Interviewer: We are here with Don Berchoff, Director of the NWS Office of Science and Technology and Don, I guess to start things off, can you just tell me a little bit about your background, where you come from…

Don Berchoff: Yes, I am originally from Long Island, I grew up in New York City and on Long Island. At a young age, I became very interested in weather. When I was 8 years old actually, my interest had peeked. And a lot of it had to do with East Coast storms and snow storms and when I was in 4th grade my science teacher talked about the fact that in order to have snow, it has to be cold, but then she told me that in order to have cold you have to have high pressure and high pressure means fair weather. And I was so confused by that, because how does it snow if you are going to have fair weather? And that was the first time I know, that I became interested in meteorology. I went on and kept diaries growing up, I used to draw weather maps off the TV, and I had this vision to become a meteorologist. I went to the State University in New York and I got my degree in meteorology, I consider myself as synoptician mesoscale forecaster before anything else.

I love East Coast weather because that is where I was raised, cold air damming and East Coast snow storms and as I have grown, I become more interested in other things like Lake Effect snow and severe weather. I went in to the Air Force because back in 1984 there was a moratorium on hiring in the weather service, so I went in to the Air Force, I told my wife it was only going to be a 4-year career and then get out. And then it turned in to 24-year career, I actually had a lot of experience operational forecasting. I have been involved in to helping develop a regional weather center, I actually built it. A 180-person center that was responsible for forecasting all the weather in the Northeast United States for all our aircraft and all our bases. And then I actually had the opportunity to go outside of the weather for a while and actually was involved in helping to build the Afghan National Army. I was in charge of Afghanistan on the Joint Staff. And I also went to Kirgizstan and I was the base commander for Manas Air Base in Kirgizstan, in charge of logistics and food and housing and all those things. So, I have a wide range of experiences, but I am still a meteorologist at heart and the message I would like to get out to folks is that, this science and technology Director is a forecaster first.

Interviewer: So, how did you think that your career in the Air Force prior to coming here in the weather service, you mentioned the operational experience and some of the other more managerial administrative things that you did. But overall, how do you see your experience prior to joining the weather service, as preparing you for your role as OST director?

Don Berchoff: Well, like I said, I am a forecaster first, and I have a keen interest in the science. I mean, I have always been a person of discovery, in learning, understanding why things are happening. I was very involved in the Air Force, as I grew through it, in developing programs for weather production systems in the Air Force. I helped write requirements. I helped to field systems, to test them in the field. I was actually at Andrews Air Force Base when the first Doppler radar was installed in the Air Force. I was also at Andrews Air Force Base when we went to the first automated weather

production system, when we went from the maps on the wall to the production system on CRTs and I was also there when we went from the old satellite paper outputs that came in from the old fax machines to a CRT satellite interrogation system. So, I was there when technology first came on. I understood the challenges of technology. I was involved in writing the requirements. I understand the issues and frustrations associated with migrating technology into operations. And then I later became the weather resources and plans, the vision chief at the Air Staff, where I was in charge of all the money and all the development money, and the program money for all programs in the Air Force weather community. And so, I got a good background on that, and I also was heavily involved in development of new algorithms and capabilities that would then feed in to the system.

So, I am bringing with me a lot of experience that I got on the Air Force side, but it all relates to what we are doing here in the weather service, except it is just civilian now instead of Air Force. I also understand IT infrastructure. I was involved in developing open architecture systems in the Air Force and data standards and managing data. And in fact, the first… the beginnings of the 4-D data cube, we were working at Air Force weather agency. So, I am bringing all that over with me also. And my goal is to help us get to that next generation, using the background experience I have to get us to the next generation. But also, using my forecasting background experience, to ensure that whatever we do is practical and pragmatic and will work for the field.

Interviewer: Obviously, you have seen a lot of changes in the technology of weather observation and forecasting in your years prior to coming to the weather service. What do you think are some of the challenges that we're facing now as we enter, as you mentioned, the next generation of science and technology. And how does that inform your vision for science and technology within the weather service?

Don Berchoff: Well, I think, first off… we are in a seminal moment in weather. If you look at the history of meteorology, going back to the 1700s and you look at the first observing capabilities and the telegraph to get information out ahead of weather systems. And you look at the development of the Norwegian cyclone model, and if you look at modeling computers, if you look at the history, weather forecasting and weather information, when it was given in the past to decision makers, it was always a cope and avoid type of an issue. "Tell me what is going to happen, but I am not going to do anything until it happens." This is changing. This is what we are seeing in our lifetime. Weather is becoming something you can use, because we are getting good enough at forecasting it where you can exploit and mitigate that information. And so the work we are doing in terms of saving lives and protecting property, it's just going to get better over time. We are going to become better at providing that information to emergency managers and getting the right effects that we are looking for for them, in order to protect those lives and properties. But more importantly, we are going to get in to a whole new realm of economic capabilities here where weather information is almost a commodity in risk management decision making in our economic systems.

Our forecasts are driving decisions. We have a lot of weather out there that impacts our economy everyday negatively. We can probably mitigate those impacts significantly

enough to save tens of billions of dollars a year in the U.S. economy. Our challenge is… is harnessing this ability we have today, and getting it into a manageable level and putting it in formats and outputs that the customers can use to reach their objectives.

Now, the biggest challenge we have is in this realm of understanding how forecasters are going to intervene with the information in the future. With the rapid requirements for data updates, like in the NextGen, having to have forecasts updated constantly. And with the advent of GOES-R satellite data coming down the pipe. Where we are going to be able to get updates every minute-and-a-half from the satellite over areas of severe weather. Other information sources, models are updating hourly, and constantly taking in new observational data. How is the forecaster going to manage that in the future? That is our biggest challenge. Figuring out how the forecaster will manage that. Because we know that forecaster can still add value, and the biggest challenge is going to be… where do we focus the forecaster's efforts where it matters? How do we focus them on where they can add value? And how do we focus them where the effects that we are looking for reach that end user in the decision support arena, that's a big challenge. So we are going to have to tackle that.

The other challenge we have, is building this data cube and building this architecture and infrastructure that is going to allow us to populate the information and make it available in a discoverable mode, for all our customers out there so they can pull what they need when they need it. This is going to be a 10 to 15 year initiative. And our customers are also going to have to be educated on how to go about doing that. That is a big challenge also.

And then we have some forecasting challenges that we got to get our arms around. Initiation and convection, big… costs us a lot of money every year and in traffic and it is key for us in our flash flooding and understanding our flash floods, and our precipitation rates. It is critical for saving lives in the golf course or mariners that are out over the water. If we can figure out how to forecast the initiation and convection 30 minutes before it happens, before that first cumulus cloud forms, that would be amazingly valuable to us. So, that is one of the forecast challenges that we have. Figuring out how to do that, and I think it is possible when we look at all this data we are going to be collecting in the future. And our ability to crunch that information and run it through algorithms. Then we could see something that will allow us to do that in the mid 20s – 2020s and I think that is what we are focusing on. So though there is technological challenge for information architecture, there's forecast challenges and then there is challenges of how we are going to use the human and how they are going to fit in to this process.

Interviewer: You are talking about the role of the forecaster and how important that is, even as our science and technology improves. And at the heart of any weather forecast office, in terms of the science and technology, we have AWIPS. And one of the biggest efforts taking place right now in your office is the development of AWIPS II. Can you briefly describe your future vision for AWIPS II?

Don Berchoff: Well, AWIPS II is the vehicle by which we are going to migrate to the next generation forecast system. We need to evolve our forecast system, to meet the needs and the requirements of this generation I was talking to you about. Forecaster intervention in the forecast process, making sure it is easy and simple that it is not overwhelming to them. That they are just moving around a bunch of grids and spending all of their time worrying about administrative functions, but focusing on the science that is going on. It has to be an open architecture capability. As we move into decision support services, we need to be bringing customer data and information into our systems, so we can have that on a common operating picture. So, for instance, the vision would be by 2020 or by 2022, we would have sensors that firefighters and fire trucks have on them that are reporting their locations back to their command center. We would have access to that same information so we can watch, fire lines and watch shifting winds and potential forecaster shift in winds as they occur. So, that we can really send messages out to notify them that they need to think about moving or realigning their resources to protect them, for life and property. I think in decision support the critical thing is to have an understanding of where the operator's needs are and having a real time update of that information. We should be getting air traffic information on AWIPS so you can see what is going on with the traffic flow and how that is going to be impacted by weather.

And then we need to have decision support tools in AWIPS that are going to help us with thresholding what is important for our customer. So that we can highlight that to our forecasters, so that they do not have to worry about memorizing or managing all that information, but that they are going to have tools assist them in identifying areas of risk. So that they can check that, and then take it to the next level and notify people out there that need that, the decision makers, so that they could take action.

Then you are going to look at the forecast process itself, which still important. They talked about, we have to build an AWIPS that helps the forecaster manage all these information, does a lot of the work behind the scenes for them and then focuses them on where it matters and where they can add value. And I think that is going to mean that we are going to have an AWIPS that is going to be able to take information about how we normally do in certain situations and provide them some insights in what they should be thinking about as they manage through a particular forecast problem. I see a system that has dynamic training capability where you can call up scenarios on the spot that match similar scenarios and allow you to see how certain things have panned out in the past and apply those immediately.

Interviewer: Sort of like the old days of weather typing…

Don Berchoff: Yes, exactly, we called it weather regimes. And I was big in the Air Force on implementing weather regimes over there and you can do certain kinds of things with technology to help do that. And the key there is not the tell the forecaster what to forecast, but to help them bring back similar cases in the past and see how things panned out. Now, the thing about training is, we've got to get away from where a forecaster goes in to a backroom, trains on something, comes out of that room, and then six weeks later is

hit with a situation that they might have learned about. We need to have on-demand type training and simulation capabilities. And I think that is kind of where it is going.

AWIPS is also going to be laying the architecture and the infrastructure for us to share information with users, through common operating standards and putting that data out there in the right formats for other people to pull in to their systems so they can make good decisions. And so they can visualize the data on top of their systems, without having us have to go through a whole bunch of software work.

And finally, research to operations. AWIPS is going to provide a platform for us to do our development, for everyone, to do development in the Python or the right coding so that it is easy to transition these applications that are developed into operations. You won't have to go around and port code anymore in the future.

So, I see a very dynamic capability, and I have been working very hard with the AWIPS II contractors and spreading this vision about what is expected that AWIPS is going to allow us to do and the flexibility that is needed. But, that all being said, my number one priority is to deliver AWIPS II TO11 to the field with the least amount of pain possible. I have already told the contractors that we are not going to have an OT&E that is a beta-tested version of AWIPS. I want a polished version to work from. I am very concerned about transitioning this to operations. I am very concerned about the local migration of applications. I know this is going to be a large workload on the field to do this. I am very concerned about it and I am going to be working hard to make sure that the first AWIPS delivery, I' not talking about the futuristic stuff, the first AWIPS delivery replaces the functionality that they have gotten used to, at a minimum, with the least amount of pain to them in the field.

Interviewer: AWIPS II is a concept that began before your arrival here at the weather service. Do you think that there are any challenges in being able to deliver it and challenges with achieving the future vision you have, given the fact that this process began prior to your arrival here?

Don Berchoff: There's challenges. I think that for this AWIPS first delivery TO11, we did not, in my mind, develop very good, specific enough requirements. Basically, we told the contractor, we want you just to deliver the same functionality that you had in AWIPS I and that is basically what the requirement was. We're finding, as I came in, I began learning that there is a lot of devil in the details. If you want to have a very robust and flexible system, how you wrap the code in the supporting process, how you set up the architecture underneath in order to be flexible, is very important. You might get that GUI you are looking for on the CRT, but what is going on behind the scenes is very important because if we are going to use this as our vehicle to the next generation forecast system, it has got to be very flexible.

So, what we are doing now is I am working with Raytheon. We have actually sent a red team out to Offit with Raytheon to look at the way the system is being built to ensure that it is going to provide the flexibility. We are also asking them to deliver in TO11, vertical

slices, because we were a little concerned that we weren't seeing the functionality we expected to see on the system by this time. Although it is possible that the capabilities are in the system, they just have not been mapped to a GUI. And so we are going to be asking for these vertical slices, and we are going to be more rigorous in our testing and in the TO11. And the primary focus is going to be on the quality of this system. So, I think the requirement's definition was a little loose, and I think we are trying to recover from that.

Now, in terms of the vision, as long as you build a flexible system, you can do anything with it. I kind of look at it as a chassis and then we just put modules on it. I think we are in a good position for an extended AWIPS that is going to get us where we got to go. The issue will be resources as in anything. And I think in order for us to be successful at making AWIPS what it needs to be in this next generation, under DSS and in the future, we are going to have to see an increase in funding on AWIPS II baseline. So, that is one of the things I will be working with others to try to figure out how do we show the promise of AWIPS to people, to decision makers, and what it can do for our societal impacts and the benefits to our country, and why it is important to invest in its capability. And hopefully we can get an increase in that baseline funding.

Interviewer: But overall you anticipate a smooth transition to operations with AWIPS II?

Don Berchoff: Smooth in the eyes of the beholder. I will tell you that I am very sensitive to the things that can go wrong. We are doing the best we can to understand what those are and mitigate them.

Will there be times when we are migrating over where we are going to run into an issue? Yes. I would be lying to field if I did not expect that. Are we working very hard to insure that those issues are not big rocks but rather pebbles? Yes. They are getting in your shoe and they are annoying, rather than a boulder in front of you that you cannot get around? Yes. Will local migration at times be challenging? Yes. We are working to try to get the hardware refresh out there earlier so that we will be able to run the new applications on the new hardware, we are doing what we can. That was not originally in the baseline. So, I am not going to promise a perfect transition. What I am going to tell you is, if the field comes back to me later and says, "You know what, that was not really as difficult as I had imagined," to me, that will be what I am looking for. Because, really, expectations--I been through two deployments in my career in production systems, both as a forecaster and as a hub regional commander in charge of the whole operation. And both of those are very painful. And I do not expect that expectations are very high on the field because of past things they've gone through. If they tell me that this was a lot less painful than they imagined, I will feel that we succeeded.

Interviewer: Are you talking a lot about some of how AWIPS II will benefit the forecasters in the field of the capabilities that is going to empower them with. What are the benefits going to be for our private sector partners in America's weather industry?

Don Berchoff: Well, first off, our software will be available to folks, especially in academia, for developing applications that they think are important to further the science of meteorology, and we will be able to integrate those right in. The main benefits to our partners will be that we are going to build tools that are going to allow us to put the best data available for them in the data cube for them to pull. And hopefully what we will have is we are going to have probabilistic information in there. And we are going to make that available for them to pull in to their front end systems so that they can make risk management decisions on the weather and how that impacts whatever industry they are trying to support. We want to give them the best data possible to increase the economic prosperity of this country. And we believe that AWIPS is going to help us to get there to do that. We have to figure out how we are going to put that data out there. And it gets back to, AWIPS is the tool we are going to have to modify and use in order to get that forecaster and that science together and get that best solution out there, probabilistic information for them to use. And also for them to take our information and our warnings and tailor them even further down to specific customers--hospitals and agencies like that we can't do at our level. We can't do that, we need private industry to help us. When they are providing pinpoint warnings to a hospital because they are paying for that, they are taking what we are giving them, and they are taking it to the next level and they are helping us save lives. So really it is going to be about the data. AWIPS II is going to help us get the best information out there for them to leverage, and it is going to provide a developmental framework where people have developed software for applications, they will be able to integrate it seamlessly into operations.