

SEPTEMBER 25, 2020

GOVERNOR'S ADVISORY COUNCIL ON CONNECTED & AUTOMATED VEHICLES

Labor and Workforce Development

WELCOME & INTRODUCTIONS

Margaret Anderson Kelliher, Co-Chair
Commissioner, MnDOT

Phil Magney, Co-Chair
CEO and Founder, VSI Labs



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MEETING GOALS

1. Discuss work of the Innovation Alliance Labor and Workforce Development Committee
2. Learn about workforce development work from around the country and Minnesota
3. Identify future Minnesota research needs

RECAP OF EVENTS

INNOVATION ALLIANCE COMMITTEE UPDATES

TARA OLDS, MNDOT – CAV OFFICE



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GOVERNOR'S COUNCIL ON CONNECTED AND AUTOMATED VEHICLES CHARTER

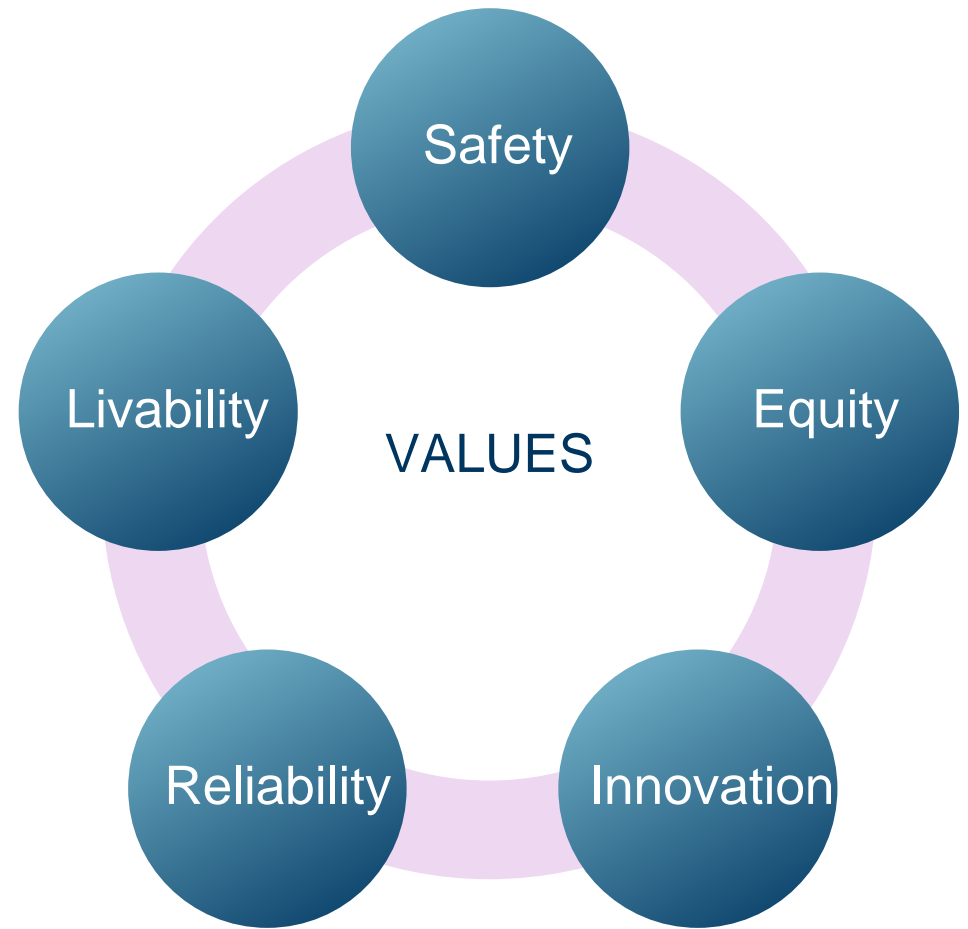
OUTLINING THE COUNCIL'S VISION, MISSION, GOALS, AND SHARED VALUES

VISION

Building a future of transportation that is safe, equitable, accessible, efficient, health, and sustainable

MISSION

The Governor's Council on Connected and Automated Vehicles collaborates with stakeholders, partners with academic institutions and private industry, and engages communities to prepare Minnesota for a future with emerging transportation technologies



ADVISORY COUNCIL GOALS

WHAT IS THE COUNCIL AND INNOVATION ALLIANCE WORKING ON IN THE NEXT 4 YEARS?

2020 PRIORITIES	2021-2023 PRIORITIES
<ol style="list-style-type: none">1. Equity, mobility, accessibility, public health and environment2. Industry and research partnerships3. Education, outreach, engagement and demonstrations/pilots to educate communities and decision makers	<ol style="list-style-type: none">4. Infrastructure investment5. Law for safe testing and deployment6. Economic and workforce development7. Data privacy and cyber security8. Insurance and liability9. Alignment with other states and federal government and sharing best practices10. Human factors and impacts of CAV on users

INNOVATION ALLIANCE COMMITTEES



SAFETY COMMITTEE



Safety

- Co-chairs –Mike Hanson (DPS) and Amber Dallman (MnDOT)
- Kick-off meeting to be scheduled soon

LABOR AND WORKFORCE



Labor & Workforce
Development

- Co-chairs –Chris Hadfield (Mn State Transportation Center of Excellence) and Patrick Weldon (Polaris)
- Potential committee goals
 - Curriculum development
 - STEM and other outreach
 - Job creation
 - Pilot project
 - CAV workforce data
- Reporting out TODAY and December 16th meeting

CONNECTIVITY AND DATA



- Co-chairs –Damien Riehl (FastCase) and Frank Douma (U of M – Humphrey School of Public Affairs), Vice-chair Eran Kahana (Maslon, LLP)
- Short-term focus: Understand current state and future state data needs
- Reviewing background information
 - National perspective on data
 - Minnesota Government Data Practices Act
 - MnDOT's CAV data work
- Committee goals
 - Develop privacy principles
 - Develop list of CAV data needs for the state (public and private)

INFRASTRUCTURE INVESTMENT



Infrastructure
Investment

- Co-chairs –Bret Weiss (WSB) and Jay Hieptas (MnDOT)
- Kick-off meeting October 7th

EDUCATION AND OUTREACH



Education &
Outreach

- Co-chairs –Gina Baas (U of M – Center for Transportation Studies) and Katie Caskey (HDR)
- Finalizing short and medium-term goals, priorities, and strategies
- Developing committee workplan
- Review of background information
 - Statewide CAV Messaging and Engagement Plan



QUESTIONS

LABOR AND WORKFORCE DEVELOPMENT

1. Committee updates
2. Carnegie Mellon University national science foundation research
3. University of Michigan CAV middle-skill workforce report
4. American Center for Mobility
5. Minnesota Department of Employment and Economic Development
CareerForce



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MEMBERS AND ADVISORS

Co-chairs	Chris Hadfield, MNSCU TCOE Patrick Weldon, Polaris
Members (capped at 30)	Amber Backhaus, Auto Dealers Association Michael Gorman, Split Rock Partners John Hauslauden, MN Trucking Association Tammy Meehan Russell, The Plum Catalyst Ed Reynoso, Teamsters Others TBI (e.g. DEED)
Facilitator	John Dukich, MnDOT Government Affairs
Committee advisors/support	Kristin White, CAVX
Technical advisors	TBA (DEED, MnDOT staff)

- MnDOT/CAV-X advise committee, support committee chairs with meeting preparation
- CAV-X ensures committee/Alliance goals support Council and CAV Strategic Plan
- State agency staff may serve as technical advisors



WHY ARE WE A PART OF THIS COMMITTEE?

- Safety
- Partnerships - Need to partner to train workforce, technicians, engineers need to learn how to safely work on automated vehicles and technologies
- Job creation - Need to be intentional about jobs that will be created. Enhanced, or modified by technology and understanding which jobs may be displaced.
- Leadership – Put Minnesota on the map and build partnerships



SHORT-TERM GOALS

ACCOMPLISH IN NEXT SIX MONTHS

1. Get committee up and running
2. Grow membership and participation
3. Remain “granular” and specific, while being aware of other committees’ work (e.g. Education and Outreach)
4. Identify clear deliverables, including:
 - Summary of existing CAV workforce development research
 - Assist DEED in any CAV gap analysis work moving forward
 - Produce a CAV supply and demand report and distribute
 - Gather anecdotal data and stories from technicians



OTHER OPPORTUNITIES

ACCOMPLISH IN NEXT 12-18 MONTHS

- Pilot project (e.g. “Gig economy”)
- Curriculum development
 - NCAT “Train the trainer” model
 - Truck driving curriculum
 - Minnesota Robotics Institute partnerships
 - Expand autonomous vehicle coursework and certifications
- STEM/youth outreach
- Leverage other existing resources and create synergies with related efforts



Stackable Micro-Credentials for Workforce Development

Vu Nguyen & Jesse Flot

www.cmu.edu/roboticsacademy

The Robotics Academy is a research, development, and outreach program within Carnegie Mellon University that studies how buildable and programmable agents can be used to teach CS & STEM skills at all ages

Impact

- 1M+ students across 17,500 schools use CMRA curriculum each year
- Over 3,500 teachers, coaches, and facilitators trained since 2005

CS-STEM Network LMS

- Curriculum and certification platform developed and maintained by CMRA
- 220k Learners have earned:
 - 26k Certifications
 - 77k Badges
 - 2.1M Achievements



Workforce Demands

Robotic and data-driven systems are embedded into every industry sector

- transportation, health, manufacturing, energy, defense, entertainment, banking, education...

Industry needs a workforce capable of installing, debugging, maintaining, and updating these systems



Completed R&D Programs:

- Robotics Corridor Phases 1 and 2 (NSF)
- Smart Manufacturing and Advanced Robotics Training (ARM Institute)
- SMART Extended Reach (Partner4Work)
- Rapid Dissemination of AI Micro-credentials through Hands-on Industrial Robotics Education (NSF)

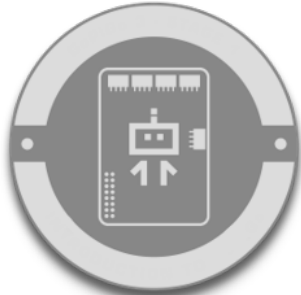
Key Findings:

- A national partnership is critical to creating an efficient, rapid, and sustainable training program for technical workers.
- Meeting demand requires a combination of both incumbent and worker training.
 - A “Stackable Micro-credential” model provides the flexibility necessary to meet the needs of both.
- Employer and trainee participation must be mutually de-risked through early asynchronous employment training, wrap-around services, and work-based upskilling.

Industry Demanded Stackable Micro-Credentials



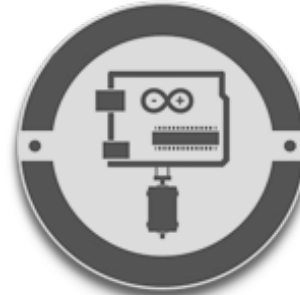
Communication &
Collaboration



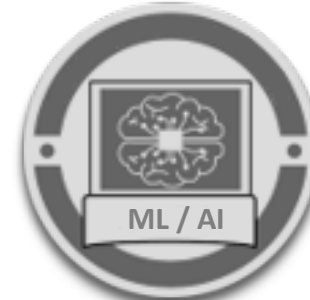
Displays &
User Interfaces



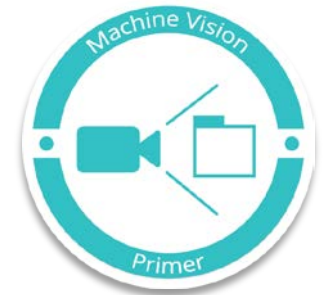
Additive
Manufacturing



Data &
Computation



Machine
Learning



Machine
Vision

Additional micro-credentials in demand for technical workers



Mechanical
Foundations



Fabrication
Foundations



Electrical
Foundations



Software
Foundations

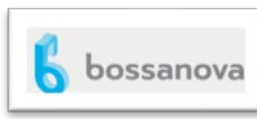
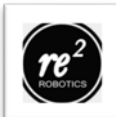


Robotics
Integration

Cross-cutting, foundational micro-credentials

Local Implementations

- 9 Community Organizations serving hundreds of learners
- 8 High Tech employers provide site visits, job interviews
- All adaptable to remote facilitation through leased kits, simulation, and virtual tours



Q&A

Thank you!

Feel free to reach us at cmra@nrec.ri.cm.edu for any questions!

Workforce Resources

- **Short-term and customized training programs** – minnstate.edu/ws/index.html
- **CareerForceMN.com and CareerForce Locations** – www.careerforcemn.com
- **MinnesotaWorks.net** – www.minnesotaworks.net
- **Labor Market Information** – mn.gov/deed/business/help/lmi/#regional-analysts
- **Coursera** – <https://bit.ly/2EvxeFL>
- **Regional teams: Veterans, State Services for the Blind, Vocational Rehabilitation Services, Dislocated Workers, Business Development**



AMERICAN CENTER FOR MOBILITY

Governor's Advisory Council

Connected & Automated Vehicles

September 25, 2020

Adesewa Adesiji Workforce Strategy Consultant

Jacqueline Buck Director of Workforce Strategy

Develop innovative workforce solutions with employers to recruit & retain local workforce talent.

- DEED labor market information
- DEED jobs in demand
- Key industries identified in state and regional plans
- External resources



A smiling man wearing a blue baseball cap and a light blue button-down shirt is holding a tablet. He is standing next to a white truck, with the truck's side mirror and a large exhaust stack visible in the background.

DEED Job Vacancy Survey

- Q 2019 Motor Vehicle Operators job vacancies
 - 5,284 in Minnesota
 - 2,371 in the Metro Area

Workforce Data

Expect job vacancies within these occupations -

- Transportation and Material Moving Occupations



Top skills:

- Dedication
- Scheduling
- Sorting
- Inverters
- Owner operator, tractor-trailers
- Logistics
- Customer service



Top certifications:

- Commercial Driver's License
- Class A CDL
- HAZMAT
- Class B CDL
- Tanker and hazmat endorsement
- OSHA certification
- Forklift certification

Standard Occupational Classification (SOC)

Similar occupations

- [Automotive Service Technicians and Mechanics](#) (49-3023)
- [Bus and Truck Mechanics and Diesel Engine Specialists](#) (49-3031)
- [Electronics Engineers, Except Computer](#) (17-2072)
- [Mechanical Engineering Technicians](#) (17-3027)
- [Mechanical Engineers](#) (17-2141)
- [Electrical and Electronic Engineering Technicians](#) (17-3023)
- [Electro-Mechanical and Mechatronics Technologists and Technicians](#) (17-3024)
- [Industrial Engineering Technicians](#) (17-3026)
- [Industrial Machinery Mechanics](#) (49-9041)

Standard Occupational Classification (SOC)

Soc Code	Job Title	Current Demand Rank	Current Demand Indicator	2020 Annual Wage		2018 – 2028 Projections		Education Requirements	Training Requirements
				25th Percentile	Median	Percent	Net New + Replacement		
172141	Mechanical Engineers	41	Five Stars	\$69,189	\$82,394	4.8%	2,022	Bachelor's degree	None
493023	Automotive Service Technicians and Mechanics	44	Five Stars	\$34,575	\$44,064	-0.3%	3,959	Postsecondary non-degree award	Short term on the job training
173023	Electrical and Electronics Engineering Technicians	60	Five Stars	\$49,184	\$60,965	-1.7%	614	Associate's degree	None
493031	Bus and Truck Mechanics and Diesel Engine Specialists	68	Five Stars	\$43,232	\$52,741	6.4%	2,597	High school diploma or equivalent	Long term on the job training
499041	Industrial Machinery Mechanics	78	Five Stars	\$47,971	\$58,302	6.4%	2,650	Postsecondary non-degree award	Long term on the job training
173026	Industrial Engineering Technicians	107	Five Stars	\$43,334	\$52,528	2.3%	1,210	Associate's degree	None
172072	Electronics Engineers, Except Computer	230	Three Stars	\$77,646	\$100,551	-1.2%	202	Bachelor's degree	None
173027	Mechanical Engineering Technicians	279	Three Stars	\$50,639	\$61,935	2.6%	503	Associate's degree	None
173024	Electro-Mechanical Technicians	330	Two Stars	\$44,779	\$56,388	2.3%	189	Associate's degree	None

Workforce Resources

Internal Resources @ DEED

- Workforce Strategy Consultants

www.mn.gov/deed

WORKFORCE STRATEGY CONSULTANTS

NORTHWEST

Chet Bodin

Chet.Bodin@state.mn.us

218.333.8200 (w)



CENTRAL

Della Ludwig

Della.Ludwig@state.mn.us

320.423.0121 (c)

320.308.5364 (w)



NORTHEAST

Shawn Herhusky

Shawn.Herhusky@state.mn.us

218.349.1428 (c)

218.302.8408 (w)



METRO REGION

Adesewa Adesiji

Adesewa.Adesiji@state.mn.us

952.261.6942 (c)

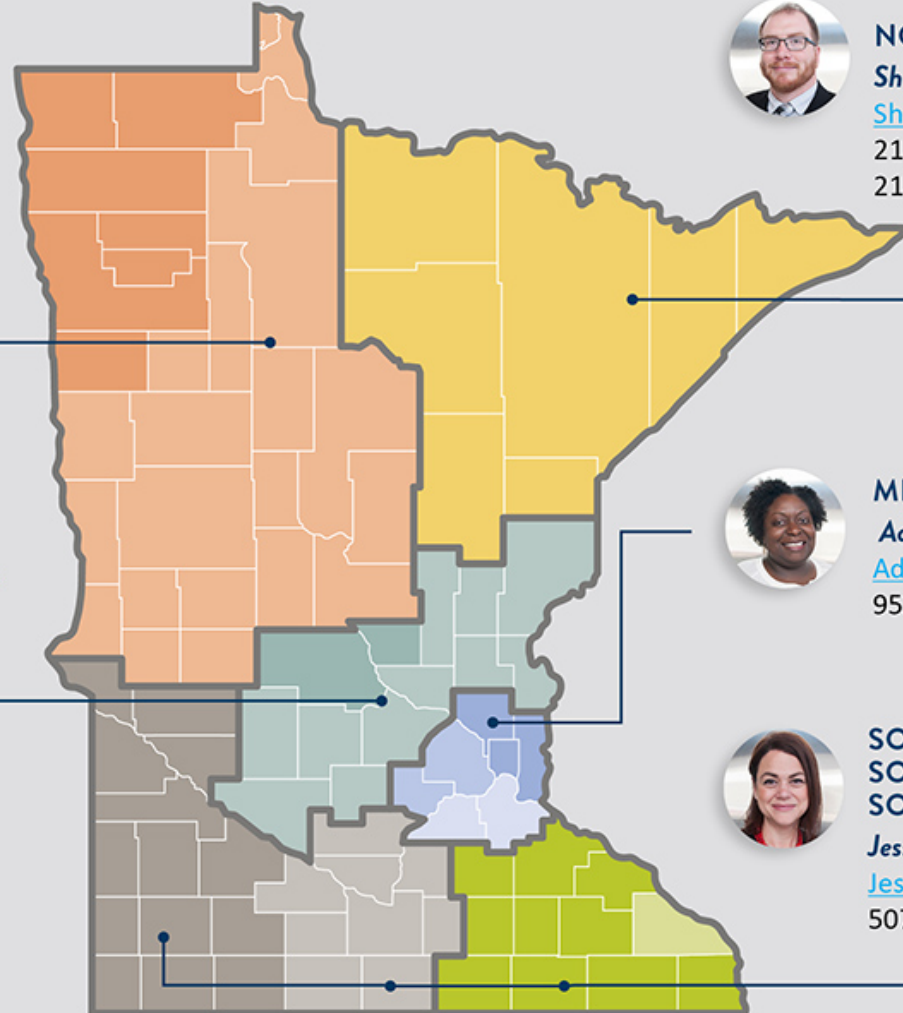


SOUTHWEST, SOUTH CENTRAL & SOUTHEAST

Jessica Miller

Jessica.Miller@state.mn.us

507.344.2610 (w)



Workforce Resources

External Resources

- Local Workforce Development Boards
- Community-based Organizations
- Foundations
- Industry Associations
- Education
- Chambers



Funding Opportunities

- Minnesota Job Skills Partnership (MJSP)
<https://mn.gov/deed/business/financing-business/training-grant/>
- Job Training Incentive Grant Program (JTIP)
- Pathways to Prosperity grants
- Dislocated Worker grants
- Local and community grants
- Business and foundation grants
- Legislative appropriations



Questions?

Contact information

Adesewa Adesiji Workforce Strategy Consultant

Adesewa.Adesiji@state.mn.us

Jacqueline Buck Director of Workforce Strategy

Jacqueline.Buck@state.mn.us



QUESTIONS FOR PANELISTS

COUNCIL DISCUSSION

- HOW CAN THE STATE COORDINATE TO ADVANCE CAV SKILLS?
- WHAT ADDITIONAL RESEARCH IS NEEDED IN MINNESOTA ON CAV LABOR AND WORKFORCE DEVELOPMENT?

4

OPPORTUNITY FOR PUBLIC COMMENT



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CLOSING

UPCOMING EVENTS:

- TEXAS MOBILITY SUMMIT: SEPTEMBER 29-30TH
- OCTOBER 22-23RD MAASTO CAV eSUMMIT
- NEXT MEETING IS DECEMBER 16TH FROM 10:00 AM-12:30 PM



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THANK YOU

GOVERNOR'S COUNCIL ON CONNECTED AND AUTOMATED VEHICLES

MARGARET ANDERSON-KELLIHER
Co-Chair

PHIL MAGNEY
Co-Chair





ECONOMIC GROWTH INSTITUTE

UNIVERSITY OF MICHIGAN

Understanding the Middle Skill Workforce in the Connected & Automated Vehicle Sector

September 25, 2020

Workforce Mobility Study

- **Big Picture:** Industry 4.0
- **Specifically:** CAV sector: design, testing and related infrastructure
 - Middle skills → technicians



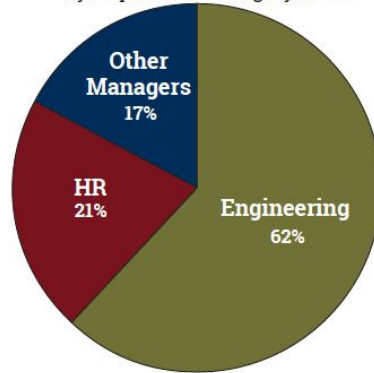
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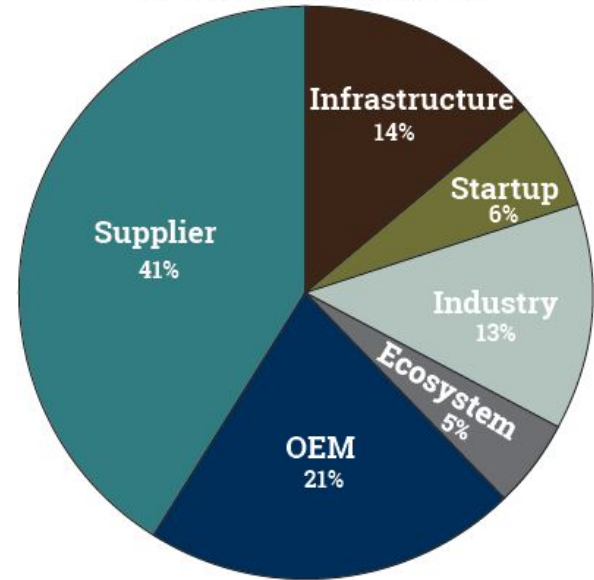
Workforce Mobility Study

Study: 63 participants representing 30 organizations

STUDY PARTICIPANTS
by Department Category, n=63



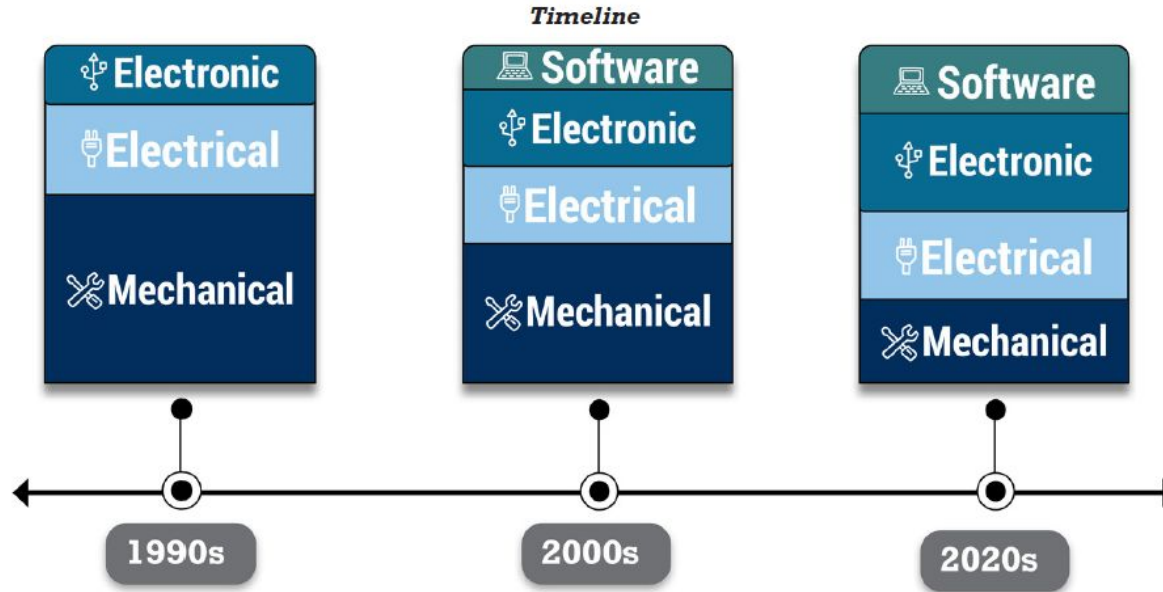
STUDY PARTICIPANTS
by Organization Type, n=63



Middle Skill Jobs

Technicians comprise the majority

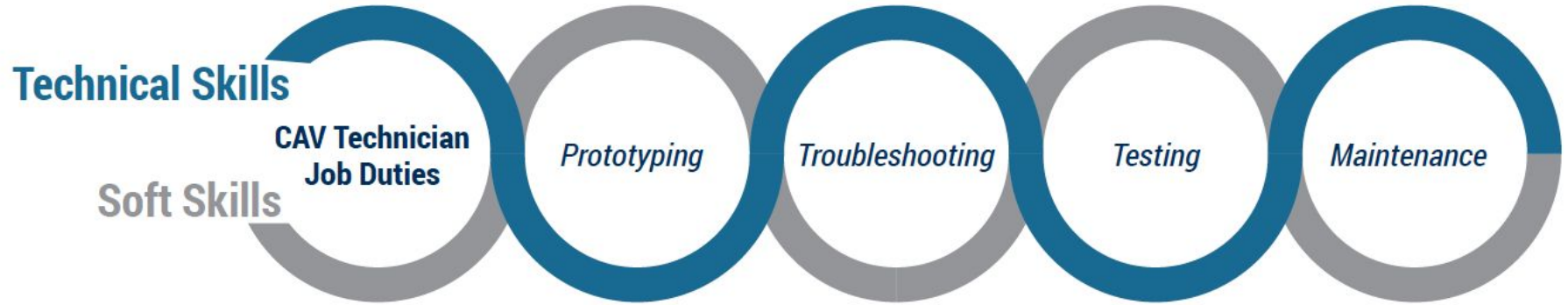
Technician Workforce General Skills



The complexity and number of skills are increasing

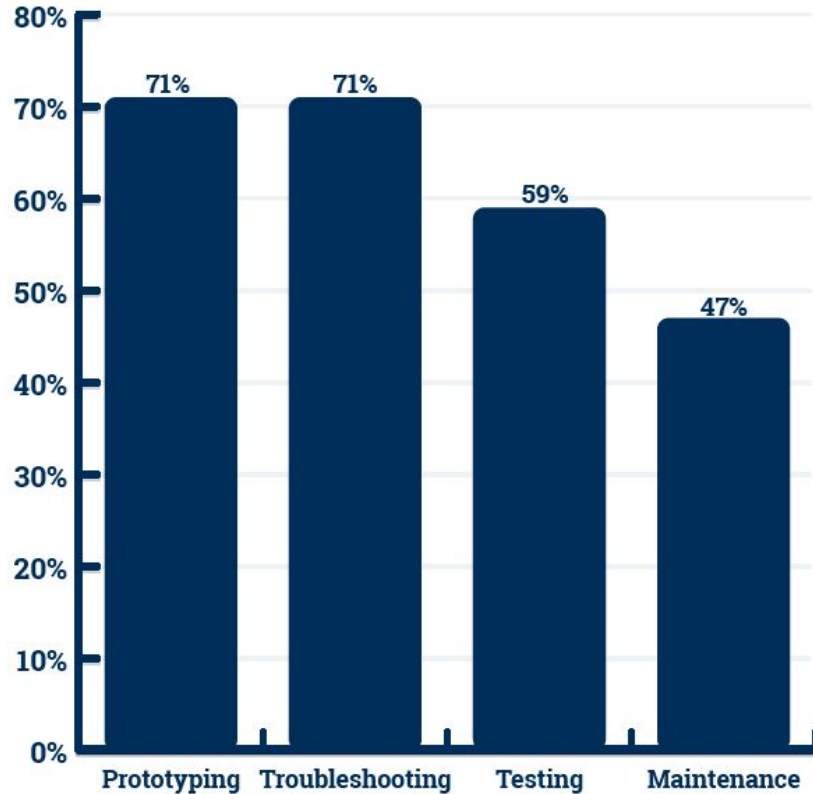


Job Duties versus Skillsets



JOB DUTIES OF CAV TECHNICIANS

Reported by CAV-Direct Employers, n=17



- “The technicians, we hope, could do...an initial Level 1 analysis of those logs and say, ‘That was a good run’, or ‘That was a bad run,’ rather than having to say, ‘I captured something,’ and throwing it over the wall to somebody. That is the expectation we have today and I think that expectation just will grow” – Engineering Manager at an OEM



Technical Skillsets

MECHANICAL

- Comprehensive understanding of vehicle
- Wrenches and other tools to assemble and disassemble vehicle
- Fabrication skills

ELECTRICAL

- Electrification
 - Batteries
 - Inverters
 - Boosters
 - High-voltage
- Electromechanical
- Hybrid motors

ELECTRONIC

- Sensors, extrinsic calibration
- Power control electronics
- Vision/Video systems
- EMC electromagnetic understanding

DATA-RELATED SYSTEMS

- Data acquisition
- A to D converters
- CAN
- Wireless, V2X, V2V, V2I
- Telematics

SOFTWARE

- Understanding coding languages
- Ability to run and alter programs for testing, as needed
- Upload and download new software into the vehicle or component

SYSTEMS

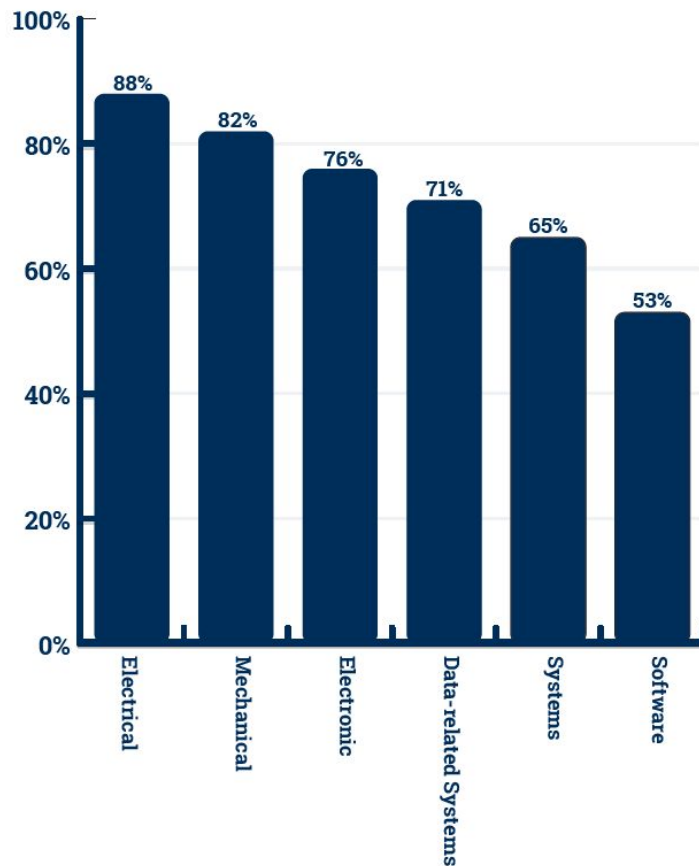
- Linkages between the systems
- Collaborative Components
- Inputs & Outputs
- Feedback loops
- Problem solving (soft skill)



Technical Skillsets

SKILLSETS OF CAV TECHNICIANS

Reported by CAV-Direct Employers, n=17



‘Mechatronics’

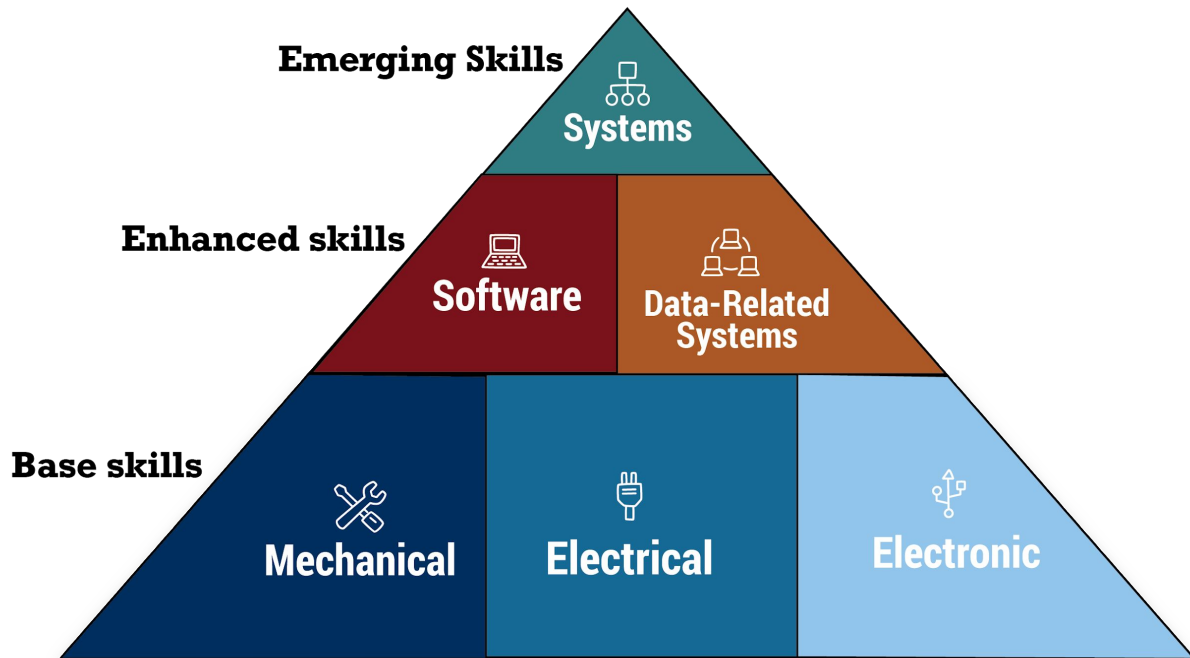


- Mechanical + Electronics
- Mechanical + Electronics/
Electrical + Computer
systems, and more
- *Training: robotics and
automated equipment or
combination of mechanical,
electrical fluid power and
computer robotics classes.*



Workforce Technical Skills

CAV Technician Workforce Skillsets



CAV Technician Skillsets, *based on mentions by employers*

13% - Emerging Skills

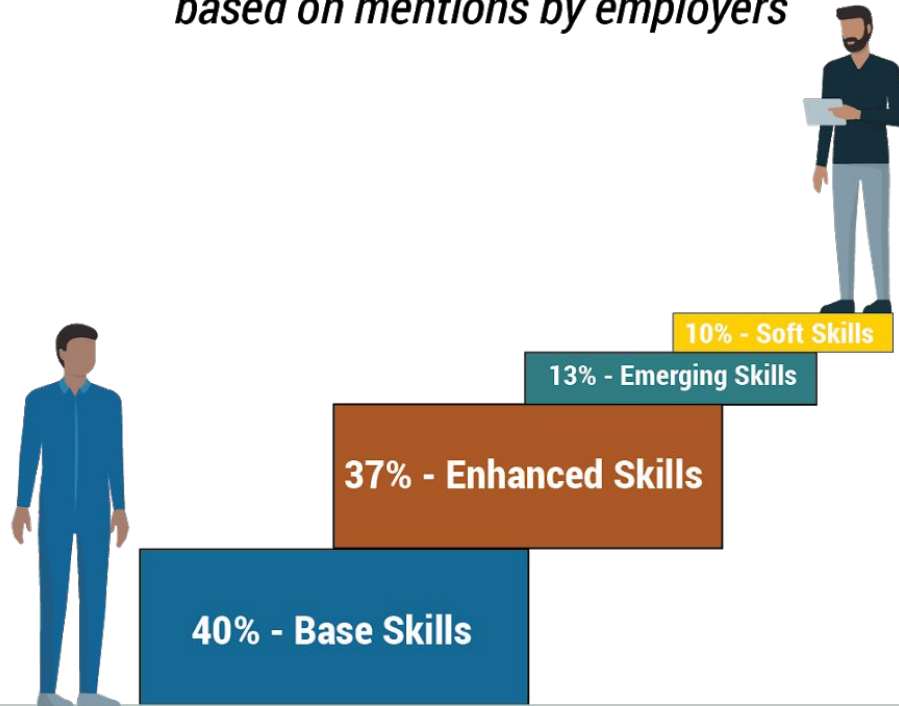
27% - Enhanced Skills

60% - Base Skills



Current Workforce Gaps

based on mentions by employers

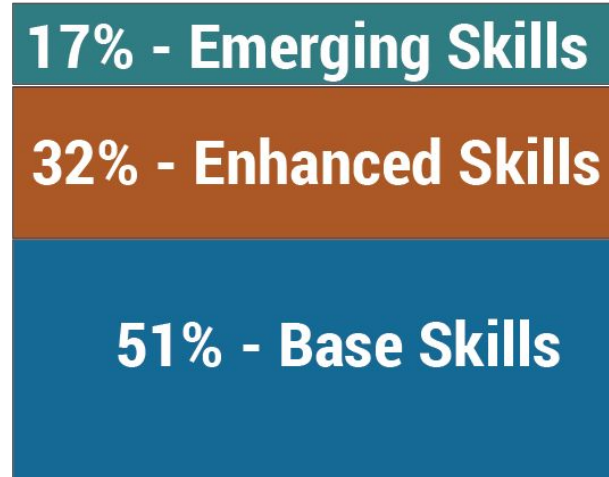
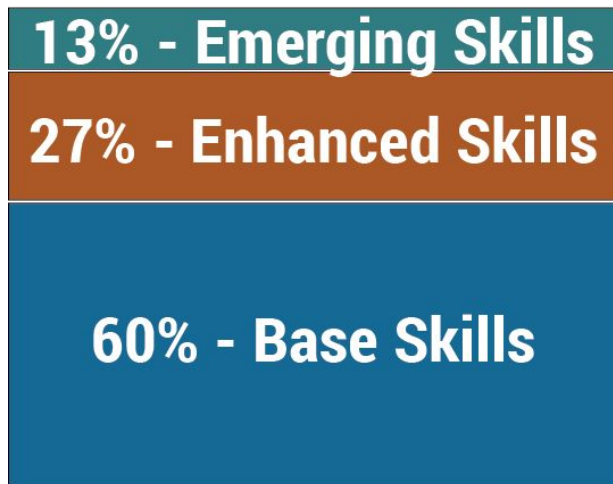


CAV Technician Skillset Current vs. Future, *based on mentions by employers*

2020

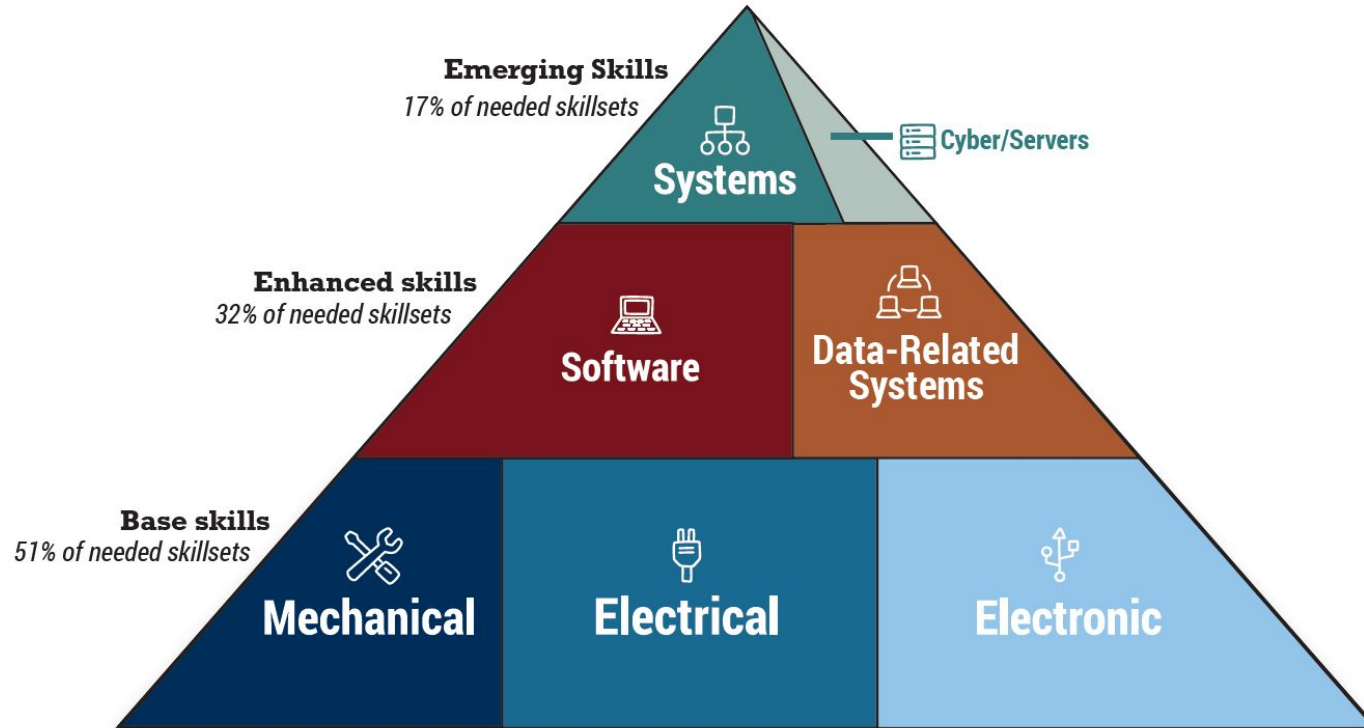


2025



CAV Technician Workforce Skillsets

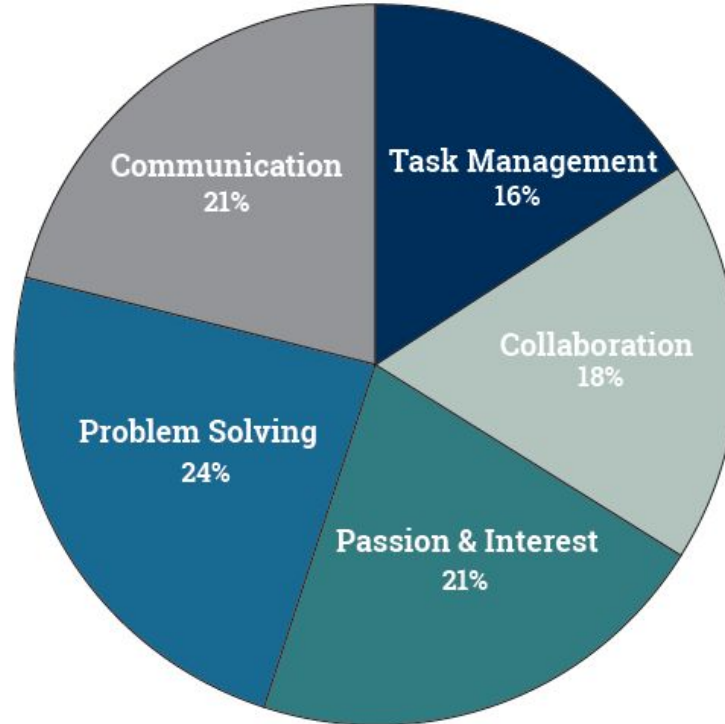
3+ year forecast



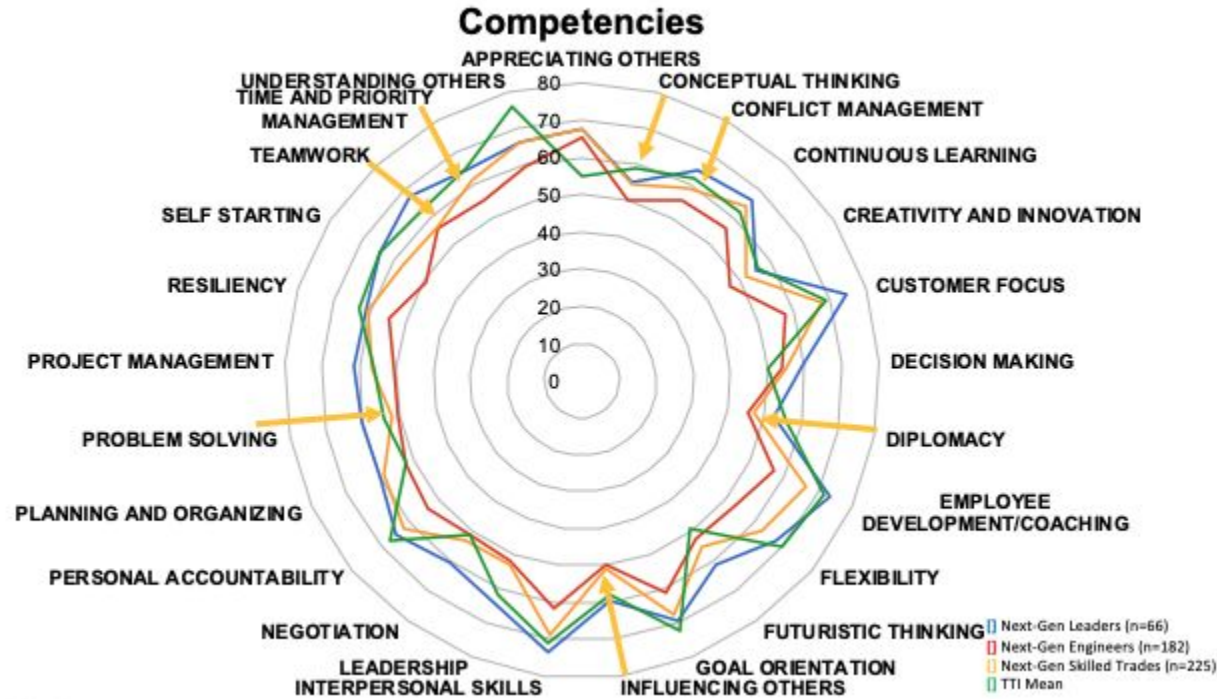
Soft Skills

BREAKDOWN OF SOFT SKILLS

n=16 organizations



Industry 4.0 Competencies



Bottom 3:

- Problem Solving Skills
- Influencing Others
- Diplomacy

CAV INDUSTRY MIDDLE-SKILLS JOB ROADMAP

Infrastructure Jobs Emerging

- Data Analyst
- Configuration Technician
- IT Technician

Top jobs in 1 - 3 years*

- CAV Technician
- Safety Drivers
- Fleet /CAV Maintenance Technician

**Significant hiring due to retirements*

Emerging jobs in 3+ years

- CAV Technician
- Safety Drivers
- Fleet /CAV Maintenance Technician
- Cybersecurity Technician
- Customer Service Representative

Top jobs 1 – 12 months

- CAV Technician
- Safety Drivers



Conclusions

- Traditional skilled trades jobs are changing, but not disappearing.
- Skillsets are increasingly complex, but can be acquired.
- Solutions may not be more schooling, but continued development through individuals courses and experiential learning in enhanced and emerging skills.



Questions/Comments

More information:

<https://economicgrowth.umich.edu/research/workforce-connected-automated-vehicle/>

Contact: Sarah Crane, research project manager

sarahrcr@umich.edu

