Elbert W. "Joe" Friday, Jr., January 2010

Topics: NWS Modernization Process, NEXRAD, AWIPS, Restructuring Field Offices

Joe Friday: My name is Elbert W. Friday Jr.; I usually go by Joe Friday. I joined the National Weather Service in August [correction: September] of 1981. I just finished a twenty year career in the Air Force. My last assignment was at the Pentagon, and I enjoyed working with the NOAA folks Dick Hallgren and others and a lot of the inter-agency activities, since I was the senior [environmental services] representative over in the Pentagon at that time. When a vacancy became available for the [NWS] Deputy I applied for it and was fortunate enough to be selected.

Bill Bonner, who was my predecessor as Deputy of the National Weather Service, had been in charge of a reorganization task force to come up with the initial plan for modernizing the National Weather Service. You may recall at the time, that the National Weather Service had a series of offices at various levels of responsibility. Each state nominally, it wasn't quite the same, but each state had an office that was responsible for forecasting for the entire state area, for the most part.

In addition there were a large number of additional offices in each state that were only warning and forecast offices – [observation and] warning offices. They would have a radar associated with them, they would issue severe weather warnings but they didn't really do any initial forecasting, so those were usually staffed with about five or six people.

The forecast offices for each state usually were staffed with about forty people to take care of the entire responsibilities for the state. But in essence as we learned more and more about forecasting small scale weather, impact weather, we realized that the offices were certainly under equipped, because the technology that was available in those offices at that time simply wasn't capable of handling the job. We had the WSR 57 weather radar, and WSR stands for weather surveillance radar and 57 is the year of design.

We had a vacuum tube radar system that was so out of date that when we realized we were going to have to use it for another few years and go out for additional supplies, we couldn't find a company in the United States that could still manufacture vacuum tubes, because that technology was left behind [obsolete] and we no longer had that. We ended up actually buying a substantial number of vacuum tube's from Russia, because that was the only country left in the world with a reasonable capacity for building vacuum tube's at the time, so we [the NWS] were clearly behind in our technology.

The staffing levels weren't really enough to handle, particularly at the smaller offices the severe weather when it really occurred. So, the plan then was to go from that number of offices which was over 300 offices if you count the individual stations that only took observations, or only operated a radar and didn't give out any kind of service to the local community. So we went from over 300 offices, and the plan that Bill Bonner put together initially had us coming down to about 125, 130 different offices and with about the same number of people.

03:12 That plan went up the line to NOAA and was rejected, because it didn't offer enough savings. And so it came back, and I came in as Deputy at the time and so it was our job to start looking [working the plan]. We started refining things a little bit and we started tweaking things a little bit. We reduced some of the offices that were later added back by a Congressional fiat. We tried to be a little more cautious on the staffing, and so the plan that we more or less came up with within the National Weather Service ended up without about 125 offices and a staffing level of a couple or three hundred below what we had at the time in the National Weather Service. There was a lot of opposition to that in the Administration at the time from the political leadership. Jim Winchester, who was the Associate Administrator of NOAA, insisted that there be an independent study by an independent contractor as to what kind of Weather Service we should have. But the mode of that study was somewhat different. What we tried to do was to identify in our planning effort in the National Weather Service what type of structure, what type of modernized service would provide quality Weather Services for the public.

04:34 Booz Allen Hamilton was contracted [by Winchester] to do a study which essentially had the ground rules. What is the minimum required Weather Service to meet the legal needs of the country? Booz Allen Hamilton did a lot of very good analysis in that as to what the needs were and so forth, and they realized that the needs were pretty much what we were doing now and maybe even more, but the pressure that they were under from Jim was such that they had to come in with substantial savings.

05:07 Now I was in a kind of an interesting situation. There was a fellow, a friend of mine in my church that worked in Booz Allen Hamilton, in the same shop that was doing this particular consulting activity. He came to me one day after church, and he said, 'Joe, what is going on with this study on the Weather Service?' And he named an individual who I will not name now, but it was another Booz Allen analyst, a woman. He said, 'She came to me the other day just crying, and said, 'I just don't know what to do.' She said 'I'm being asked to do things that are not correct'. She said, 'We go and we brief the entire team' that included Dick Hallgren who was the Director of the Weather Service at the time and myself, as well as other senior members of NOAA. 'We go in and brief them on our particular findings, we tell them what our conclusions are, and then we're taken down to Jim Winchester's office, and he says, 'I don't give a damn what you've found, this is what you're going to write'. And he gives that kind of explicit direction.

As a result of that direction, Jim initially told them that they had to come up with a Weather Service structure for the country with twelve offices, and put it together in that particular fashion. They resisted that completely, they refused to do that. They came up with a dual structure type of thing. They came up with one structure which had 25 offices, and another that had 50 offices, and they supported the 50 office structure over Jim's objections. But they refused to go as far as he wanted with twelve offices across the country.

The structure they put together, when you really costed it out, would have required more people than our plan did, because of the particular way you had to work and have the expertise in all the various areas. The plan that we put together was based on some academy work [National

Academy of Sciences reports] and some work by other independent committees. There was an organization called NACOA, the National Advisory Council for Oceans and Atmosphere or something like that. It was a chartered advisory committee and it came fully under the FACA legislation that looked at various issues [within NOAA].

07:42 And one of the final things they [NACOA] did, before they were disbanded actually, was to put together a study called ‘The Future of the Weather Service’. In addition to that, the National Academy of Science in 1981 released a document entitled ‘Technological Opportunities for the Coming Decade’, in which they talked about certain things that were going on in the technology that needed to be applied to improve Weather Services across the country. One of these things was the Doppler radar. They strongly stressed that that [Doppler] radar be deployed across the country, because there was already evidence from some research that was being done, that you could significantly improve the forecasting of severe weather, particularly tornadic type of storms and severe thunder storms by using Doppler radar as opposed to the conventional radar that we had been using.

In addition to that, they talked about interactive computer systems for integrating all of these data that were coming from satellites and radar and surface observations and radiosondes and all this. And at the time, that recommendation was made there was very few examples of real [time] active interactive computer systems, so this was pretty cutting edge that the Academy recommended. And they also suggested that automated observations would allow us to expand the observational network across the country and do a better job of really understanding what was going on, at the surface certainly.

09:07 And so those three components became fairly well accepted as things that should be included as core elements of the modernized Weather Service from a technology standpoint. The Doppler radar network covering the country to provide a solid surveillance of what was going on, an automated observation system at well over a thousand locations around the country to provide a dense surface observation network to keep track again of what was going on, and what later became known as AWIPS ‘the Advanced Weather Interactive Processing System’, to permit the forecaster not to have to do what he or she had been doing before, which was to have a radar displayed on one desk and a satellite display on another desk, and basically some machine to display the weather patterns on another desk, and then the weather forecaster would have to try to mentally integrate all of this.

10:05 So the AWIPS system was to bring all of these data together into a single system, to allow the forecaster to easily integrate [the various data] and see what was going on, and overlay these various data sets, manipulate them, and generate forecast as a result of that. That system is still in place today. It’s been improved several times, a new generation has gone in. But it allows very, very good manipulation [integration] of the data to help the forecaster understand what is going on. It has automated systems to help identify warning areas and generate the warnings so that the forecaster doesn’t have to go through and very, very carefully lay everything out in a message that he or she is typing for transmission. It has all of those aids that make the forecasting process go smoother and more complete.

But probably more important than that, we were basing the new model of a Weather Service on the local scale forecasting processes in each one of the local offices. We were looking at meso-scale forecasting for the first time and there had been a lot of work done in the previous decade on understanding meso-scale systems, and understanding that more often. But it was only by having a professional meteorologist at each one of the 125 offices across the country, covering that local region around that office that permitted the application then of this emerging understanding of meso-scale meteorology to be taking place.

11:44 And it was that kind of structure in which we would have a limited area of concentration at the meso-scale with all the necessary tools for doing that, with the Doppler radar and the AWIPS system, and all of that to integrate that information, so it was that kind of concept that we had for the modernization. The devil is always in the details. Where do you locate the offices? Well, one of our core concepts that we had was to try to co-locate the offices with the radars, or vice-versa depending. And so we started at the East Coast and the Gulf Coast of the United States, because of the hurricane threat to that area of the country. And we placed a radar network along the coasts to provide extensive - the best surveillance of the coastal areas, and as far out to sea as you could possibly go with a ground-based radar system. And so that formed literally one tier of, the first tier of the stations. Where possible, we co-located those radars where existing offices were so that we would have a core nucleus already in place without having to relocate people [and equipment] and the like.

And then we moved inland to the next level [tier] and we continued to go across the United States to where we had pretty solid coverage. It wasn’t perfect. If we had had perfect coverage across the United States, if I remember something we would have required on the order of about 180 radars. That was clearly well beyond the [constraints of the] budget situation. We ended up with about 140 radars across the nation, so there are areas particularly in the mountainous areas of the west where the mountain blockage and the distance between radars left some areas that were not covered very well, especially at the lower levels of the atmosphere.

13:35 But nonetheless, it ended up that this network that we had was much better than anything that we’d had before. With the Doppler capability, it gave a much more complete understanding of what was going on up in the atmosphere. I still remember to this day, when we first started using our Doppler radar systems with the animation capability, because we really didn’t have animation capability with the old radars. We started using this with animation capability, and now you could start to see, visually, the processes that were going on in the atmosphere that created convection. You would see an outburst. I don’t know if you’ve ever stood and seen a thunder storm in the distance and then felt a rush of cold air coming at you from the down flow out of that thunderstorm. That’s called a gust front. And you can feel it, but the radar can see it in many cases. And you would see a thunderstorm come out of it, and you would see a gust front start to come out of it, and maybe in another thunder storm some distance away develop, and a gust front come out of that, and where those two gust fronts would collide, you would end up generating, frequently, another thunderstorm. You can now see this process at work, and then

you would say to yourself, ‘Of course that’s what happens.’ But, we didn’t see it before [before the animation capability].

And so that, as these systems were being put in place, each and every place we put a new radar in, we were now able to see the phenomenology around that local site, that meso-scale phenomenology that was really causing the weather to occur in the way that it did. The Palmer Ridge is a slight ridge that comes out from the Rocky Mountains near Denver, and we knew that ridge had some impact on the weather, but once we put in the Doppler radar there with animation to watch the [atmospheric] motions, we could see when the winds were right, it would come around and that ridge would actually form a small cyclone. It would form a swirl around that ridge, and it would serve as the generation of convective elements and convective thunderstorms, and so now, instead of just guessing whether or not the situation was going to cause a thunderstorm in the afternoon or not, we could frequently provide information on those thunderstorms thirty or forty minutes before they even developed, because of the systems that were developing.
And literally every place across the country, as we started to look with open eyes if you would with the Doppler radar, we were able to tell what was going on and apply the mesoscale training that we did.

16:18 We also did another thing in that modernization which was absolutely critical. When we started the process, when we were doing our initial planning, the composition of the Weather Service had about three thousand meteorological technicians and about one thousand professional meteorologists in the organization. If we were going to take advantage of the meso-scale sciences across the country, and do a competent job on the forecast and warning process at the meso-scale level, we had to reverse that [ratio]. And indeed, the final structure had just the opposite. It had about a thousand meteorological technicians and three thousand professional meteorologists.

Now, we had a lot of people in the Weather Service that had done very good work over the years who were meteorological technicians. We set a system in place to cross train those and to provide them the educational courses that they needed to qualify to be a professional meteorologist. We set up a program out at San Jose State University, and it was an accelerated course. It was very similar to what I came through when I first went into the Air Force. I went through an eleven month course which had basically 24 credit hours of meteorology crammed into that eleven months. And we did basically the same sort of thing at San Jose State. We set up a course there so that a lot of the met techs who had a lot of qualifications already, but they usually didn’t have the dynamic meteorology aspects, the more theoretical aspects of the meteorological sciences, so we set up so that they could get those in a short order.
And we trained well over two or three hundred, cross trained, people that wanted to do that. We also made a commitment to the people in the Weather Service that if they wanted, that there was a major of course change in office structure and office location, but anyone that was in the Weather Service that wanted a job would have one. Not where they were necessarily located, and they may have to go to a cross training program in order to qualify and so forth, but we promised it.

18:16 Now, we had a union in the National Weather Service, still do, called the National Weather Service Employees Organization, and one of the mistakes that we made actually, we were ordered to make in the development of our whole modernization activity was the fact that we could not involve the union in the planning. And as a matter of fact, we were directed by the NOAA management and the Office of Management and Budget that we could not even release any details of a plan until after they had completely approved of it.

A vacuum of information breeds all kind of ill ideas and ill concepts about what’s going on. The union felt that we were probably going to end up doing something like Booz Allen was doing. After all, this thing became public knowledge of what was going on and they were certainly adamantly opposed to that. And they carried out quite a campaign. I worked as closely as a I could under the restrictions that I was given to involve the union in the planning as we went into the implementation process, but the fact that we kept them in the dark so long generated such a distrust of what we were doing, that it was a major impediment to a smooth modernization effort. In the long term, things worked out reasonably well.

19:42 We put an assignment preference process together, if you would, so that we’d ask everyone who was going to be in an office that was closing, where they would like to go and we told them to make three choices, give us the top three choices of where they would like to go, and most of the people were accommodated in their first and second choices. Very few did we have to go to their third choices to accommodate them. So, we did everything we could to make it easier. We set up relocation assistance; we set up all sorts of things like that from the personnel standpoint. But we also set up a very, very active training program to prepare all of the forecasters for the new technology, the new science.

We set up -- every forecaster in the National Weather Service went through a several week program - I can’t remember if it was a four- or six-week program - in Doppler radar interpretation. We took over an entire Residence Inn in Norman, Oklahoma and kept it full for many, many months sending our forecasters through that program there at Norman where the Doppler radar had been developed, and extensive program.

We set up what’s called the COMET program, the Cooperative.. [Cooperative Program for Operational Meteorology, Education and Training]at Boulder, Colorado in order to assist in updating all of the meteorologists that we had on board in the latest science of mesoscale meteorology so that all of the new research work and the new developments were transferred into operations through that mechanism. COMET is still going on today, and has expanded its activities considerably. It started out as an organization to develop training and educational materials for the modernized Weather Service, but it has extended now and it’s being used by the private sector, it’s being used by academic community and teaching and everything else and is being used in many, many foreign countries as well. So, it really is an educational resource for the world meteorology community that resulted started from that. They're still generating; every time new technology is coming downstream or every time there’s major new outbreaks they develop online educational material for that.

[Pause in recording]

Dick Hallgren had retired and I was fortunate enough be selected as Director of the Weather Service to replace him. But we still didn’t have the strategic plan for the modernization approved. Congress got pretty upset with that and they put together basically a piece of legislation in the authorization bill that required the Department of Commerce, ninety days after the enactment of the legislation, to forward to them our strategic plan for modernizing the National Weather Service. They also required that in the execution of that plan that nothing could be done in reorganizing the Weather Service if there was a degradation of services.

So the non-degradation of service became a critical element for the modernization. In addition to that, they [Congress] required the development of a National Academy of Sciences committee to basically provide oversight and review of all stages of the modernization. It would be meeting several times a year, reviewing plans, reviewing programs, reviewing activities implementation and so forth. I recall it reviewed the radar network; it reviewed the communications internally within the National Weather Service, how effectively was management communicating with the field about what was going on. Part of this was driven by the union saying that we didn’t tell them a thing. This was a very good committee, it gave me advice, some of which I didn’t like but nonetheless it provided a buffer as well, however, to keep the budget processes and the political processes from creating such a compromise that we would have ended up with a bad modernized Weather Service. So, in one respect I thought it was equivalent to having a necklace of garlic around my neck to keep the vampires away, but at the other times, it was sometimes the advice as I said I didn’t really appreciate, but in general, it was good, all in all. I can’t think of a thing that they suggested, that they recommended that was wrong. Some were a little more onerous than others was the situation.

So that bill was passed, and that caused a real flurry of activity to try and get the final approval of this modernized plan. And I recall a meeting that I had in the Office of Management and Budget. We went forward and [at the OMB meeting] I was directed to rewrite the plan with 2000 people fewer than what was in the plan. My statement to the analyst at OMB at the time, I said, ‘You send me a letter to that effect,’ and we had a very senior person from OMB in the room at the time, ‘I said you send me a letter to that effect, a signed document to that effect, down the chain and I will do my absolute best I can to implement that direction’. [OMB replied] ‘No, this is your plan’. ‘In that case, I refuse to do it, because in my professional opinion, I do not believe that is an appropriate Weather Service for this Nation and I think it would do the country a disservice’. The OMB analysts got up and stormed out of the room, all of them. I left; I told my wife when I got home that day that I expected to be fired the next day.

I came to the office bright and early like I usually do. I usually got to the office at about 6 o’clock. It was an opportunity to read all of the [email] nonsense that had come in the previous day before the work started at eight. At about 7 o’clock, I get a call from a department of commerce budget official, a fairly senior one. He said, ’The Office of Management Budget is very disappointed that the only basis of planning is your professional judgment as opposed to

facts’. My professional judgment didn’t come out of thin air, it came from facts, it came from various things. ‘However, they will approve plan under the following conditions. You remove the five lowest priority offices from the structure’. They’d asked us which were the lowest priority and we’d told them. ‘You also take one person out of each office, so that you reduce the number of meteorologists on shift for the least weather active shift for one as opposed to two, and in that case, you have your plan approved’. I thought that was a compromise that we could live with, and I approved it. I agreed to that, and that’s when we then published the strategic plan on record, and that’s when all of the activity started in earnest.

We ended up with not only the strategic plan, which was only about fifty pages if you recall, it was a very thin document. But that plan then formed the basis of all the implementation planning that then started. I forget how many hundreds of thousands of individual line items we then had in the final planning process, when you took into consideration everything. But it was all of the office construction, all of the office moves, the training of people, the movement of people. All of that then had to be put into place and so forth as a result of what we were doing. A long process, but when you take a look at the results, in my opinion, it was worth every bit of it. The accuracy of the weather warnings improved tremendously and they're still continuing to improve, as we learn more. The professionalism in the office has stepped up an order of magnitude; we’ve continued the training program so that we maintain currency across the board. It’s not a one-shot training activity and so forth. And in general, it turned out to be, I think a very good process.

~~29:24~~ I remember right after the plan was approved. We had a substantial percentage, not only of the union members, but also quite a few members in management that didn’t really think that we could do it or didn’t think we should do it, because they kind of liked the status quo. They kind of liked the way things were at that time. So we held for the first time in one hundred years, in Boulder, Colorado, a management meeting. Modernization management meeting in which we had every manager in the Weather Service attend. You’ll have to look up the date of that, there’s a picture some place with all of the attendees. The previous one was held in something like 1898 and there was a picture pulled out of the archives of that, in which some of the heads of the weather offices were wearing clerical garb because at that time, many of the offices were still the old Jesuit sites that were missions, where the weather observations were being taken. None of our crew this time were wearing clerical garb, I don’t believe.

29:44 So we spent a week in Boulder at the Harvest House, or whatever the hotel is called now, it kept changing its name. We had all the technologists come down to work with us and we set up the technological opportunities [demonstrations], there were some research interactive processing systems that were being made by Sandy MacDonald’s group. So we set up a lot of things there to show them what was going on. We had the weather experts in the field give daily weather briefings using the new technology and so forth on the [auditorium] screen for everybody. We answered all of the questions that we possibly could. We had personnel people there, we had budget people there, we had maintenance people there, we had everybody there that we could possibly have. We had a session, we opened it up for questions, and if we couldn’t answer the question directly we would work overnight to answer it the next morning, I don’t know that I got more than about two hours of sleep a night at that meeting. When we started, I

would estimate that we had only about 10-20 percent of the people there that felt this was a good idea. At the end of that week, we probably had about 80-90 percent of the people that felt it was a good idea. We still had a few hold-outs, and I remember quite a few guys and gals coming up and telling me, ‘We really are thankful that this meeting occurred, because now we understand really what’s going on, as opposed to the rumors that we heard’. We ended up with those modernization management meetings about once a year as things evolved and as new things took place.

31:24 The structure of the modernization was different in a lot of respects to the old offices. We recognized the fact that we needed to maintain the scientific integrity of the office structure, so we put together a personnel system there that included the science and operations officer, who was basically going to be the chief scientist. I wanted to call him chief scientist, but personnel wouldn’t let me. There were some rules against it, only certain people and organizational levels could have chief scientists. So, the science and operation officer was really the chief scientist of the office. Then, I wanted a marketing person and outreach person. I couldn’t call them that either, because that was not right, so they were warning coordination meteorologists, and they were the people that looked out to the community, the emergency management community, the cities and the town councils around and all that sort of to work with them. It was important for them to be able to tell the community what we could do for them, and it was equally important to tell them what our limitations were that we couldn’t do, so we could really do the type of planning. Their jobs were to become as well known to the emergency managers as the other emergency managers were, and it has worked very well in helping Weather Service work with the communities at large.

32:52 The science and operations officer has also worked very well in maintaining the scientific integrity of the office, making sure the training is up to date, making sure that the latest processes are there. We also did one other thing. These people were not just people out of the rotation cycle. Each one of these folks were required to pull a minimum number of shifts themselves a week, including the MIC [Meteorologist in Charge]. So, that the senior people in the organization didn’t forget what it was really like to work the job. It was important to do that, it was important for them to have the capability of doing it, and to fold in needs from that operation into the future developments. Those were some of the philosophical things that we put together. A lot of hard work went into that, the regional planning, the local planning, and as you can imagine things didn’t always work out quite right.

33:58 The first implementation of all these plans sometimes created difficulties. The first shovelful of dirt that we struck - when we first turned for the office outside of Kansas City, hit an undocumented Indian burial ground. That’s an important area, because when we get ready to start the building process and the implementation of the radars across the country and all of that, we made a decision, a very conscious decision that even though as a Federal government, we had the right of eminent domain to do strange things and not follow all the local procedures, we did not want to be bad neighbors. So we made a decision that we would follow all of the rules, not only the Federal rules that we had to follow, but also the state and the local rules as far as environmental impact assessments, environmental impact activities, historical site activities and

dangerous species, all of these various things we would follow. It cost us more money! The site that we had for the Melbourne, Florida radar for example, when we started to build on that we discovered that there were Gopher Tortoises on the site, and Gopher Tortoises are an endangered species.

Florida has rules that you can move endangered species or you can relocate them. So, we bought in some qualified people to relocate the endangered species. A few days later, they showed back up. I don’t know if it was the same ones, a different group just roaming around the neighborhood, or if other folk bought them back, that sort of thing. We ended up having to put an additional $25,000 worth of chain link fencing around the site, into the ground, cause these little suckers would bore into the ground, so it turned out that they moved in right next to the fence, as close to their old home as they could get, I guess. So we had that process. We relocated [the Kansas City office] completely after the Indian burial ground, because we always did an archaeological search about anything that was significant that we didn’t want to disturb and all this. We hired engineering companies to do all of these things for us; we didn’t try to shortcut that,we tried to do - it was quality work. We hired engineering companies to do all the site surveys to site the radar, so again, it was solid quality work that went into the modernization effort, and it wasn’t just done haphazardly.

36:35 The last radar went up in June - the 6th of 1995 in Indiana; it was a site that was added to the original one because of political pressure. At least that’s the last site when I was in the Weather Service, as a matter of fact that was my last day in the Weather Service, when that dome was erected at that particular point. The process proved itself very solid, from the very first time we turned the first radar on, we improved the forecasts and warnings. We were able to identify things that we had never seen before, improved the weather warnings, improved the forecasts and improve the credibility of the Weather Service offices.

37:28 In 1982, we started a program called ‘the automated verification program’, in which we started keeping track of every warning and forecast that went out of the National Weather Service. We did that before the law actually required the non-degradation of services determination, but we realized that we were going to have to show people that we weren’t causing problems as we went through the modernization, so this began to serve as a baseline. By having this base structure from the old office structure to the new office structure, you could show the changes in the accuracy of the forecast as the new offices went in. Before we closed the old offices, we had to show that we weren’t lowering the level [of forecast accuracy], and so that worked out very well for us. Every office structure and closure that we had, we put together that entire package and that work had to go before the Modernization Committee in the National Academy of Sciences, and they would review it and ask questions if they didn’t think we’d done a thorough job of analyzing, but in general they were very supportive of our activity and our analysis. There were a few ones that came back and asked questions about, but for the most part it worked out fine. The fact that we had that track record all the way from 1982, and we started putting in the new offices in 1989 to 1990, that increased the credibility when we made a statement that we weren’t degrading services, we actually had the data to show it.

39:06 Then that diffused a lot of arguments. It didn’t make people happier about closing over 200 offices in the Weather Service, I got a chance to meet almost every senator and a substantial number of congressmen personally and up close, but that was a necessary part of it. We made no bones about it and we went forward to Congress proactively to tell them what was going to happen. When the modernization plan came out, we basically touched base with every congressional delegation that was effected over a period of time. We had our modernization communication office within the National Weather Service which worked in association with NOAA’s public affairs and legislative affairs, but did a lot of work in addition to the standard things that NOAA was doing for us, so we worked on quite a communications system.

40:02 The Doppler radar program of course goes back in some respects to the very beginning of radars. One of the things that we did in the very early days of radar was to get rid of the noise caused by moving targets, and to try and get rid of that and go with the conventional reflectivity signal and so forth. As we learn more about it, the Doppler signal would actually give us information about what was going on internally in the clouds. The Doppler radar development that went on was heavily done at the National Severe Storms Laboratory, in Norman, Oklahoma, and in order to prove the utility of the Doppler radar after it had been developed as a research tool in the mid-70’s, there was a program called JDOP, the Joint Doppler Operational Project, and it was basically at Oklahoma, at central Oklahoma, to try to understand how operationally the Doppler system could affect the forecast and warning process.

41:13 JDOP was staffed by people from the Air Force, and the National Weather Service, and from OAR [Office of Oceanic and Atmospheric Research], what’s now OAR, and the interesting thing here of course is that this was research equipment that we were using. It was not robust equipment for operational use, so we had PhD’s in there interpreting all of this and doing the forecasting warnings and all of these sort of stuff, and they did a great job. I was in DOD [Department of Defense] at the time, and one of the things there at the end of the 70s that made it very easy for me to sell the concept of joining in on this Doppler project for the NEXRAD radar, was the fact that one warning coming out of JDOP for Vance Air Force Base north of Oklahoma City allowed for the sheltering of a very large number of aircraft inside hangars, and a tornadic storm with a large amount of hail came by, and if those planes had been outside, the DOD would have lost millions of dollars’ worth of aircraft from that one storm, and so the fact that the Doppler radar had been able to give the indication of what was developing inside the storm and how severe the storm was going to be. And a forecast warning was issued on the basis of that, action was taken and money was saved. I took that information when I was in DOD, I walked down the hall and I gave it to the Undersecretary of Defense for research and engineering. I said, ‘This is why we need to get involved in this and support it’, and that’s the main reason the Air Force was funding a substantial percentage of the NEXRAD product across the country.

43:01 It was a great deal of work going on at Norman during the entire pre-modernization and modernization era. Not only the Doppler radar but also the inclusion of lightning data, which of course is now incorporated completely in our forecast office, and the weather office, the Oklahoma City Forecast Office served as a guinea pig on a lot of this. They were actually using a lot of this stuff in real time, and every time that we’d come up with a different way of doing

things with the research radars in the office and everything, I sometimes felt sad or sorry for the management in that office because procedures were changing all the time. But, it was real people doing real work, in a real environment and they could give real feedback in a hurry as to whether or not the research community, the development community was going down the right way or not. They did a lot of influencing on how things developed.

44:00 We had another site in the pre-modernization and modernization era as well that served as a real test bed, and that was the office at Denver working with the Boulder laboratories at the time. They would take the latest developments out of PROFS [Program for Regional Observing and Forecasting Services], put those prototypes in the office and have the real forecasters use it in their real applications. They’d train them on it and then have them use it in the real applications. I recall stopping by the office on my way out of Denver one time, I had a few minutes so I stopped by the office at Stapleton Airport where it was located at the time, I walked in the door, and I can’t remember the gentleman’s name, but he said, ‘Dr. Friday, I just want to say that I’ve worked for you now for thirty three years, and in recent months when we started doing these things with the new technology, for the first time in my life, it is really a lot of fun coming to work’. [Laughing] I don’t think so, I think he enjoyed it before, too, but he was really enjoying the challenge and the innovation even though he was an old-timer. He was really enjoying the challenge and innovation of this new technology, and seeing things develop and being able to use it. That was, in general, the sense of both those office. They really enjoyed being participants in these landmark episodes of new technologies and trying out things. And by having both those offices in different areas of the country, you got a slightly different perspective as well, and I think that made the development efforts more robust than they would have been had we not done that, certainly, or if we’d done that in only one location.
The AWIPS development was done heavily, in addition to the contract activity but also done heavily in PROFS and subsequently the Forecast Systems Laboratory.

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