

Zach Nicklin Interview Transcript

SPEAKERS

Mike Lesiecki, Zackary Nicklin

Mike Lesiecki

Our series on the Future of Work is continuing with the focus on integrating emerging and cross cutting technologies. We are hearing from educators on exactly how they are creating changes and new opportunities for learners in partnership with industry. Note that this presentation does not necessarily reflect the views of our sponsor the National Science Foundation. A video version of this presentation is available on our website [Preparing Technicians.org](http://PreparingTechnicians.org). It's my pleasure now to invite Zack Nicklin, the UAS director at the National Center for autonomous technologies, Zack, introduce yourself to the audience. Absolutely.

Zackary Nicklin

I appreciate that, Mike Lesiecki. So as Mike Lesiecki said, my name is Zack Nicklin. I've got a couple of different roles. The primary one we're talking about today is as the UAS director and the Co-PI at the National Center for Autonomous Technologies, where we really focus on these emerging technologies in the uncrewed space, whether it be driverless technology, driverless vehicles, underwater ROVs or autonomous underwater vehicles. And then of course, our unmanned aircraft and other emerging aviation technologies. And so I am also the UAS Program Manager for Northland Community and Technical College, where it's a (FAA) part 147 Aviation Maintenance school located in Northwest Minnesota. Today, as Mike Lesiecki said, we're going to talk a little bit about converging technologies and the way I like to paraphrase this or, or to capture this as a single doorway to multiple educational and career pathways. This presentation is really going to be focused on what we're calling our core autonomous systems technician pathway that we're helping to develop. So here's my contact information (zackary.nicklin@northlandcollege.edu). If anybody has any questions, you know, after viewing the recording, please feel free to reach out to me when we talk about this convergence. I'm not going to read the full definition here. But if you look under subsection two there, it creates new pathways opportunities and frontiers and competencies, knowledge, technologies and applications. And that's really the part of it that we're going to focus on here as we start talking about this project. So what I'm going to do first is I'm going to introduce you to some of this, some of these industries that you may be unaware of, or you may not have the information necessary to really move forward with this. So we want to start here. So right now we're going to talk about advanced air mobility. And advanced Air Mobility is really the concept of a safe, automated and affordable air transportation, whether we're talking about cargo organizations, such as Amazon, Wing drone up with Walmart, and there's lots of organizations out there that are delivering groceries and things like that, just kind of that last mile delivery aspect. But we've also got organizations like Beta technologies, Joby aviation, Lillium, and quite a few others out there that are really looking at personal mobility. So we're looking at essentially, Sky taxis. If you're if you're my age or older, you may remember the Jetsons where everybody was flying around and in their own little flying car, and this is the the next step in that direction really. And so when

we when we look at the the suburban sprawl and urban congestion, these are being billed as a way that we can kind of short circuit some of that. So whether it's a taxi system between two points, or whether it's actually going to stationary points, or whether it's going to be essentially, you know, door to door. Some of the things that they will notice about these about all these technologies that I'm talking about the programmable routes, we use sensors to both determine its own internal state, and to navigate and move through its own its environment. Many of these technologies, they're either hybrid or fully electric. And they tend to use higher voltages and then what we're typically working with whether it's the automobile or the aviation industry, and we have driverless vehicles, and I've got a few examples here again, these are these are ways that we can increase mobility that we can decrease congestion and then of course, you know take take the human error out of out of this transportation system right humans we are prone to error things happen we get accidents, you know, billions of dollars a year are spent on on accidents of the driverless feet or in the in the automobile space. And once we have a system where not only is the all the vehicles talking to each other, but also talking to the roadway and its environment, hopefully we'll be able to mitigate a lot of those accidents going forward. But again, it's sharing some of those same technologies that are being used right, we're still using the same type of sensors where we're using electrical propulsion systems and frankly, the the electric propulsion system, it doesn't care whether it's driving a propeller or if it's turning a wheel. Next we got autonomous underwater vehicles and and ROVs or remotely operated vehicles, these are made they perform missions underwater and environments that aren't easily accessible to humans. They're they're used as backups, they're used to explore whenever we have things like, you know, a ship sinks or, or we're missing an airplane that falls into the ocean. It's these type of vehicles that go out and locate that debris. Again, act with sensors, these are platforms for the, for the cameras and sensors on them. Sometimes they may have manipulator arms, but the technology is very, very similar when we start pulling out these these new technologies.

Mike Lesiecki

So Zack, I was just reading about that underwater stuff. There's this whole new industry of underwater mining isn't that starting to happen? Now that will be all autonomous won't it, right

Zackary Nicklin

when you're looking down at the bottom of the sea floor, it's very hard to have, you know, a manned or crewed vehicles down there, if you just look at some of the recent happenings with the the manned sub that they wound up sinking news for the last couple of months there, you know, it's things like that we want to avoid, and we can avoid that we can increase our safety case, by using this new technology. And that's the same regardless of the industry that we're talking about. And then you can take that same mission profile, and we can apply it to space operations, right, because there's been talk for years of you know, mining space and, and some of the asteroids or comets out there. We're currently you know, performing resupply, we're doing data gathering and exploration missions in both near and deep space with uncrewed vehicles, and really, the beginning of our space program began with uncrewed vehicles. So we're sending these probes out into deep space, and we're getting imagery and data that we otherwise wouldn't, with with this type of technology. And then you've got organizations such as, as SpaceX, and you know, they've got these, these booster rockets that are coming back and landing all by themselves. So really, it's this type of technology, regardless of the industry that we apply it to is, is really starting to take over a lot of our lives. Right. And I'm not saying that necessarily in a bad

way, I'm just saying it's, it's becoming ubiquitous, everywhere we turn, right. I mean, I, I personally don't fly without a small drone that I bring with. And you know, so I can go out and explore in the new places that I go to, and take pictures. And you know, there's plenty other people that work much the same way. So as we're, as we're talking about these, these different industries, that seem really unrelated. Again, when you when you take a look at them, they're very heavy on the sensors, on on computer maintenance, on networking, the different components being able to talk to each other. And as we got the National Center for Autonomous Technologies together, and we started bringing these these SMEs or experts within these fields together, we started to really see a whole lot of similarities between the things that we were doing, you know, we all had cores that we're working on. So the automobile industry, you know, you have the core, you still gotta be able to change brakes and tires, and all that fun stuff. Then we look at the aviation side, and, and you still got to do the same type of thing, which I mean, you know, planes have brakes and tires, as well. But when we start talking about this new technology that we've added on to make things more efficient, or safer, a lot of those technologies really, really look the same. And they perform the same. So we started to investigate a little bit. And we started by by bringing five folks into the room. And basically, we locked them in there for about five days as a part of this project. And they each had a standard that they went by now. It was not the mechatronics it was the SAE automotive, or part 147 or the airman certification standards for aviation, and then a UAS maintenance standard and international ROV standard. So we bought representatives from each of those standards into a room locked him in there and said, Hey, you're not coming out until you figure out what do you have in common? Right, where's this core that goes across the board. And we started to really bring out as I said, before, hydraulics pneumatics, Computer Maintenance, networking, electricity, and electricity is kind of a big one there. But we, what we put this together, we put a whole report on it. There'll be a QR code coming up if you're interested in the report, but we developed this Excel spreadsheet that kind of broke all this down right into categories, because sometimes on the UAS side, on the unmanned aircraft side, I'd be talking one thing, and the guy on the automobile side was talking another, but as we dug deep down, we found we're actually talking the same thing. We just use different nomenclature. Right. And so we decided that okay, well, we've got to have a, we've got to have headings and subject areas that they really go across the board. And so that was kind of part of the work as well.

Mike Lesiecki

So let me interrupt what is ETAS again. Sorry, with

Zackary Nicklin

with this slide here. I'm getting to that there, but that's electronic technology, automated systems. Okay, good. Thank you. Robotics, industrial robotics, that type of stuff, right? And so, as we started to dig and find these, I took a couple examples. And right now what you're looking at is examples of coursework offered at Northland college. And you can see that aviation maintenance has a five credit basic electricity. The ETAS program has a six credit basic electricity. Automobile has three credits and construction electricity is eight credits. Now, I fully believe that there are different things that folks need to know, regardless of what based on what field they're in, right, or the the aviation side, we don't get into, into PLCs and controllers for for some of the, you know, manufacturing type equipment, right. And construction, electricity, well, they've got to know things like the National Electric Code, right, which some of the other organizations don't deal with. But when you dig into the details of this three to four

credits, or so, really is the same across the board. All right, and so we started looking at at efficiencies, and in this case, inefficiencies, and basic electricity is really just an example. There's multiple areas where this happens. And again, the the computers and the hydraulics pneumatics, that type of stuff. So when we, when we dug deeper into this, we found that, hey, there's, there's a core here, and this core here can go across the board. So right now we've got four different people teaching four different classes, that most of it really is the same, right. And so we're not very efficient there. And I know some educators might not be happy with with me when I say this type of thing. But the reality is, is that colleges are losing funding, right, we're losing state funding, we're losing federal funding, and being able to keep our doors open and keep our programs going is something that we need to look long and hard at, right. And so having one person or one core, electronics class, and then breaking out. So in this case, we'll say a three credit, basic electricity class that any of the students from any of these programs can take. And then the construction electricity adds the extra stuff they need. Aviation adds the extra stuff they need, ETAS adds the extra stuff they need, right. So it would it would take a couple of credits out of an instructors hands, but it would make things more efficient. And more importantly, when we look at this core that goes across these multiple programs, a lot of students that I get, you know, there the heck, even 18 to 35 year olds, I mean, I'm 40 and almost don't know what I want to do with my life, right? So being able to start into a program and take this core would give you exposure to all these different pathways, right. And so you'd be able to really have a make an informed decision on what you want to do. And regardless of which way you go, you've already started knocking stuff out, right? It's not Well, let me go take my generals and then explore these other courses here to see what I want to do. It's let's take this core. And that's going to expose me to these other things that I'll take. So looking through the process of where we're going with the project that we're doing right now, identifying a Common Core was our was our first step there. So we got that, get that checked off. So next, we're working to develop credentials, and then really establish this pathway. So it's getting buy in from from industry and other academic partners. And that's, that's kind of the step that we're working on right now. And then we're going to follow that up with creating a curriculum and really link it to individual industry. So getting folks to, to stand up and say, Hey, this, this is an entry level in to where I need to go from the industry side. And then from the academic side, it's going to be acceptance, right? If you have this core, can I join your advanced automotive program? And will I have credit for these type of things. And so it's really helping to create those pathways for students, So ideally, this, this core would be a standalone entry level, you know, way to get into a company. But of course, you still need the training on those specific systems, whatever it is, right, whether it's vehicles or aircraft, things like that. So as I said, before, there's a QR code here, this will bring it to the NCAT website, specifically to our download of the report, um, it is rather lengthy, but if it's something that interests you, you know, feel free to to go there also explore the other resources that are on the NCAT website, all free to use, we've got some great resources out there, some of the barriers that I see the change to making this, you know, maybe a little bit more difficult, but not impossible, is stovepiping. So we run into this, you know, my, my, my automobile program is exactly what it needs to be and they need to go through my electricity class because I talk specifically about automobiles, right. And you get the same thing on aviation and the other side's The reality is, is the electrons don't care. Right? The they're going to act the same regardless of you know, of where they're flowing in what system right because we're all using wires, we're all using the same type of thing. So they, they don't care, and it's something that we need to maybe work on getting past ourselves, right. Credit load requirements, that's gonna be a significant one. Right? Yeah, you got to be able to justify your job. I've got a credit limit that I've got to hit every

year as far as with classes taught and there may be some changes to that or freedom workarounds that need to happen. It'll be significant front end work. I don't know about how things work at your colleges, but being able to get folks from different from different departments together on a reliable basis over and over again, to really work through the front end of this is going to be time consuming, right? There's, there's going to be some front end work there to make it happen. But I think it'll really streamline things in the end, and hopefully, add to the student body within the programs, right, because now we've got just this more open front end that allows for those different pathways. And then of course, will the core credential be success be accepted, if we can't get industry buy in and acceptance on the academic side, that's going to make things a little bit harder. So with that, again, just contact information at the end there. And that's, that's going to be the end of my slideshow there and love that field. Any questions or anything like that you may have?

Mike Lesiecki

I do, could you reshare, your slide there for a moment. So I can go back to that that one? That one right there. You know, this core credential? Is it a issued by the college, for example, they've completed four courses, and we call that a credential or certificate or is it something that's validated by industry? What exactly do you mean by a core credential? Right, and

Zackary Nicklin

I'm looking at it multiple different ways. Again, we're still I wouldn't say we're at the beginning of this project, because it's not the beginning, it's been a long road to get your even, right, but so I'm looking at it multiple ways. I'm looking at, for instance, individual community colleges, you know, we've got overnight, I think, the last time I looked, it was like 916, community and technical colleges or community or community colleges, here in the US, and they represent a significant block of education, right, we can get those folks to start running this. And here's the way I see it. These type of programs, when we talk about unmanned aircraft, advanced Air Mobility, aviation, advanced automotive, they're expensive programs, right, and technology moves really fast. So when you go in, and you invest, you know, half a million dollars into a program. And then a year and a half later, your stuff is really seen as out of date by industry. You know, that's, that's hard to justify. And not a lot of folks have the budget for that. But almost every community and technical college I've looked at, as some basic computer technology courses, they have some basic electricity type courses, and they've got courses within this, you know, hydraulics, and pneumatics. And so if they can piece this together, and allow a local student to come in, gain this knowledge and the certificate through them, and establish a pathway with another college that does have the funding and the ability to host one of these programs like a yearly round and make sure that there is a there's an articulation agreement in place for those pathways. So that's, that's really what I see is it it'd be opening it up in you, you'd keep a local student local, as much as possible. But then they'd be able to matriculate into these other programs to get specifics or from their go into the to the workforce, depending on what that student wants to do.

Mike Lesiecki

Good. Oh, by the way, we appreciate it that you locked these people in the room for five days. I wonder how they were when they came staggering out afterwards? I thought that was interesting.

Zackary Nicklin

Well, you know, I did let them you know, go to the hotel and sleep at night. But no, it was it was a great group of folks, like I said, that represent kind of kind of all sections of the industry that were looking at everything from educators to industry personnel. And it was it was a great group of folks to work with.

Mike Lesiecki

But I thought was fascinating. Was the breadth of the industries that you address you started today, right? We're talking about the marine industry and others. You didn't mention agriculture, I sort of asked this tongue in cheek, does anyone drive a tractor anymore? Are they all autonomous? Right,

Zackary Nicklin

right. Absolutely. And I'll tell you, this is the there is no standard out there that we found, or representative. Right. So that's where we started was with we needed actual standards in place, not what this guy thought, right? We wanted to go from that. Because if there's a standard in place, it's at least an industry accepted and accepted by academia. Right. And so that's where we wanted to start from. But yeah, it goes beyond just the things that I talked about here, right? Looking at agriculture, I know UND is down the road, and they're, they're buying big into the space aspects. And so there's there's quite a few different different industries or verticals, that this would be absolutely apply to.

Mike Lesiecki

So we have another question that's come up, Zack, you mentioned and I think people see this right away, for example, the electronics and electricity is a good cross, cutting across the core of those various programs that that's important, but there must be other things. Does things like you mentioned sensors. What about data acquisition data analysis, is that starting to be common across See all of these programs? You know?

Zackary Nicklin

Absolutely, because at the end of the day, you know, the computers have to be trained, right? If it's if it's going to be fully autonomous, it's going to understand its environment and what it's looking at. Alright, so data analytics, not only data for the the sensors of whatever vehicle it is, right to make sure that it's understanding its environment. But a lot of these are also used to capture data as a part of its operation. Right. So when we look at unmanned aircraft, you know, it's, it's a platform for sensors, essentially, that flies. Same with the underwater, you know, AUVs, and ROVs, they're essentially platforms for sensors. So yeah, so big data, data storage, the analytics, I mean, those are going to be huge parts of it. On my side, my side is really I have a focus on maintenance. And so that's, I know, where I, you know, where my niche is there. But there's absolutely room for, for other places there as we start to expanding into other job titles, you know, within some of these verticals.

Mike Lesiecki

In the approach, this is last question Zack, in the approach that you're taking at the center there, Would you let's keep our focus on data analytics or data acquisition for a moment. Do you think there should be a separate course developed, that is common in these various programs, Or let's suppose you were king, would you rather see it integrated across into the programs, instead of as a separate standalone course? What do you think would be the right approach? Well, that's a tough

Zackary Nicklin

one. And I think part of that is going to depend on what outcome you're looking for. Are you looking for someone who is a pure data, you know, analytics type person, or, you know, data visualization, that type of stuff? Versus, Do we have a technician who needs to understand what data is coming through here and verify that it's the correct data? You know, I think it's kind of two different levels there. And really, if you dig down deep, you can make it a whole lot more than two levels. Right. So I think that's a good way for me to skirt around your question there. Okay. So I think like, like in many things, it depends, right? It depends on what outcomes you're looking for. I could easily see both pathways, depending on what you're trying to do.

Mike Lesiecki

Oh, there's a good picture of you, Zack, I like that one by the by there. That's a is that a drone?

Zackary Nicklin

That is that's an R24 Global Hawk. Like, oh, yeah, so it's got a, you know, 130 plus foot wingspan and flies for, you know, 24 plus hours.

Mike Lesiecki

So we wanted to thank Zack again for his presentation today giving us a sense of how autonomous technologies are part of a cross disciplinary core and the approach that they're taking at the center. You know, there are tools in addition to the ones that Zack mentioned. He talked about the KSA analysis, that's an important tool. On our website, preparing technicians.org all one word, Preparing Technicians, you can read and share a framework for cross disciplinary stem core, that's about a five page PDF, we have something called instructional cards. I'll show a picture of them in a moment. But there are short time classroom activities that you can do to start implementing these cross disciplinary skills. You can listen to podcasts in our series, that feature cutting edge industry interviews, and you can share recorded interviews like this one. I mentioned those instructional cards, I have shown in those same three buckets. Again, look at the middle one advance digital literacy. You can find instructional activities, they're short, they can go right into the classroom on the network, excuse me, Internet of Things, automation, robotics, digital twins, network architecture, and more. Just to give you an example, these are all free, and they're downloadable directly from the website. I mentioned the podcasts. Here's some examples. We talked about the marine economy, Zack, Justin Manley, and episode 38 talked about the new blue economy. I like that word blue tech or blue economy. And boy, was it robotics and autonomy autonomous systems. That was that was one of the featured things.

Zackary Nicklin

Absolutely. And Justin Manley is a great guy, I've had the opportunity to meet him. So he worked

Mike Lesiecki

good, I'm good. I'm glad to hear it. Also, there's a companion document that allows you to, to look at these podcasts and decide okay, what's in there for me? What can I learn from them what use of it you get to scan through it rapidly instead of listening to all 44 podcasts. So take a look at those. There's recordings of this webinars or is this a continuing series. The first of the three was Preparing Technicians using the cross disciplinary stem core. The next one on professional development and

resources. And the third one on integrating emergent technologies. Zach, this is the gonna be the fourth in the series and all of them are going to be available at [preparing technicians.org/webinars](http://preparingtechnicians.org/webinars). Colleagues, thank you very much for joining today. Zack, we appreciate your efforts and all the work that you and your colleagues at the National Center for autonomous technologies are doing

Zackary Nicklin

well thank you Mike Lesiecki and you as well of the folks over there at [preparing technicians.org](http://preparingtechnicians.org) and CORD you guys are doing some some great work. well so thank you for having me really appreciate colleagues

Mike Lesiecki

that officially concludes our webinar for today