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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 Mike Lesiecki. In each podcast we'll reach out to 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, interviews with working technicians, forward thinkers in the field. We'll do some background research, and we'll curate that research to make sure you have the most up to date and relevant information. And in every episode, we'll suggest action that you can 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 "PreparingTechnicians.org."

Our guest today is Justin Manley, and he's the President of Just Innovation, Inc. Justin, I read a thing that described you as an expert in all things marine technology and innovation. That sounds pretty cool! Why don't you tell us a bit about yourself and what your various roles are.

Justin: Certainly! Happy to be here and share some of my background. I will say I'm a little uncomfortable with that characterization, because what you described is a massive field. I would say I am a "fan" of all things marine technology and innovation. And I try hard to do good work in a variety of areas.

Very briefly, my background here: I started my career in academia. I ran a research lab at MIT, where we built underwater robots—surface robots as well—but all ocean robots. Transitioned into NOAA: the National Oceanic and Atmospheric Administration. The program I worked in was

called Ocean Exploration. And, in fact, I helped fund the development of technologies like underwater robots or instruments designed for ocean exploration.

Eventually, I transitioned into industry. And I've worked for startup companies and big publicly-traded corporations in a variety of roles, mostly all about connecting that technology to its end users—to its customers. And for the past seven years now, I have been running an advisory practice focused on both ocean technologies (all things "ocean") and robotics. And the real goal is still that same question, which is to help end users understand innovative technologies and find the right solutions to meet their needs.

These days, my primary activities are in the areas of ocean-impact investing and ocean philanthropy. I'm also very, very involved in the "professional society" space. So, I'm the President Elect of the ***Marine Technology Society***, one of the leading organizations for practitioners and users of marine tech.

Mike: That's perfect, Justin. That's quite a background. Gives you a real perspective. You know, our project—at "***Preparing Technicians for the Future of Work***," we want to focus on what technicians need to do out there in this economy. And Justin, can I call it the "Blue Economy?" Should I call it "Blue Tech?" How should I refer to it?

Justin: I wish I could tell you that there is an obvious known and agreed standard. The reality here is, yep, the "Blue Economy," referred to sometimes as the "New Blue Economy," "Blue Tech," "Ocean Tech," these are all terms that get thrown about. There is no good definition. But I think maybe it would help to articulate a little bit about what those various terms might mean in reality.

Mike: Sure. What does it encompass this "New Blue Economy?" Is it resource mining? Energy generation? Exploration? Farming? Is it all those things? What is it?

Justin: So, it is! That's a great list. The way I like to think of "blue tech" or "ocean tech..." If you think about all of the developments that we've experienced over, say, the past 20 years, driven by personal computing, the internet, cellular telemetry, smartphones, flat panel TVs, if you want, right? All of those kinds of trends, and the technologies behind them. And you translate those

innovations into an "ocean economy." And that's where you get the things like shipping.

Ships are one of the oldest sophisticated machines human being have built. The first person to roll a log across a river: that was a ship (in a manner of speaking)! And so, it's a very historic field. Very slow to adapt. And there are ships sailing our oceans that predate the personal computer!

There's industries like offshore energy, oil and gas, offshore wind (which is a rapidly growing field), where very expensive assets built and designed over years, and then they operate for decades.

There's fishing—another one of the oldest industries, right? We've been catching food in the ocean forever, essentially, since we've been a species. And that industry as well can be very slow moving and slow to adapt.

So, I think of the blue economy as the opportunity to take this deep cultural and economic connection we have to the ocean (it is an ocean planet, after all), and advance it the way we have experienced very rapid technological advances in the past 10, 20, 30 years. So, I realize it's a little vague, but it's a framework that I find very useful. And hopefully that helps folks think about this field.

Mike: It does. I like the idea of considering it a framework. That makes sense. If you were to think now, from your experience, those technicians working in this environment. So, from that standpoint, from a technician standpoint, what sort of skills would a technician need to work in this new blue tech economy? And how do you know what those skills are? How do you know those things, Justin?

Justin: Yeah. Bear with me, if this is a slightly long-winded answer. But it's a very important question! At the first level, the good news is, I think a lot of the skills a Marine Technician in the new blue economy needs are very analogous to the skills you might see in many of the trades. So, I think about an electrician that might come to my house and do some wiring. Or maybe install a sophisticated wireless home theater system. The people who work on HVAC systems. My personal HVAC system is a forced-hot-water system. So, there's plumbing. There's an electrical computer control. There's mechanical parts, right? There's a thermostat. So, a lot of those same elements and skills will translate into this environment.

And what are those? Those are understanding of electronics. At a theoretical level. You don't have to design a circuit, but you have to be able to look at that control unit for a boiler and not be scared off. You need to be able to pull out a multimeter and take a measurement. You need to be comfortable picking up a tool—a wrench. (Not often a hammer! We don't use a lot of hammers!) That's the good news. Very similar skill sets.

Then we ask ourselves, "Well, what makes the skillset of a marine technician different from, say, an HVAC technician?" Well, so now we deal with a couple of things. One is Lifestyle. We can talk about that in a little bit—but "the nature" of what it means to have one of these jobs.

Another is the Environment. The ocean environment is harsh. So, now we take systems and they go into waterproof housings. And you have to worry about O-rings, and sealing, and connectors.

We go into an environment where there's Biology. So, you have to understand how does corrosion or biofouling impact a system. You might be working in a fish farm. And there you not only need to understand the technology of the farm, but the fact that you're in a biological system, and how does the technology and your product, in this case, let's say "fish," interact.

So, we start with a set of skills that I think are perhaps not commonly available, but easily obtained through some traditional education. And then you have to move them further into the marine technology value stream and specialize just a bit further. Hopefully, that's a helpful framework. Happy to continue to dig on that if you have some further detailed questions.

Mike: I do have a follow up. So, what you're saying is that it makes more sense to start with a technician who has electromechanical type of skills, and then give them more in the marine side. As opposed to starting with a marine side, and giving them the electrical mechanical skills. Is that correct?

Justin: Thank you for laying that out. That's a way of going about it. I'll offer that as a suggestion for folks who may be interested in this field and may say, "Oh, I work in HVAC. And I want to become a marine technician." My message is one of encouragement. You can translate.

If you want to become a marine technician, and you're just starting out, you don't have to do that. In fact, another way to go about this, which I've often seen, for example: someone might get into marine science, let's say. And then recognize that they have technical aptitude, and frankly recognize that there's probably a better living to be made as a marine technician than as a dolphin trainer. (I love dolphin trainers, right? They're really important! But there's only so many jobs for dolphin trainers. There's a lot more jobs for technicians!)

So, to answer your question explicitly, I think that transition can go either direction. And that should be seen as an advantage to people considering careers in this field.

Mike: Yeah. Okay, I'm just thinking out loud here. On a recent podcast, we talked about digital agriculture. And they were facing a similar thing, right? You have people that are skilled in agricultural sciences, but not so much in the electrical mechanical side? Or the digital side? It was an interesting conversation. Sounds like it's a similar thing here.

You know, I suppose many of our listeners, just like me (I have to be honest), I don't have a clear idea of what a technician working in the marine environment actually does. Can you tell us a story? I know it's a broad thing, but pick something and tell us a story about what a marine technician might actually do.

Justin: Absolutely. And I think the most important thing to think about here is a lot of this work happens in a non-typical work environment. So, one example...

There's a demand for what we call "remotely operated vehicles" (ROVs). These are typically fairly large and sophisticated systems attached by a large cable, often to a ship, sometimes to a fixed structure. And they go down underwater, and they do important things we can't do, because we're not suited to that. Our biology doesn't work in the deep ocean. And these systems require all kinds of support and maintenance. To put it colloquially, a fuse blows. Or a part wears out. And so, these operations, just as one example, are typically run 24 hours a day, because they're very expensive. And you have to optimize the use of that expensive asset. And so, you'll have a crew that's

designed to rotate. So, a classic is a 24-hour cycle with at least two—if not three—work shifts.

So, a technician might be living on this ship or this platform. So, they might go to work, and go to work for a month straight, and live at work! They're not working 24 hours a day, but they're sleeping, and eating, and recreating, just literally down the hall from where they work. That may be a cold, wet, wavy, seagoing environment. So, you know, seasickness is a thing. It happens to everybody. And so, it can be challenging, though.

For those who it works for, it can be very exciting and a really interesting lifestyle. So, you're at work, that's it! You're working. You're off. You're sleeping. You're eating. Maybe you're watching a little bit of TV. And you're not worried about anything else. You're not mowing your lawn. You're not going home to clean house. And then usually you'll get an extended period of time off. So, that's one way a marine technician might live life and execute on their career.

But, just to be clear, for those who are worried: there's plenty of opportunity to be working ashore, working alongside the sea. A lot of aquaculture facilities are fixed in place. They're either attached to land or not far from land. And there, you might get into more of a "commuting" kind of lifestyle. Maybe take a boat out to the farm, do your work on the farm for a few hours, and then take the boat home. So, you don't have to live on a boat and live away from home for a month at a time to be a marine technician. But that's one of the more unique versions of how life is lived in that career.

Mike: That's an interesting picture. Because I'm sitting here thinking to myself, Justin, I might be a bit nervous going out of sight of land. But you've calmed me down a little bit there! I know what: I'll go as long as the boat doesn't go north of 20 deg N? How about that? [laughing] I'll stay in those tropical latitudes! That'll be better!

Justin: There's a great expression, usually in the ocean research community, and it sort of says "If coconuts do not grow, I do not go." [laughing]

Mike: Oh, I like it. Oh, I like that a lot. I've got to remember that. Okay, I'm going to shift gears on you a little bit. (But, thank you. That's a good picture that you painted there.)

Robotics, that's one of your interests. And it sounds like that's an important thing in this field. It probably has a scope that ranges from autonomous vessels to underwater robots. What does a technician need to know about robotics? Should they know how to program a robot? Or should they know how to essentially integrate a robot into an ongoing system? What's your sense of that? What do they need to know?

Justin: So, you're absolutely right. In the ocean economy, there's a lot of growth in—the big picture term I typically use is "uncrewed maritime systems." And this can range from things like a "hobby drone" (that maybe listeners own and are familiar with) that would fly in the air because we use those over water. To robot boats that can be very, very small, to very, very large, to various kinds of robot submarines of a great variety.

But I think the important thing, especially from a technician perspective, is not to be afraid of a robot as "overly sophisticated." There's a lot going on inside many of these robots. But presuming they're well engineered (and they've gotten much better these days), the technician's job is not all that different from supporting... Again, I'll use my HVAC furnace as an example. There are valves. There are connections. There's power. "Is this On?" is still a really important question. "How do I know it's On?" The right light's flashing? Okay, the RED light's flashing—that means something's wrong! And there's usually a measure of a troubleshooting manual.

And, in fact, I would argue, again (I hate to make analogies, but maybe this helps)—if you think about a modern automobile. There's a lot of computers in your car. And the first step is you plug another computer into the car, and let the computers talk, to figure out what the problem is. That's a really good analogy to how you might go about supporting and debugging an ocean robot.

So, doesn't mean it's easy, but also doesn't mean you have to go get some immensely massive amount of training or engineering. If you are competent as a technician with modern systems, you can translate into this space. It's about learning a new system, not learning a whole new field.

Mike: That's a great point. I like the analogy to using a computer to diagnose the computers on a automobile. It just make sense, right, when you think about it that way.

But Justin, what about some of these emerging technologies? Have they made their way into the new blue economy? Things like artificial intelligence? Machine learning? What about cybersecurity? What about things like that? Or how much does a tech need to know? Or do they pick it up on the job?

Justin: So, "AI," "ML"... It's important probably to think of this differently. Artificial Intelligence in its truest form, is just barely being seen in the blue economy. And that's mostly because it demands large, large datasets for proper training and development. And the blue economy doesn't necessarily have the same density of data as other fields. So, Amazon has so many transactions, that it can apply AI very well. The ocean economy is broken up into much smaller chunks. So, AI is coming more slowly.

Machine Learning has a bit more of just powerful use of statistical analysis. Yeah, that's come in. But in terms of a technician's concern, I don't think you need to be a master of those. You may need to understand conceptually that they exist, and that they influence the way equipment functions. But the technician is almost certainly not going to have to debug code or worry about algorithms per se.

Mike: Right.

Justin: Cybersecurity is definitely important. And I would argue, in this case, a marine technician should be as comfortable with cybersecurity as maybe a first-level desktop-support IT person.

Mike: Oh!

Justin: What I mean by that is your average user maybe doesn't understand how the antivirus software on their computer works. But when the helpdesk comes, they kind of need to understand what's going on. Again, you don't have to write the code, but maybe being able to use it and being able to recognize risk signs, for example, right? Being able to recognize, "Hey! Something's running funny with the computer. Maybe I better check that it's infected with some malware." That instinct and that awareness is highly relevant to (I would argue) any technician in the modern world and certainly marine technicians.

Mike: I think you're right. I mean, there's that whole realm of technician skills that apply across disciplines, like "troubleshooting," for example, or, as we just talked about "cybersecurity awareness." It's certainly true.

Justin, as we're starting to wrap up today, I was thinking: Is there advice that we could give? Let's suppose I'm an electronics technician. I might be in school. I might be working. If I'm working, I might be thinking about a career change—doing something different. Is there an advice that you might give to someone who's got a good foundation? Or is currently in a program that might think about this as a career: the blue economy? The new blue tech? What advice might you give them? Is there a way they could explore the career? Or what should they do?

Justin: Yeah, so absolutely. And I would suggest that there are two parallel paths that I would encourage such an individual to look at. Path one, I kind of call "The Culture" or almost "The Emotional Aspect" of the ocean and the blue economy. And you could engage that by being a surfer. Getting into scuba diving. Getting into boating. Maybe you're a mechanic for cars, and you decided to go check out the local boat yard and see what's going on with mechanics for boats, right? Get exposed to the ocean community environment in a non-working way is actually really, really important. Because it'll help you understand your comfort and tolerance for seasickness, being on water, the nature of how ocean community people—who live every day in that environment—work, act, and feel. So, that's Step One. The good news is, by the way, that should be fun! Right? That should be exciting, and people should enjoy that. If you're not enjoying that, maybe you don't want to be a marine technician. [laughing]

Mike: Sure.

Justin: And then Step Two is "The Professional." And on the professional side, there are many interesting ways to engage. I got to put a "plug" in, right? So, the Armed Forces are a great place to get involved. Right? You can pick up technical skills in the enlisted service: the industry. There are many large companies that still almost follow the "apprentice model." So, you can kind of come in with an Associate's Degree in Electronics Technology, get an entry-level job, and work your way through the field.

And then there are...we'll call it "The Professional Society." So, I mentioned the ***Marine Technology Society*** where I'm involved. We collaborate with a variety of efforts to help broker workforce development at all levels of the field. It's not just for highly-trained engineers. We work with student competitions, where we get young people exposed to the field. Where an electronics tech could become a mentor to a student team building an ocean robot, for example. And we have a lot of activity, for example, in community colleges, where we see that kind of activity. So, definitely looking at professional societies or growing industries is a way to go.

And my last comment on this front—so long as you don't have an audience of 8 million people who immediately find me on LinkedIn!—we are a friendly and welcoming community. I try to make time for anybody who raises their hand and asks for advice and help. And I believe that to be true of my colleagues in the industry. So, asking for help and advice is absolutely welcome in this space. And it all harkens back to kind of an "ocean culture" of: if you go out to sea together, you're sharing an experience that, frankly, could be risky, but can also be rewarding. And this is not a place for individuals who don't want to participate with their colleagues. It's a place for teamwork and collaboration. And hopefully, that is sufficiently inviting to your audience and folks to reach out on any of those tasks for further growth.

Mike: You know, it is Justin! And I really appreciate the genuineness of those remarks, and giving people an idea of what this is really all about. I think that's just great! I'd like to put a link in our *Show Notes* to that ***Marine Technology Society***.

Justin: Certainly, we're very welcoming. We actually, within MTS (bear with me for a second), we have a thing we call ECOP: Early Career Ocean Professional. And what that means is, for people who are within 10 years of their last degree (and that degree could even be an Associate's Degree), you can basically join that community. So, let's say you got an Associate's Degree in Electronics Tech.

Mike: Yes.

Justin: You're welcome to join that community and meet other people who are practicing within the first 10 years of their career. We're trying very hard to bring those people together and support them.

Mike: Darn good idea! I'm going to make sure we link into that in our Notes. Justin, thank you, again! It was such a interesting perspective on—let's call it—the New Blue Economy. And your perspectives on what people do, and how they think—just really valuable! And I want to thank you, on behalf of our project, ***Preparing Technicians for the Future of Work.***

Justin: My pleasure. I appreciate the opportunity to share some thoughts. And look forward to growing this "new blue economy" together!

Mike: Thank you again.

Justin: Cheers!

Mike: Listeners, today, you heard Justin paint a picture of a unique working environment in the ocean economy. You know, really, there's new opportunities to work in areas that involve autonomous vessels, robotics, automation, sensors, marine technology, marine science, electromechanical skills, all these merging into really a new type of environment for a technician. So, your task today is to find out more about this "new blue economy."

And there's links in the *Show Notes* to the ***Marine Technology Society*** and to two National Centers for more resources and more information.

I'd like to acknowledge that our podcast is produced by John Chamberlain at CORD. Thank you, John, for all the excellent work you do in this series. And our project is led by Principal Investigator Ann Claire Anderson at CORD. Thank you, Ann Claire.

Today, as you access this podcast from the website, you'll see a link next to the *Show Notes* that says, "Feedback Survey." Take a moment. Give us some feedback on how we can improve this podcast series. And finally, thank you, our listeners, for ***Preparing Technicians for the Future of Work!***

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