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Mike: From the Center for Occupational Research and Development welcome to Preparing Technicians for the Future of Work. I'm your host Michael Lesiecki. In each podcast we'll reach out to the people who are actually on the front line of the future of work and hear what they have to say. That means interviews with industry leaders, working technicians, and forward thinkers in the field. In every episode we will suggest action that you could take. We want to inspire you to take that action.

This podcast is brought to you by the Center for Occupational Research and Development, known as CORD, with financial support by a grant from the National Science Foundation's Advanced Technological Education program. Opinions expressed in the podcast do not necessarily represent those of the National Science Foundation. You can find out more about our project and our approach at "preparing technicians"—all one word—dot org.

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Our project has completed its first year of activities and it's a good time for us to pause and let you, our listeners, know what our main accomplishments are, and findings. Let's invite the project's leadership in and put them on the hot seat. Let's begin with Ann-Claire Anderson. Ann-Claire, you are the project's Principal Investigator. What have we tried to accomplish this past year? And how did we do, Ann?

Ann-Claire: Well, right off the bat, let me say that we have recruited ten dynamic and dedicated National Industry Advisory Committee Members. They provide us with ongoing guidance and feedback on all our project activities. And then that guidance helps to keep us on track, but also sometimes, to think outside the box.

Another success story from this year is that we've held really productive meetings that bring representatives from industry and from colleges to the table to discuss the future of work more in depth. The group's discussions we've had at those meeting have allowed us to begin to identify core issues of concern, and, then, three cross-disciplinary knowledge and skill areas. These will be key as we go forward into Year Two.

Something else we've done this year is develop a site visit and interview protocol, with input from our industry advisors. We piloted this protocol this Spring as a way to gather information from actual technicians, their supervisors, and others at plants across the country.

Mike: Ann-Claire, we've thought of this as our "Discovery Year." Did anything really surprise you in this discovery process?

Ann-Claire: Not really a surprise, but just a little data point that kind of illustrates how rapidly the field is changing, and then puts it in some perspective. I found an interesting data point from interviews that kind of mirrors the development of cars. As machines become capable of performing higher level functions, coming to the shop floor pre-programmed and using more AI, their increasing complexity means that their maintenance may need to be hired out to vendors at this point, because technicians don't yet have the skill set for fixing them. This is in contrast to older, less complex machines that broke more often, but were easier to fix. So, a little mirror of the car industry, and its growth from 1950—when you could work on your own car—to today—where it's probably a computer in there!

Mike: That's an interesting point, Ann-Claire. Of course, there's technicians working for those vendors who are coming in to repair those machines. It's an interesting hybrid of the manufacturing floor today. Thanks for those comments.

Colleagues, let's turn to Hope Cotner. Hope, in your role on the project, you interact quite extensively with outside communities, and I know you've made a number of Future of Work presentations. What, in your view, is going on out there that relates to our project and its findings?

Hope: Thanks, Mike. I have had the opportunity to share our work with several groups of community college leaders who are really hungry for insight about how Future-of-Work related issues will affect their students. They're looking for information applicable directly to the technician workforce, and strategies they can undertake that will ensure their programs are preparing students for the workplace of the future. The details we're gathering from our meetings with industry leaders and interviews with technicians are of particular interest to them. New research and business advice on Future-of-Work issues is

released almost every day, and it's unrealistic for a community college administrator to monitor it all and to distill it into actionable steps for their community—all by themselves. We're aiming to be a conduit for the field for information and resources for the narrower, yet much deeper, slice of the future of work conversations that are specific to STEM technicians.

Mike: Excellent point.

Ann-Claire, how does someone find out about these things that Hope's talking about? How do we provide information? Where do they go to find this information?

Ann-Claire: Our website is a great place to start: preparing technicians—all one word—dot org. And there you'll find updates on our project. There's a link to our Twitter feed, where we push out information, both from our project and then from other relevant industries and ATE Centers that are doing work in the Future of Work.

On our website you'll find podcasts. Right now we're up to eight of them. And one a month comes out. They're on a variety of topics, but we're focusing on industries that are involved in the Future of Work, and how they are evolving.

We also have blog posts on a similar theme: "How is the future of work evolving?" And also "How are educators supposed to adapt to that?" That's one of the issues we're exploring this year: "What kind of recommendations can we make out of our research for two-year STEM Associate Degree programs?"

Mike: Good comments, Ann-Claire. Thank you.

In this first year we had an opportunity to work closely with our industry advisors, and Ann-Claire mentioned our strong Industry Advisory Board. We also had an opportunity to explore an advanced manufacturing facility at Toyota Motors. Marilyn Barger has worked closely with our industry members and led the delegation at Toyota. Marilyn, what did you see there?

Marilyn: Well, Mike, I don't know who doesn't enjoy a good industry tour! I'm really lucky enough to visit a lot of companies every year, and I always learn so much about how different products are made, and how production businesses are run. Like Hope and Ann-Claire mentioned, the Future of Work project is collecting data from a variety of different

sources including these site visits. When analyzing all the data together, we expect to get a good and detailed picture of what technicians will need to know and be able to do in the future of a typical industrial site.

Our site visits are taking us to facilities that currently are investing and implementing a wide range of new technologies. On these visits we are not only taking in-depth tours, but also interviewing technicians, supervisors, upper management, and human resource personnel. We are hoping to hear what is happening now and what is "coming soon" on our "ground zero:" the facility floors.

Our first site visit for the Future of Work Project was to the Toyota manufacturing plant in Kentucky. We spent a day touring the facility and interviewing five employees, asking them what new technologies were being installed, and what changes that was making in the skill sets of the facility's technician workforce. We also toured a partner Technical College manufacturing program that works closely with Toyota.

What did we learn on our visit? Here are a few takeaways.

1. More robots and more cobots with more functionality, which means they're more complicated and more connected, are being installed everywhere.

2. Most technicians need to know more about digital communication protocols between equipment.

3. More connected and automated robots and machines mean more challenging troubleshooting situations.

4. Across all the operators and technicians, strong fundamentals in math science and technology are key to understanding the new equipment and processes, and are building blocks for critical thinking, troubleshooting, and the transference of knowledge.

And, last but not least, employability skills (or the soft skills) are still extremely important—maybe even more so today than they have been in the past.

One reality check that we heard about installing new equipment and new technologies is that it takes time, focus, money, and training. All of that new stuff has to be tested to be sure that the new technology or processes meet the quality and production goals as well as the company's goals for ROI. So, at Toyota, for example, we saw several

places in the factory where they were set up for testing new equipment being run right in parallel with the production lines. And much of that work, however, is under the supervision of plant managers, senior technicians, and engineers. And this kind of provides us with a little time buffer between all that new technology and the technicians that we are working to train.

Mike: You know, and I really appreciate those five points you made. I think things like that can help move our project forward this coming year as we delve more closely into the technology side of things. So, thanks, Marilyn. I really appreciate your input on the project.

Marilyn: Okay, Mike.

And now we have a question for you! You are always driving us crazy with your podcast. It's "podcast this" and "podcast that." What have these podcasts accomplished? And what do you hope to accomplish in the coming year with them?

Mike: Okay, Marilyn. I think I can answer this question. You know, our "first year," we called it the "discover phase." And I think the podcasts really helped us do a lot of discovery. Like, we had a podcast on "overall equipment effectiveness." And another one on "digital twins." Industry knows a lot more about those topics than typically educators do. And so, in a way, we were discovering what's known on one side, but may not be known on the other side.

We also saw what some colleges are doing: things like, a number of colleges, as you know, are developing micro credentials. We heard a detail about that. But I really think that these podcasts are helping us "discover." But as we go forward in the Year 2, I want to delve a bit deeper in a technological sense, really talk about some of the things that you just highlighted in your 5 points, in more depth, to really help people integrate those technologies, those technological approaches, into their workforce and workforce training programs.

In this first year we had an opportunity to identify three, broad, cross-cutting skill areas that are driving and creating a focus for the project. In shorthand we call them data, digital, and business. Richard Gilbert really thinks about new technologies on our project, and the implication for technician skills. Richard, did we make progress? What do we need to do now?

Richard: Well, we have assigned these simplifying qualitative identifiers to corral our efforts to quantify the expectations of technicians directly affected by the technology's advances in the workplace. Actually, the National Science Foundation Advanced Technological Education program views the Future of Work nationally from three perspectives.

First, future of work issues will impact "how" and "what" we do to prepare technicians. Are there new skills a technician must acquire? If "yes," are the STEM essentials needed to master these skills already taught? Are there current skills being taught that need to be upscaled? Are there topics in today's curriculum that need to be downscaled? Or even removed?

The second perspective from NSF is, if new knowledge and skills are to be inserted into the curriculum, what is that curriculum going to look like? And how is it going to be delivered?

Finally, the third perspective: knowledge and skills in a new technology are being introduced today into the workplace—now and in the near future. What will faculty need, from the professional development perspective, to make our technicians ready for that advancement?

One quick, simplified example from our Data Group category might help. New computing power and data acquisition techniques have pushed Big Data into the workplace. For scientists and engineers this means that large data matrices must be manipulated. But what does it mean for the technician? Is it a shift from thinking about sample average and deviation calculations to a more likely population mean and variance calculation from big data sets? I don't know! This is not a yes-or-no question. Depending on what the technicians working space is, the skills needed will be somewhere between the two extremes I just mentioned. However, the insertion of edge computing into a process will push technicians' fundamental knowledge and skill sets closer to the population statistics’ edge, as well.

So, that was just a brief pass at our data analysis grouping. We are approaching the business knowledge and process group, as well as the advanced digital literacy group, in the same way. And those are the things we need to do in this current and follow up years.

Mike: I appreciate your interest in the project, Richard, and your focus on the technology side of it. So, thank you very much.

Richard: You're very welcome.

Mike: Let's jump back to Hope for a minute. Hope, we're starting our second year. Imagine ourselves one year from now. What will it look like, if we're successful this year?

Hope: Well, given the things we hope to accomplish over the next 12 months, I certainly hope we'll have collected valuable information about, not only the challenges, but the opportunities ahead for technician workforce development at the regional level—because we'll be having a lot of conversations across regions—and that we'll have engaged leaders in the establishment of regional networks that can support collaboration between industry and education leaders around these Future of Work-driven issues. I also hope, as Ann-Claire was alluding to in her comments, that we'll have an actionable framework around the new foundational skills for STEM technicians and the implementation of the frameworks recommendations will be underway.

Ann-Claire: In Year Two we also will continue doing industry site visits, which involves not just plant tours, but talking to working technicians, technician supervisors, middle management, executives, HR—anyone who is willing to sit down with us and answer some questions about trends that they see happening and their needs. What kinds of technicians do they need? And what is the skill level they're looking for? And also, along with our big topics that we've uncovered (digital, and data, and business knowledge), how are those to be integrated into their education, so that they come prepared to the shop floor Day One?

Mike: Good point! Ann-Claire, Hope said that we have to develop an actionable framework. Does that make you nervous? Can we do it?

Ann-Claire: Of course, we can do it! And, of course, it makes me nervous! [laughing] It's a lot of work. And it's a lot of listening. And so, the listening continues. And then the synthesis of those ideas. And the use of subject matter experts to help us refine those ideas. This is a four-year project. We're starting Year Two. We'll get there. We'll have something that we can take back out to the field and

share with them. And, as always, be responsive to how they feel about it, what their comments are, and where they see other gaps we might not have addressed.

Mike: Okay, good! Well, we're right there with you!

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Mike: Today we were joined by the leadership team from our Preparing Technicians for the Future of Work project. It was our opportunity to report to you and keep you informed of our progress.

As you know, we always encourage you to take action at the end of each podcast. Today go to PreparingTechnicians.org, and on the upper right of the homepage, go to Download Project Information. There you will see our brief summary of the year's accomplishments. And one more thing: explore some of the blog posts. I like the one titled "ABCs of Industry 4.0."

That's it for today: "The Year in Review." Thanks to Ann-Claire Anderson, Hope Cotner, Marilyn Barger, and Richard Gilbert, who joined us today. Helping keep our project managed and coordinated is Tiffiney Gray. Thanks, Tiffiney. Find our podcasts on PreparingTechnicians.org or subscribe on Apple podcast or Google Play. A rating and review are always appreciated. Our series is produced by John Chamberlain at CORD. Thank you, John. And thank you, our listeners, for Preparing Technicians for the Future of Work!

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