Oklahoma Innovations Radio Show

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Guests: **Bob Palmer**, director, Atmospheric Radar Research Center, University of Oklahoma

[Music]

>> From the OCAST Radio Network, this is Oklahoma Innovations, a weekly science and technology radio magazine brought to you as a service of OCAST, the Oklahoma Center For the Advancement of Science and Technology. OCAST is the state's only agency whose focus is technology, its development, transfer, and commercialization. OCAST's mission is to locate and fund promising technologies and allow Oklahoma to compete in a global market economy from our own backyard. This program features some of the state's most gifted and talented scientists and inventors, entrepreneurs, manufacturers, and business leaders who all have one common goal. Developing technology-based economic growth for all Oklahomans. Now here are your hosts Gary Owen and Steve Paris.

>> We are on the road, once again. And this time we're in Norman, Oklahoma, at the National Weather Center. We have come out here a couple of times in the last couple of years, because in fact it all started, Steve, back in 2006, when we did our first Oklahoma Innovations weather show from the National Weather Center. And I think you were gone that trip.

>> I missed that first one, but I've been here since, Gary. And I tell you what, this is really -- it's a national treasure, but it's also a treasure for Oklahoma. We're very fortunate to have this facility in Norman, Oklahoma, affiliated with the University of Oklahoma. And we get a lot of attention, a lot of accolades, I'm talking about as a state, and let's not hide the fact we get a lot of money to fund this place and do all the great research that's being done down here, because you know, was it Will Rogers that said you know, everybody talks about the weather but nobody does anything about it. Well, maybe we're doing something about it down here, here in Norman. And you're going to hear about that in just a moment.

>> Of course, we're in one place in the country where the whether is so diversified, if you don't like it today, wait until tomorrow, you know in or if you don't like it now, wait a few hours. You know, kind of one of those things. We have -- I think we have unique weather patterns compared to most states around the country.

>> And you well know, I've in the past been involved in aviation, and I used to hear about pilots as they were learning, wow, fly in the wind. Well, then you're not going to fly in Oklahoma if you're not willing to fly in the wind. And we're going hear about all kinds of things here in just a little bit with our guest Dr. Robert Palmer.

>> There was a -- an article in the paper recently, and it's made big news, it's been in all the state papers, actually made USA Today. OU unveils weather radar. And so you're going to want to stay tuned because you're going to find out that this radar is specifically for educational purposes, but it is unique in its design, and this is no rinky-dink operation.

>> No, it's not.

>> It's a very sophisticated system.

>> And if you want to learn about weather and all the science that's involved with this, then Norman, Oklahoma is the place to come.

>> You've got an announcement from the governor's office, by the time this program airs it will be halfway through of the month. But this is a cool announcement.

>> Well, it is Gary. A lot of people know every April we celebrate Oklahoma science and technology month. And one of the things that we at OCAST have done to celebrate that month is take some cues from the National Science Foundation. Some years ago they used to provide training curriculum for high school or junior high or middle school and high school students, and they quit doing that, but we continue it here in Oklahoma. And our -- our program director, Debbie Cox, heads up this program. And what she does, she work with science teachers across the state, and we -- we know that often times, you know, all it takes is a little bit of encouragement and these students -- these students who work what we call in STEM, science, technology, engineering, and math, they are sometimes willing in recognized to go just a little bit further and maybe get totally involved in some of these learning processes. So what we do is we give away a very nice little certificate signed by the governor and signed by the OCAST executive director. And we give it to the teachers. They send in their students and we put their names on these certificates and they're very nice, suitable for framing, as they say. And last year I think we recognized -- along with the governor's office -- 1100 students across the state. Every county has been involved in this, and this is a little bit of an out reach program. But the governor choose this last week in his regular weekly column to talk about this program and about April being science and technology month and he said to encourage the next generation of inventors and researchers, my office along with OCAST has developed a certificate of recognition that science teachers can use to honor their hard working students. So we were glad the governor is on board with this, and he is every year. And we -- I don't know that our goal should be to increase the number, but if we had 12 or 13 or 1400 students recognized and had these certificates presented at a ceremony at their school, that wouldn't be a bad thing.

>> That wouldn't be. There was a big event at the University of Oklahoma on April 4, and that -- it's at the research campus, and this was to launch the university's newest radar called OU Prime. And it's for innovations in meteorology and engineering. We're going to find out what that all means here with our guest Dr. Robert Palmer, and we're going to call him Bob because that's what he prefers. And he is director of atmospheric radar research at the Research Center here, and interesting stuff. Welcome to the program, Bob.

>> Okay, well, thanks for inviting me.

>> You know Bob, we've given your title, but that really doesn't tell us everything we need to know about just who you are. You're pretty important working here at the Weather Center. So take just a minute if you will, tell us a little bit about your background, where you studied, some of the things you've done, so that the audience will know just who Bob Palmer is.

>> Okay, well got my Ph.D. here at OU in electrical engineering in 1989. And then went off to Japan to Kyoto University for post doctoral studies. Then moved back to the U.S., went to Clemency University in South Carolina, and then finally in 1993 landed a tenure track faculty position at the University of Nebraska at Lincoln.

>> So you were a corn husker for a while?

>> Yeah. Love the football.

>> You're in the big 12.

[Laughter]

>> Okay, now you're a Tommy C. Craighead chair and professor at the school of meteorology. So you're -- you occupy a chair, and that means you get to do some special things and you get some funding that --

>> Yeah, Tommy C. Craighead, oil man, lives in Ardmore, very nice guy. And donated money to endow my chair here at the University of Oklahoma. So the funding that comes off of that every year I use for my research and education and weather radar here at OU.

>> So your specialty it weather radar?

>> Weather radar.

>> Okay, now we hear about weather radar, we hear about Doppler, we hear about, you know, the next generations, whatever that might be. And I'm sure you know more about that than I do. But when you talk about whether radar, give us an idea of how that's applied.

>> Well, it's used for direct observations of storms. And the great thing about radar is you can see inside storms.

>> Is this Doppler or is this --

>> Yeah, Doppler. Weather radar, now a days are all Doppler. Almost all of them are Doppler radar, which means that can measure the wind speed, that's what that word means. Now more advanced radars, now, like dual polarimetric radar. They transmit the signals in a certain way so we can get extra information about the atmosphere. And even more advanced than that would be like, phased array weather radar, which we're working on a project now with the national sphere storm lab on phase ray weather raider. So there's a lot of advancements, but generally all weather radar are Doppler radar.

>> Okay, all right, so we're dealing with radar, and we're not trying to change the weather we're trying to understand the weather, right?

>> Understand it and observe it. So meteorologists focus on understanding the weather and modeling the weather and a lot of times, weather radar data help them do that. The engineering side of it, of weather radar field, usually tries to improve the techniques to produce better quality data or maybe new parameters that weren't observed before.

>> Is this hard to learn?

>> Well --

>> Can be challenging, I'm sure.

>> We have our educational programs joint between electrical engineering and the school of meteorology. And so yeah, there's a bunch of bright kids in the program, so it's usually the top high school students who come into those programs.

>> So it's very intense a scientific endeavor, then?

>> Sure. Yeah. I mean, the -- of course electrical engineering is in the college of engineering, but meteorology grew out of the college of engineering many years ago. So the background in math and physics is almost identical in the two programs.

>> You know, probably most people who watch weather on the television, most of them probably have an idea that there are -- think maybe you guys are weather chasers, storm chasers, and that's probably not quite what you do, or is that involved in this?

>> Well, we have programs at the university and with our Noah partners that have mobile radars. So yeah, there are storm chasers, and there are scientists that go storm chasing. In fact, this spring there's a big program called Vortex 2 which is a very organized scientific study of tornado genesis and severe storms. But there's also the casual side of it that students will go storm chasing, but that's more on a personal sort of hobby level.

>> Okay, we're going to get a little insight into who Bob Palmer. Have you ever chased storms?

>> I have with my students, but I spend more time actually here at the Weather Center with our stationary radar systems like OU Prime, which is not a mobile radar.

>> We're going to hear about OU Prime here in just a minute. But obviously this man is very intelligent, because he doesn't spend a whole lot of time chasing those things. You sit back and look at them on the radar screen, right?

>> Yeah.

>> Very good. Gary, we're getting I think. How much time --

>> We've got plenty of time.

>> Okay, good. Because I want to carry on here. Now you've got, you know, the latest addition, what you announced this last week. Tell us a little bit about what and what you hope to accomplish with that program?

>> With OU Prime?

>> Right.

>> Well, this is a major partnership between the University of Oklahoma and our private sector partners called Enterprise Electronics Corporation in Alabama. And we've purchased the radar with them, but designed it to our particular needs. And it -- it -- in the end of this design process the radar is unique in the world. Has the highest resolution of any C-Band polarimetric weather radar now. I know that's some terminology, but C-band is the type of radar used mostly by TV stations and it's used in Europe and across Asia quite a built. Polarimetric is this capability to tell the difference between, like, hail stones and rain drops, for example. Which is very important for estimating, like, rain fall rate.

>> Of course. And that's a big part of the data you're trying to gather is rain fall rates because that -- you can use that to predict what's going to happen next, right?

>> Yeah. There's a whole sort of side area of weather radar called hydrology or radar hydrology, and these people map out what water build up and water flow will be in certain basins and so forth. And they need good estimates of rain fall. But they don't want to go out there with a thousand rain gauges. So instead you transmit electromagnetic wave with a radar and you can measure the rain fall rate remotely. So that's kind of the huge advantage of radar.

>> Now the unique thing about this particular radar is that it is accessible to students. People would think that normally they've got access to the National Weather Service and all that. That's not true, right?

>> Well --

>> They have some, but it's not --

>> We have worked closely with the National Weather Service and with the National Severe Storms Lab with their radars. We get access to the data, students have taken tours of those radars and so forth. But the missing piece in -- given the goal of knowing the weather service for protecting life and property, they cannot allow sort of ready access to students who want to tear the radar apart, especially engineering students, who want to try some new technique. You just couldn't allow that on an operational radar.

>> Radar is not cheap, is it?

>> It's not cheap, and you know, it's hard to fix after students get a hold of it.

>> Oh!

>> Got to love those students.

>> But for them to learn they really do need direct access to the radar. And that's what this university is -- OU Prime is going to do.

>> We're coming to you from the University of Oklahoma. We're talking about OU Prime. We're got a lot more to talk about when we return on Oklahoma Innovations.

[Music]

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[Music]

>> Gary Owen and Steve Paris, coming to you from the University of Oklahoma. And we're always glad to come to the weather research center here because there's no many wonderful things we get to see and some new things. OU Prime has been described as probably the most powerful, most sensitive radar in the country, and this is the first commercial weather radar in the world with a fiber optic rotary join for time series data collection. Bob, what does that mean?

>> Tough question --

>> The rotary joint is a device in the radar which allows us to take data from up stairs where the dish of the radar is to down stairs where we make use of it and analyze it and so forth. So to get through a pedestal where the radar rotates is actually a difficult task. So EEC, our partner corporation, has developed one that's based on a fiber optic link. So we can get a lot more data down and do things like collect these time series data, which doesn't happen so often in weather

radar. And this is ten times more sensitive to clouds than nation wide Nexrad radars that we're familiar with, is that right?

>> Yeah. The -- that is true. Mostly because of the wave length of the radar, it's a C-Band compared to Nexrad which is called S-band, and because it uses a different wave length. Our radar OU Prime is more sensitive. Now it has some drawbacks too, but on the good side it's more sensitive to very small non precipitating clouds where we have no hail, no rain, no nothing.

>> So it will pick those up too --

[Multiple voices speaking]

>> Ceiling or cloud cover --

>> We started looking at some cloud studies, although the radar has only been operational for about a month or so.

>> Sure. This facility, you know, the actual radar itself is onsite here.

>> Right.

>> And you don't need a bunch of extra radars around the state or the country, I guess. Or do you -- do you draw information from other sites too.

>> Sure, we use the data from the Nexrad network, which is all over the country and certain places in the world. It's a world class radar facility. Like we said earlier, it's operational with certain goals of the weather service. OU Prime is an educational platform for our students and faculty to develop new techniques, new hardware modifications.

>> One of the things you mentioned earlier that caught my attention is that this is a cooperative effort between academia and the private sector. And I assume you have maybe some federal involvement also, you work with the FAA and different organizations --

>> We work with the FAA, but probably more importantly is we work with Noah and the National Severe Storms Lab and the Weather Services Radar Operations Center. They're both located in Norman. We have a lot of development and research projects with them.

>> Let me see if we have this straight. You're going to be working with students. This is a teaching process, a learning process. And that's what this OU Prime was designed to do. I assume, then, you're going to be training these students to come out of the University of Oklahoma to go out into the field and they're going to be working with the FAA, they're going to be working with private weather organizations. Do you have any ideas of the kind of jobs they might come up with.

>> What kind of jobs? Well, it turns out that in the field of meteorology one of the most important things that we need to teach our students is how to deal with instrumentation and weather radar is one of the most important instruments in the field of meteorology. Most universities don't have such a high quality radar that students have direct access to.

>> Okay.

>> And we're going to go out of our way to include it in every one of our courses which makes some use of radar data. In fact, we already have two or three classes going over there, using the radar, setting up the experiments, and then taking the data and trying to learn something out of it.

>> I see. Well I can see any number of things, but one of the things that comes to mind is -- would be students working maybe in a military situation, trying to -- trying to predict or you know, learn about what's going to be happening down the road. Would that be a likely position for someone?

>> You're talking about military radar, talking about weather radar applications to the military?

>> Yeah, I'm talking about application to the military. For instance, if you have an operation that's going to be underway, you're going to need to know what the weather is. .

>> Yeah. Weather is very important to the military. We have some good contracts from the DOD and we work with some major contractors for the government. So a lot of the techniques we do are also applicable to, say, air traffic, tracking radar.

>> Here's a question that came to mind a little bit ago, and Gary, I have we have enough time for this. We've -- you know, we've been building stealth aircraft so that they can't be seen by radar. And you're working with radar and working with your students who are trying to find the most minute particles or most minute, you know, hail stones or drops of water or whatever in these storms. Is there any cross over of application here?

>> Well --

>> Very little, probably.

>> That's a good point. If you're looking for an aircraft with the radar, normal aircraft, you don't need that powerful of a radar.

>> No. They'll send you back a signal, right?

>> Yeah. Because it's a big hunk of metal.

>> Exactly.

>> But with weather and especially clouds, you have very, very weak echoes that return from those signals. So you're right, that weather radar are some of the most powerful, sensitive radars in the world.

>> Very good. Do you ever have any problem with flocks of birds messing up your signals or something?

>> Sure.

>> Okay!

>> But we don't call that messing up, because we have a whole field called aerobiology, working with some people in zoology who are using radar to track flocks of birds and migratory birds, migratory patterns and so forth. Also, you can track bugs and there's some work with disease that is borne on birds, for example.

>> Really?

>> Another application of weather radar.

>> Do you get involved in that yourself or --

>> I have some colleagues in my center that are doing that.

>> Wow. That's fascinating. I didn't know where that question was going to go. Little did I know, it was going to take us where you are right now. That's a fascinating story.

>> My understanding, this technology you're going to be able to have some extensive international collaboration with Europe and Asia and other countries around the country, is that right?

>> Yeah, the C-Band wave length is primarily used in Europe for their national weather radar network. So because of that, a lot of the algorithms we develop here are applicable to Europe and other places in the world.

>> We're talking about OU Prime, the polarimetric radar for innovations in meteorology and engineering, and we're coming to you from the Atmospheric Radar Research Center in Norman, Oklahoma, on the university campus of Oklahoma University, of course. We're going to take a little break. We'll come back and talk more with Dr. Bob Palmer when we return on Oklahoma Innovations.

[Music]

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[Music]

>> As we've been talking about on this program this week, we're coming to you from the National Weather Center and we're talking about OU Prime. This is a technology providing state-of-the-art platforms, supporting innovative radar engineering and meteorological projects by researchers, students, and educators. A unique resolution dual polarization radar, which will be used to enhance collaboration of the University of Oklahoma with academia and government and private sector partners, and it is being housed, actually, or being used by the Atmospheric Radar Research Center, or ARRC, which is what we're going to talk about next. Steve?

>> That's exactly right. Bob, we're here in the ARRC facility, the Atmospheric Radar Research Center, and that aside from the things we've been talking about already has its own niche, has its own set of criteria. Tell us a little bit about the center and its beginnings and kind of where it's going and -- always had some growth in the -- what, five short years --

>> Yeah, about five years ago President Boren decided to start something called the strategic radar initiative. That meant putting a lot of university investment into faculty positions, equipment, infrastructure, and so forth. We've hired -- out of that radar initiative, we've hired, like, 10 new faculty, you know, even in these income times we're hiring 10 new faculty with a focus on weather radar now what grew out of those 10 faculty is the Atmospheric Radar Research Center, which I direct. We currently have 11 faculty involved in the center. We have five or six staff members, and we lead a lot of the weather radar activities here on the campus.

>> Wow.

>> Including OU Prime, of course.

>> Of course. So this is quite a facility. There's been a major emphasis on the development of this, and it's relatively young, five years isn't very long.

>> Yeah, well we're working kind of hard.

[Laughter]

>> I can tell you that, there's a lot of emphasis at OU on weather radar, and it's a great time for us, but it really keeps us hopping.

>> Well, and that initiative I think we heard about because it's been talked about by the Oklahoma legislature, it's been talking about -- talked about with people all over the state, and I'm sure outside the state. So a lot of people know that you're here. You get a lot of interest from outside our boundaries, a lot of conversation, questions --

>> Academic folks in general, of course, collaborate internationally and nationally. And I can tell you a lot of people are jealous of what's going on here at OU and weather radar.

>> You think?

[Laughter]

>> Now, you have a leader, a program -- tell us about this -- I forget what you called it, you mentioned it a little bit ago?

>> On the wind turbine project?

>> Yeah, it was leading to that. It was a program that you have an education program.

>> Oh, the educational program. Okay. Well, we -- the ARRC is an interdisciplinary between the school of electro and computer engineering and the school of meteorology. I have a Ph.D. in

electrical engineering, but I'm actually a faculty in the school of meteorology. So at OU, we recognize the interconnection of those two disciplines and we try to completely eliminate those boundaries between engineering and meteorology. So we believe that's the best way to educate our students.

>> So you can have a seamless transformation here.

>> Well, we try to give both of them the best of both worlds. And in our educational program when we got here at OU we decided to develop a whole new suite of courses, well organized and sort of seamless between each other, and right now we have about six to eight new weather radar courses in our curriculum. And these courses are typically about half electrical engineering and half meteorology students. We get them to do joint projects together and we want them to work together.

>> Very good. Now you did mention wind turbines, and as we were talking during the break a little bit ago you brought up some things I thought were just fascinating about wind turbines. We're all hearing about them, we're seeing them, some of us are getting electricity from them through our providers. And if you go to western Oklahoma, especially, south west and northwest Oklahoma, and a little bit up in the panhandle, you start to see these big devices that are standing out there on the horizon. I've told people they always remind me of some of the pictures I've seen of the war of the worlds. They stand off out there and they look like they're creatures from Mars. But they've a very important function. And -- but in doing so, they also create some issues that are requiring a technological approach and innovative approach. Talk to us about the wind turbines.

>> Well, we're all supportive of green energy, of course. And us in the ARRC are actually trying to help that along. Now it turns out that wind turbines cause a type of interference to radar. Not just weather radar, but FAA radars, everybody's radars. And this problem is extremely difficult. So we're trying to put a team together and we've actually been working on it for a few years with the radar operations center here in Norman trying to solve the problem for weather radar first. And that means to come up with a technique or an algorithm that can eliminate the wind turbine interference from the radio signal. And if you do that, then we can estimate the weather the way that we want to. We can observe and track aircraft the way that we want to. And this -- turns out this is very difficult and important problem if wind energy is going to grow.

>> So what is it about the wind turbines that cause the interference, is it the blades, is it the wind they cause, or is it a combination of --

>> Well, weather radar folks and radar folks in general have to deal with what's called clutter. And ground clutter is typically like buildings. We know how to take care of it fairly well, so stationary thing like a building is pretty easy to take care of. Unfortunately, a wind turbine is as big as a building, but it's moving.

>> Then you've got a string of them together, they're all the same.

>> Yeah. One is not so hard. But when you have a whole wind farm it's a big problem. So the fact that it's moving and it's huge is the main concern.

>> Has this problem manifested itself already? Obviously, you know that it's there. But has it created any problems with maybe tracking aircraft or maybe tracking weather. Is that something that's already happened yet?

>> Well, there's not yet a documented case of, say, false alarm detection of meta cyclone or tornado or something like that. There have been cases where they've rerouted aircraft around wind farms because they thought it was a major storm.

>> Is it the movement of the blades or the movement of the air.

>> No, it's the blades.

>> It's the blades, okay.

>> Although the turbulent fields behind the wind farms, some people believe it may have an effect on radar also. We haven't verified that. But it's the blades at this point that are the big problem.

>> Well the point -- point being is with everything you do there is -- there's unplanned consequences. And that's just the nature of the world we live in. And you already identified or starting to identify some of these issues, and there's a good chance the solutions will be figured out right here at this facility. And that -- that makes it even more important. Because we're all, as you said, interested in green energy, and we're going to -- I think wind turbines are probably here to stay.

>> I think so. We just have to work harder and get a solution.

>> Right. Now you mentioned Radar Innovations Lab, which is a part of the Atmospheric Radar Research Center. Now is it a separate part?

>> No, it's just our lab. The center is I would say the center, if I had to define it, are all the people. 11 faculty, 30 graduate students, all --

>> It's not just a place.

>> It's not just a place. But for these people to work, part of what they need is a very state-of-the-art laboratory. And the Radar Innovations Lab is our state-of-the-art laboratory. And it has -- it represents an investment of about 1.3 million by the university to buy all the latest and greatest microwave test equipment so that we can build radars, fix radars, test radars, and so forth.

>> So I guess there's a lot of student activity there or mostly professor level.

>> Oh, no, no, no.

>> Research, R&D level.

>> Students do a lot of the work at the university no matter what the topic is, including hardware. So we have probably about ten -- ten of our students hang all out over at the Radar Innovations Lab. The rest of them are over here in the Weather Center. But it's within walking distance. We interact a lot.

>> Now when you send these students out into the real world what are the applications of careers that these students can acquire?

>> Well --

>> A broad spectrum, I would assume. Because you're talking about meteorology on the one hand and engineering on the other. But like what you just talked about with the RIL, it's going to be engineering related I would assume. In a lot of applications.

>> Yeah. Almost all those students that are developing the hardware are engineers, although we have meteorologists working with them very closely so that the end product has the application in mind. But we -- the engineering students have gone to say, like, Ratheon, Lockheed and Martin, big radar companies, local radar companies like ATSC, then some of the meteorologists have actually gone to the wind power industry to work on identifying good resources of wind power. They've gone off to national labs, we're starting to feed some of our students even here locally to the National Sphere Storms Lab. And so it's important. Even though we've been around for only four years, it's important for us to graduate these students and disseminate them across the country.

>> How many students say I'm going to go out and be a TV star. I'm going to go work for a TV station.

>> See, I don't think we have any -- we're much more on the technical and scientific side of that. But in the school of meteorology there are --

>> I just had to throw that out. Sorry.

>> The school of meteorology, of course, we have a broadcast meteorology minor and there's a lot of students interested in that.

>> And I think it would be fair to say that's a relatively small part of what meteorology is all about.

>> That's the part we see because [Inaudible] --

>> Yeah, it's a small piece. I mean, our department is definitely more focused on the deep scientific problems in the field.

>> Very good.

>> We're talking about Dr. Bob Palmer. He's heading up the Atmospheric Radar Research Center at the University of Oklahoma, and it's housed in the Weather Center facility. We're going to take a little break. We'll be back with our last segment momentarily on Oklahoma Innovations.

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>> It began more than 100 years ago. Making buggy whips in the small rural community of hole Bert, Oklahoma. Today that same company is still in business, turning out nearly 40 million wheel and axle seals a year. That's a lot of change in 100 years. The Oklahoma Center for the Advancement of Science and Technology or OCAST in association with organize organizations like the Oklahoma Alliance For Manufacturing Excellence help manufacturers across the state compete in a global economy while at the same time developing a technology-driven economy for Oklahoma communities. Armed with information, education, resources, an partnerships that improve manufacturer productivity and profitability with cutting edge technologies, OCAST and its affiliates work hard for Oklahoma's technology-based economic development. Investing, partnering, and promoting the development of science and technology. That's what OCAST is all about. For more information call 866-265-2215. OCAST, whipping technology into shape so Oklahoma manufacturers can seal up business.

[Music]

>> You never know what you're going to learn on this program, Oklahoma Innovations, and Steve and I periodically, we get where we get the travel bug and we like to travel out and go to

different facilities. And our producer Debbie Cox has been very good lately about getting us into some interesting places of research and science. This week we're talking about OU Prime, which stands for the polarimetric raider for innovations in meteorology and engineering, which is was completed. And it was actually launched April 4. Its operated by the Atmospheric Radar Research Center, which we've called ARRC at the University of Oklahoma. This is one of the most advanced Doppler weather radars constructed to date, and was built primarily to provide OU students and faculty a platform for research and education in the field of radar meteorology. The Atmospheric Radar Research Center, ARRC, is involved in many aspects of radar research, applied to studies of the atmosphere and topics range from sophisticated radar processing to precipitation microphysical studies. And we still have a lot more we haven't talked about, Steve.

>> That's exactly right. And you know, one of Oklahoma's -- actually, Oklahoma's most favorite son I think I'd be fair in saying so, once made the statement if you don't like the weather here in Oklahoma just wait five minutes. And we've all found that to be true, I think, in this state, at different times.

>> You know what the biggest complaint I've heard about the weather this year?

>> What's that?

>> The wind. It's just -- I mean, it's something else.

>> Well, if you live in Oklahoma and you're unhappy with the wind, you're out of the luck. Because we're going have it. No matter what happens, we're going to have wind. But as we talk about students across the state of Oklahoma who are in maybe the 11th or 12th grade or even younger, and they're hearing this or maybe learning about -- different things about meteorology, and they think, you know, that's something I might want to -- want to get into. And you all have -- Bob, have some ways of helping them make those decisions, I think. Some connections. Tell us about -- about your program, you know, as you --

>> Meteorology and engineering.

>> Yeah. I think any high school kids that have a science bent to them need to be taking math and physics as much as they can. If they can get up to calculus, and then typically advisors will push them into engineering or some kind of science field. I think weather radar is a perfect blend of those because you're helping society because you're designing radars which help protect people.

>> Right.

>> But if you're interested in electronic circuits and so forth, you can feel that too. So our students or someone interested in the field could go into electrical engineering or into meteorology. We even have some students that dual major in the two.

>> Hmm.

>> So you're able to reach out and bring those students in and maybe with a little help from their high school teachers, right?

>> Yeah. I have a daughter in high school, and I'm sort of pushing her along that direction, too. But --

>> Is she resistant?

>> Yeah. I don't have a -- don't seem to have a lot of influence with her recently. So --

>> Are you saying she didn't get the math -- math genes?

>> No, no, no. She -- well, I wouldn't say I'm a genus -- but --

>> No, I said the math genes.

>> Oh. I -- I push her in math and physics. But --

>> You know the value of it.

>> She is a teenager, okay?

>> They have a mind of their own, don't they?

>> Yeah, they do.

>> Every one of us who has raised one of those knows that. Well, you have a web site. And this could be very helpful for most students and citizens in general who need to know more about this program. Tell us about that web site and how to get there.

>> Yeah, the ARRC, the Atmospheric Radar Research Center web site is arrc.ou.edu. And it outlines a lot of the topics that we're working on, the faculty that are involved in the center, it even has student contact lists and so forth. So if any high school kids or undergraduates from around the country would like to contact us, they can talk to our students or the professors, anybody they want to. But if you're interested in weather radar, University of Oklahoma has got to be the best place to come to study that. And we take education very seriously from the undergraduate level to graduate, and I think they'll have a great experience here.

>> So come to OU, and make it happen.

>> You better.

>> Polarimetric radar for innovations in meteorology and engineering or OU Prime. It's the most advanced radar we have right now for any purpose, of its kind. And I'm sure probably six months, 12 months, 18 months down the road something else will come out. That's just the nature of the business.

>> Yeah, we're already working on other things. Of the big next front is probably in phased array technology, which has been used in -- in military radar for many years. But it's just way to expensive for meteorologists to play with. But we -- the National Sphere Storms Lab heads up a big phased array weather radar program and we work with them closely. In addition, we're developing our own what we call imaging radars, which are basically like a digital camera. You take a snapshot of the atmosphere, you don't have to look in different places, it all happens in one instant in time. So we really feel that's the future of weather radar, and we have plans along those lines.

>> Yeah, I know that your focus is in education, dealing with radar, learning how to gather data on -- meteorological data, but let's go a little further down the road. The students that you put out here, the ones that you let fly are the ones that accomplish what they set out to do. They're going to be having opportunities and monitoring meteorological conditions as it relates to agriculture, and what -- what -- we're going to have enough water for certain crops, and transportation, and -- from trucking to aviation, all -- everything in between. You know, everything that has to do with travel is impacted by weather.

>> Yeah, it's pretty amazing where all the students go. I can't even keep track of it. You know, I'm just in such a niche field of weather radar, and I think about weather radar all the time. But when the students graduate they go to many different employers.

>> All right. Military applications, government applications, any number of things. So for those teachers out there and for those students that think this is kind of a narrow field, you need to look at it again. This is a wide open field and it's getting bigger and bigger all the time.

>> Oh yeah. Yeah.

>> You know, a question in the mind of some of our listeners with all this sophisticated technology it is still very, very difficult to predict when and where a tornado might hit, and so forth. But because of the -- the sophistication of radar systems today, like the new system you have, talk just a moment about how good these radars are today.

>> Well, you bring up and important point of prediction. Radars don't really predict, they observe things when they're happening. But we're working very closely with what's called numerical weather prediction folks here at the university and the center for the analysis and prediction of storms. They are world experts in numeric weather prediction or modeling of the atmosphere. But the big field over the next several years is what's called data assimilation. And that means to incorporate real radar data into the models and then let them propagate forward. So you do the prediction based on radar data. Turns out that's a very difficult thing to do. But given the fact that we're in the same building, we're in the Weather Center, we work together very closely with them.

>> You know, we always ask the question when we -- when we visit with folks like you, Bob, who are doing a very special type of training and who have some very special skills, you know, you run this center, you've got several faculty members, a lot of students involved. And you've got a very specific mission, although it doesn't mean that your studies are specific, but the mission is pretty specific. Let's look down the road, five years, ten years down the road. What's this center going to look like then?

>> I imagine in -- in five years, we will have a new building called the Light Industrial Facility. Our OU Prime radar was placed exactly where it is because the architects already have a plan for something called the Light Industrial Facility where we'll probably have our lab facilities. I imagine that we will be developing polarimetric phased array radar. I see that in the next five to ten years.

>> Even though it's expensive, we're going to go there, aren't we?

>> Well, we're going to build it ourselves, and it's going to make it a lot cheaper than what the military can do it for.

>> Oh really?

>> Yeah. I mean, we have faculty in the center who are developing phased array antennas now for very cheap. And very high quality antennas. So we think we can do it at the university better and more efficiently than military contractors can do it.

>> Wow.

>> By the way, while we have a moment, because we only have about a minute left, Steve, I want to mention something to our audience where they can learn more about what's going on at the National Weather Center. There is a web site where you can check out the Weather Center and many other partners. It's www.nwc -- National Weather Center -- .ou.edu. And if you -- or just type in National Weather Center, Norman, Oklahoma into your browser, and it will take you to that web site and there's just a wealth of information about. Got about a minute left. Any final thoughts there, doctor -- Dr. Palmer.

>> How about moms and dads, keep those kids in science and math, right?

>> That's always a problem in this country. You know, I think we have to keep emphasizing that students study hard when they're in high school. Because college gets tough. And high school is the time to sort of get primed for that.

>> Well I tell you what --

>> Make use of your opportunities.

>> Yeah.

>> When you come to the Lloyd Noble Center or you're down on this side of the campus and you see this great big -- what looks like a golf ball on a tower, that's the radar we've been talking about. Bob Palmer, thank you very much. You've been an interesting guest and we've learned a lot more about what's going on here at OU and the Weather Center, and of course ARRC. We've got to run, Steve I'll see you next week --

>> Okay Gary.

>> On Oklahoma Innovations, you have a good, good week. Bye-bye.

[Music]

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