Medium



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Task Analysis



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Task: Perform in-process quality checks

Step 1: Monitor live telemetry

PERFORMANCE STANDARDS (Observable and measurable criteria)		DECISIONS (What decisions must be made by the worker?)		CUES (Identify the data needed for making correct decisions)		ERRORS (What may result if incorrect decisions are made?)	
1	Observed real-time sensor metrics, melt pool geometry, and thermal profiles on the edge-compute dashboard throughout the laser run.	1	What sub-surface trends are these thermal fluctuations indicating before they breach the tolerance line? How does this current melt pool shape compare to the ideal baseline of the previous shift?	1	Real-time line graphs showing laser power stability, live numeric readouts from the coaxial photodiode, historical rolling averages of the melt pool's surface area, and engineering spec sheets defining acceptable thermal amplitude ranges	1	Failing to notice a gradual thermal drift or ignoring sub-surface sensor anomalies, which results in unchecked machine calibration decay, localized overheating of laser optics, and a high volume of scrap material produced before a hard threshold is finally breached.

SME also provide input on step-level:

- Tools, equipment, supplies, and materials
- Required knowledge and skills
- Safety concerns
- Worker behaviors



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Industry Engagement

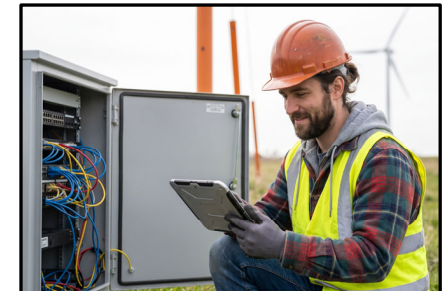
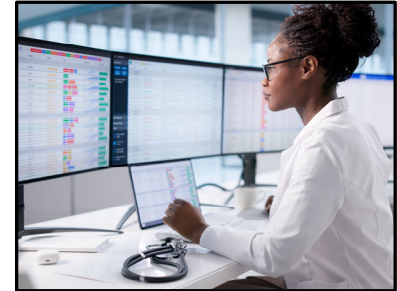
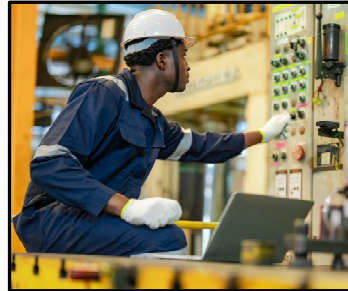


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Across Industries and Sectors

- Technology
- Manufacturing
- Skilled Trades
- Healthcare
- Human Resources
- Public Utilities
- Telecommunications
- Infrastructure



Industry Expertise

- Technical Competence
- Full-time Employment
- Occupational Representativeness
- Effective Communicator
- Freedom from Bias



*Utility Managers, National Rural Water Association
April 2025*



*Modeling & Simulation, Clark State College
October 2024*



*Electromechanical Technicians, Onondaga Community College
June 2024*



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Questions?

Learn more about CETE's workforce development solutions:

dacum.osu.edu

skills.osu.edu

Thank You!



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