Dennis Walts, June 2010

Topics: PROFS, AWIPS, Role of Research

Dennis Walts: My name is Dennis Walts and I actually was a Weather Service employee, rather than a NOAA employee. But my effort with a particular AWIPS I was assigned here in Boulder to the Environment Research Labs as a Weather Service representative. So, I really was never with the ERL. I was always a Weather Service employee. And my background – actually I was an operational meteorologist actually at a forecast office. And when AFOS started coming around – pre-AWIPS, I was very interested in that and then got very involved at the regional headquarters level and then at the national headquarters level, and then I ran the Systems Monitoring Coordinations Center for several years, before getting involved in AWIPS directly.

Barry Reichenbaugh: Talk to me a little bit about how you first got involved in PROFS then and some of the work that you were doing with them.

Dennis Walts: When I was back at Suitland, Maryland at...I was the chief of the Systems Monitoring Coordination Center for the AFOS System Communications Network. Lou Boezi and I talked quite a bit about the replacement systems that we were going to have to do to upgrade and modernize from AFOS to the next generation system. And I remember spending an entire day in Lou's office one afternoon, talking about AWIPS and the requirements for AWIPS and how we were going to try and implement this complicated set of technologies, changes to the operational structure, changes to the organizational structure...doing this all in one fell swoop and what a challenge that was going to me. And so, Lou one day – we were talking about AWIPS and we'd had some early requirement documents drawn up for AWIPS, but it was such a new technology, we really didn't understand too much about, OK, we've got all these requirements which ones are complicated, which ones are easy, where do you get the most bang for your buck, which ones are the cost drivers, high-risk items, and so on. So, Lou says, "Why don't you go out to Boulder and work with Sandy McDonald build one and we'll learn from that. Learn by doing this, but we want to do it in a non-operational environment to begin with. We want to just build the system, put in as much of the functional specifications as we can that seemed reasonable at the time and try to learn from that." So, I did.

So, Lou and Doug [Sargeant] and Dick Hallgren sent me out here as the Weather Service rep to build an AWIPS system. So, we did that in a non-operational environment of PROFS at the time. And Sandy McDonald of course, was the head of PROFS. So, what we had to do with this AWIPS system was not only build the workstation component, but we had to build within the research environment all the datasets that were going to be part of the modernization, too. The Doppler Radar, the Advanced Guidance Gridded Data, and other surface data and satellite data and all that and integrate it. So, within the PROFS environment and under Sandy's direction that's what we did.

We built the datasets that were going to be part of the modernization, as close as we reasonably could build them at that time and that kind of a way – and put an end to this prototype workstation that we had here at our old facility over across town before we moved into this building. And we were doing some testing as we could in that non-operational environment. We had meteorologists and forecasters and we would bring forecasters in from the field and we would sit them down in

front of it and use it. Tell us what's good, what's bad, what works, what doesn't work and all of that.

4:22 So, we went through that phase of it for a while. I don't know exactly how long, but a couple of years of putting that altogether. And then of course, Doug and Lou said "okay the next phase is – let's put a single workstation into a field office. We're not going to replace everything that they got there, but let's put this thing that we have tested for a couple years and built into a field office." And of course, Denver was the logical place because it was close by. But, we're still going to have to feed these modernized datasets from the research environment in Boulder, because we don't have them yet in the field. They are not there yet. This is something that is going to happen. So, we have to build these datasets – the Doppler Radar datasets – as close to the Doppler Radar that was coming as we could; as they were defined here and all of the other datasets and we are going to support an operational field office workstation – a single workstation in an operational office from a research environment.

5:35 Now, red flags of course went up everywhere. How you going to do this? Because the field office is 24-hours a day, seven days a week and a research facility is not. So, we had to accommodate not only building the datasets, but how do we support this in an operational environment, 24/7? So, that was my job...to make sure that we could support operations within the work station in a field office in those kinds of situations.

So, we did that. We learned a lot from that and that was called DARE...D-A-R-E, which essentially stood for Denver AWIPS Requirements Evaluation. That went pretty well. We learned a lot from that and the forecasters gave us a lot of feedback. We had some really good people down in Denver that were helping us with this and they understood you know...that it doesn't always go perfectly in this sort of situation and we're tolerant of that.

6:35 Okay, so we went that direction with the first DARE and then the Weather Service says, "We need to expand on that. It can't just be a requirements evaluation. We want to also do – incorporate a risk reduction aspect to what we're doing in an operational environment." So, rather than come up with a different acronym...we just called it DAR–Cubed E, which stood for Denver AWIPS Risk Reduction and Requirements Evaluation. So, that's how we got to those acronyms.

Uhm...so that's sort of Phase I do this in a research environment, Phase II tip-toe into an operational environment, Phase III is let's expand this now.

And so, the next challenge that we had here...I guess was pretty much my responsibility...is now let's expand this to not a single workstation in an operational office, but let's replace everything they've got there at the operational office. All the workstations – all the old AFOS workstations and the whole thing, but we were still using the datasets that were generated in a research environment. So, we did sort of two things at once. We – by that time the contract had been let for the WSR-88D Doppler Radar. And I think Sperry was one, Ratheon was one...and I can't remember...did Sperry win out and Ratheon was the loser there? Whichever the loser radar was, we said we're not going to throw that radar away. Let's bring that radar, which is a real Weather Service Doppler radar, even though it didn't win the contract...out to Boulder and we're going to set

it up and operate it. So, we're now feeding our operational workstation in the Denver office, with a real Doppler radar.

And that was a big challenge...bringing that radar out, getting it setting up, staffing it 24-hours a day and we worked with NCAR a lot on that. We actually gave the radar to NCAR and then paid them to operate it for us.

Barry Reichenbaugh: So, what then?

Dennis Walts: The next step was, okay now we're getting the real radar datasets...we have to start looking at how we're going to provide our offices with the real other datasets that – what's called NCEP [National Centers for Environmental Prediction] now...you know the National Meteorological Center [NMC] at that time – they have to build a data stream that they can feed over satellite networks to once we deploy AWIPS nationwide, they have to be ready to build those – feed those data streams. We started a project then called, ISPAN, which stood for Information Stream Project for AWIPS NOAA Port. And we worked with NMC at the time and the people there to build these datasets that were going to be – at least initial set of datasets – that were going to be part of the modernization.

10:00 And so, we then brought those in to the Denver office. So, we were now getting closer to a real operational data feed, with NESDIS satellite data coming over satellite data feeds. We were getting the NMC NOAA Port data stream, gridded datasets and all coming from NMC. We were getting Doppler Radar data coming from a real Doppler Radar, even though it wasn't the one that was chosen. And then of course, we were still trying to support it from here at the lab. We replaced every workstation in Denver with a pre-AWIPS – we called it – workstation built by the lab here. And those kinds of things never go one hundred percent smoothly, but it went pretty well. We did pretty well at supporting them.

So, the next step after that – as directed by Doug Sargeant and Lou Boezi – was "Okay, now, we want hook up to a real Doppler Radar – the real Doppler Radar in an operational office directly. Not supported by a research facility or whatever. So, the next step was we built a pre-AWIPS systems, essentially the same as we had in Denver – all the workstations, all the capabilities – and we put that into the Norman, Oklahoma office and we hooked it up to the first real Doppler Radar. And this was – our job was to build those interfaces; both the interface to the AWIPS NOAA Port, build the interface to the real NEXRAD radars, and all the other local interfaces and satellite feeds, and so on.

Barry Reichenbaugh: What went into building those interfaces and maybe if you could back-up also and describe a little bit of the challenge of building the datasets, given they were coming from different technologies.

Dennis Walts: Uhm...I am trying to think what the biggest challenges were. We had to work closely for example; with NMC people that were designing the gridded and datasets and so on. We worked with so many different people and organizations that the coordination of that was probably the biggest challenge, okay? Now, we also had to work with Weather Service Headquarters, because all of our requirements that we were trying meet had to be coordinated with Weather Service Headquarters and particularly the Office of Meteorology, the Office of Hydrology, and so on. So, it

was a interesting challenge to do all of that coordination...make sure that in fact the datasets that we were getting were essentially going to be part of the modernization. That the interfaces we were building were going to interface to the real datasets and that we could – the real challenge was so many of the pre-AWIPS datasets were on their own scales, their own coordinate systems. You know...everything was different.

Barry Reichenbaugh: Right.

Dennis Walts: And we had to build a system which integrated all of this and do all of the coordinate conversions, all the scales conversions, all the processing to handle this data so that the forecaster could display it and interact with it, without having you know...a workstation here for satellite data. And a screen here for radar data and a screen here for gridded data...it all had to fit into one displayable system, at different scales, because for the local scale on up through the global scale, we had to do a lot of processing of that data. That was one challenge.

14:10 Another big challenge was as you know, meteorological data is very perishable. So, we had to build a database management system that could keep the forecaster informed of what was available and be self-purging, so that the forecaster didn't have to worry about "Oh I gotta throw this data away in order to get new data in" and so on. It had to be self-fulfilling and replaced. So, we tried to do that commercially and we couldn't find any database management system that could hand the volumes of data in the timely fashion that we had to handle it in a forecast office. So, we had to build our own database management system. That was a real challenge to do that.

Okay, so now we're at Norman and now Norman is a city next to the research lab and we can't support them every day. We tried to support them as best we could, but we also had to provide training for everybody. We had to provide training for forecasters...we had to use…this is all new stuff for them, you know? They hadn't for the most part used a lot of this dataset. Of course, the Norman people were involved with the NEXRAD development, so they were pretty familiar with the Doppler Radar data. But, we had to train the forecast staff, we had to train the maintenance staff, we had to train the administrative and the management personnel on all of this stuff. So, we were saddled with doing all of that training, as well.

16:00 So that was sort of the next step...was doing Norman and in the process of doing all this, we scrubbed the requirements from one end to the other. What things really are big cost drivers? What things are real easy to do? What things do you get the most bang for your buck on? So, we worked with the Office of Meteorology and the regions and so on to try and scrub the requirements continually...to keep refining them. Obviously, we didn't want to pass along a set of requirements to a contractor that we couldn't afford. But, we wanted to pass along a set of requirements that were needed, so we were continually trying to balance that with matching the requirements to what we could afford and what was needed. So, that was going on through the whole process here.

Barry Reichenbaugh: So, among those challenges were there any specifics that you particularly remember being ones that were just real – really – did they stump you or were they just ones that you just had to put the time into?

17:18 Dennis Walts: Yeah. There were challenges that we never expected...you know we expected a lot of challenges. I will give you an operational example that really baffled us for a while. We – during the whole time that we had a single workstation in Denver and then the full set of workstations in Denver and then the full set of workstations in Norman...we recorded every mouse click on every workstation 24/7. We wanted to be able to go back at any time and say, "Okay what was the forecaster doing say in the fifteen minutes prior to a warning situation or routine operations. Where were they getting lost in the system and had to backtrack and all of that." And we had a full staff of people just to evaluate and we would actually have people go down to Denver and sit with the forecaster for a day. Say, "talk to us while you are doing this stuff. What do you like and don't like and you know...what things work for you" and so on. So, we had a staff of people doing that...our evaluation team...constantly monitoring that. But, there were things that really surprised us.

We, here in the lab had been working with Doppler Radar for a long time and we knew the value of Doppler – velocity data as well as the reflectivity data -- how good it was. And we trained – before we put Doppler data into a workstation, we would train the people on using it. We thought as soon as we put Doppler data onto the workstation in Denver and they get into a significant weather situation, they will use the velocity data just...you know it will be the top product. They will love that data. We did that. We trained them on using it. We put it down there and we found out that in the first few severe weather situations, they didn't use the velocity data hardly at all and we were baffled by that.

19:23 How could they not be using this data that we know is so valuable to them? What we found out, after studying this for so long, is that all of the image products for example on our workstation were uhm...stored as separate individual products. So, when we wanted to load an eight-frame image loop of satellite data or radar data, it went to the database and pulled up these eight frames and you looped them. Now remember, we're talking about more than fifteen years ago here, so loading an eight-frame loop now and taking fifteen or twenty seconds, doesn't seem like much. Back then that was pretty good...we were – that was about as good as you could do. And this one particular example – I am giving you an example of the kind of things that we learned and how we learned them. What we found out, why the forecaster wasn't using the velocity data in a severe weather situation – they loved the Doppler reflectivity data. It was so much better than the old WSR57 data. And they would get into situations where they were looking at that. And for them to take that data off of the screen they were looking at, clear that screen and load that screen up with the velocity data would take them about fifteen, twenty, thirty seconds to do that. Clear the screen, go the menu, load it up, that fifteen to thirty...and then they weren't sure if what they were looking at – they weren't as comfortable with the velocity as they were with the reflectivity. For them to go back then and clear the screen and go back and get the reflectivity data, it would take another fifteen to twenty to thirty seconds. They – in a critical weather situation – that was too high a price to pay. They just didn't want to do it.

So, we said "Okay how we going to solve this problem because we know that will be valuable." So, we took the – it was really a pretty simple solution, but we hadn't thought of it before. We said, we're going to take the reflectivity data and the velocity data and we are going to combine that into a single eight bit image. So the first four bits are the reflectivity data and the last four bits are the velocity data and now the forecaster can load up this combined image set and instead of clearing the

screen to go from one to the other – all he does is hits a toggle button and he is toggling back and forth. So, it's instantaneous. We did that and the velocity data instantly became the number one product on the workstation. So, it's not just the data it's how you present the data that's as important and sometimes more important than the other. So, learning how to present data to the forecasters in ways that they can use it better was a very important aspect of this whole procedure, yeah.

Barry Reichenbaugh: I understand, yeah. So, we're at Norman and you got that system in place...ah what followed?

Dennis Walts: Uhm...for us...uhm...what followed was working with the contractor. Because that was about the time that the AWIPS contract was being awarded, so we were – at that point working with the contractor which was PRC and trying to help them. And again, we were doing less system development at that point and more maintenance and operational support and then supporting the Weather Service. So, we really weren't looking at okay – do we try another office? You know...put it in another office, but we were trying to understand at that point – we had a Denver forecast office operational and we had a Norman forecast office operational, but those offices are not going to have the same problems as Seattle or Miami or Portland, Maine or any place else. So, we were trying then to understand how do we integrate all of the capabilities required of the system so it supports all the offices and not just a select few? So, that was where we spent a lot of time and to be honest we didn't get a chance to spend a whole lot of time on that, because that is about the time that this lab was – how do I say this delicately – we were told that we had to build the operational AWIPS software to go into all the systems, not just this. So, now we transferred the support – what this office did at that point was then start working on the operational software for AWIPS. And that's where we just got totally involved in that for a couple of years. So, I don't know...how does this mesh with what Carl was telling you?

Barry Reichenbaugh: Real good. I thing you have given me some things that he didn't cover and he spoke more about the requirements. He mentioned though, the twenty two thousand "Shalls"...is that how...

Dennis Walts: Yeah, Carl was involved in the requirements, even from the beginning. Remember I said when we started out with the original DARE workstation we were working with a set of requirements that the Weather Service had put together. Carl was one of the people that was involved in those early – putting that together, as well as a couple of people from the lab here. I think Tom Slaughter was involved in that. Obviously, many of the Weather Service people were involved in it. But then after were assigned the responsibility to develop the operational AWIPS software then you know...exploratory development in this lab kinda came to a halt, because we just didn't have the resources to do that and support that.

Barry Reichenbaugh: So...then you took on the operational software build and as you were saying, you needed to – I guess make it work for all offices.

Dennis Walts: Yep.

Barry Reichenbaugh: Any memories of that phase?

25:50 Dennis Walts: Yeah, some memories of that. One of the difficult parts for us was integrating the hydrology, because we had done very much in that area out here. We had tried to get involved a little more in Denver and we had the Weather Service provide us with a hydrologist on my staff to help us with that, but the Office of Hydrology never...remember it operated a little differently than the Office of Meteorology and I think that bothered Louis Uccellini a lot when he was there. That the Office of Hydrology had their own development arm...the Office of Meteorology didn't, they kind of depended on TDL at the time. And so, we didn't really get involved with the hydrology side of the workstation as much as we did with the meteorological side, because the Office of Hydrology pretty – held that pretty close to the vest. And I think that was – I don't want to call it a mistake, but I think that was a problem for us, particularly with Denver and Norman. We really didn't have the hydrologic components into the system that eventually made it into AWIPS. And I really like the stuff that they've done. I mean, I look now on the web and see the advanced hydrologic system that they have there and you can go in – it's some great stuff. And I wish we had had that and been able to integrate it into the early – we could have probably learned a lot from that. So, that was probably one of the things that bothered me a bit when we were here. We really didn't have the connection to "OH" that we needed. You know...when you are building a workstation, it has to do everything for everybody. You can't build one for Denver and a different one for Norman and a different one for Miami, you know you got to build a system that supports everybody everywhere.

Barry Reichenbaugh: Yeah you've got to have those economies of scale.

Dennis Walts: Yes, absolutely.

Interviewer: Uhm...lessons learned, I guess. What did you bring away from that whole experience?

Dennis Walts: Uhm...my...I guess the main lesson I learned from all of this is that people like Doug Sargeant and Dick Hallgren knew what they were doing. You have to learn by doing. You can't just sit down and write a bunch of requirements and specs and vacuum it and think that you can build a system that will work doing that. You have to go through these – these painful integration steps to really do it. There was – I'll tell you a kind of a story that – there was a movie a few years ago, called *Body Heat*. I don't know if you saw the movie...with William Hurt and Mickey Rourke and Kathleen Turner were in it...but in this movie, William Hurt is kind of a sleazy lawyer from down Miami, I think... and one of his clients – Mickey Rourke – happened to be an arsonist [Laugh], so and of course, it's kind of a sleazy movie to begin with. William Hurt wants to learn from this arsonist, how to set a fire because he is going to kill his girlfriend's husband and burn him up in this old building. And Mickey Rourke teaches him how to do it and then he says, "Are you sure you want to do this?" He says, "This is pretty complicated stuff...you gotta get in and get out and not get famous in the process." He says, "There are fifty ways you can screw this up...if you think of twenty-five of them, you're a genius and you ain't no genius." And I thought about that a lot when we were going through this. There are a lot of ways to screw this up, more than fifty probably. I said, we've got some pretty smart people here, but we can't think of all of it. We've got to learn by doing. There are a lot of ways to screw it up and we can't afford to screw it up.

Barry Reichenbaugh: I know you did multiple...I guess the word was builds.

Dennis Walts: Yes.

Barry Reichenbaugh: Ah...it seems like all along you were looking at phasing pieces in phasing...

Dennis Walts: Yeah.

Barry Reichenbaugh: ...phasing complexity as you went.

Dennis Walts: Yes.

Barry Reichenbaugh: Again, and I am putting words in your mouth, but I think that the assumption there too was that technology was going to advance...software techniques advance...

Dennis Walts: Yes.

Barry Reichenbaugh: ...processing speeds advance...can you talk a little bit about that approach?

Dennis Walts: Probably not as much because once we got AWIPS deployed and we got into the operational phase and supporting the operations...uhm...I thought that having this lab do that was a serious mistake. Ah...we were taking the expertise in developing advanced capabilities and we were putting them into a maintenance mode and I said, "You know...that's like eating your seed corn. You know...you won't be hungry for a few days, but next month or next year...you're not going to have what you need to continue the evolution of the system." And when we got into that phase, after about a year of that, I said..."I can't deal with that anymore," so I retired. [Laugh] I'm getting out this. I don't want to do that, so I left. But I was involved in it for probably a year and maybe a little more of supporting the builds. And that was an interesting way of going about it.

31:28 The Office of Meteorology at that time had a group called...what did they call them uhm...some sort of – anyway that group was responsible for what went in to each build. And that was a very complicated process, because they got input from all the forecasters, you know...fed in through the regional headquarters, sorted and then fed in from the national headquarters and what TDL wanted and fed in from NMC what NMC needed – ah...and tried to integrate that. And then, we would get involved in these meetings and we'd say, "Man if you want to do this – this is going to take our key person here six months to do this one thing." So, it was a constant give and take on what resources we had with these things versus what was important to get in and what the forecasters wanted. It was always a struggle to balance this. And we said okay if we want this next build to be six months, here's what we think we can get in, in that next six months. It may not be the highest priority thing for the – that the field wants, but if we want to do that, that might take us ten months instead of six month. So, it was constant give that there and that was a really tough problem. Really tough problem to deal with.

Barry Reichenbaugh: What's the legacy of all of this?

Dennis Walts: Well, I think AWIPS works. I think it's a – I believe it's a fine system. I think AWIPS is the legacy. It brought the Weather Service into the modernization. It brought the datasets and the components of a modernized world into our field offices that we didn't have before. We had

to do it. We did it and so, I think the legacy is AWIPS and it's been around for more than ten years now and I think it's still supporting the offices pretty well.

Barry Reichenbaugh: Yeah. Anything else you would like to add?

33:36 Dennis Walts: Uhm...oh I am sure if I set around and thought about it there would be a lot of things. I think you really have to have people with foresight in order to go through something like this. Uhm...and it takes a variety of knowledge – people with different knowledge and so on to do it. If we just went to a forecast office and say okay forecaster, what do you want? We did that. We went to the Denver Office and said, "If you were going to build an AWIPS system, how would you build it? This was before we ever put a workstation in. My God, they had twenty screens in front of them. They had two screens for satellite data and three screens for radar data, so you can't just do that. You know? You've got to figure how to do this in the right way. Uhm...and it takes a variety of people with different knowledge sets and skill sets and so on and you have to have people with vision at the top. The Weather Service was very fortunate to have people with vision at the top. And I think they were very fortunate to have someone like Sandy McDonald out here, you know...that probably wasn't the thing that Sandy wanted to do most was support the Weather Service – Sandy's into research. He wanted to do modeling and Science on a Sphere and all that kind of stuff. But Sandy knew how important this was and he let me – a spy from the Weather Service – come in here and work with this organization and do an awful lot of stuff here in his organization that uhm...that most organizations don't…wouldn't allow. Wouldn't want. I had a big staff of people working for me and I was a Weather Service person, as a senior staff person in Sandy's ERL organization...FSL at the time.

So, you have to be able to do a lot of that kind of give and take, I think to make these really big things happen. Uhm...so I don't know. I think – I'm sure I'm way biased on this, but I think we did it right, because we had the right leadership, the right vision from Dick Hallgren and Doug Sargeant and Sandy McDonald to make it all work. So, uhm...I don't know you manage to do that...say okay, let's put the right people in these key positions. But if you don't have that and you don't have the right vision and understand how this all works, it's a tougher problem – it's a tough enough problem to begin with, if you can imagine, doing this. So, it wasn't cheap, you know? We didn't do this on a nickel and a dime – putting all the staff of people together here to develop the software and getting the hardware and getting it in place and maintaining it and putting an evaluation team in place and all the stuff... That didn't come cheap. So, I think that's another thing. I don't want to say, you know...that ah...ah...what it would cost to do something like that these days, but ah...it's...i'ts...it's an expensive process at the time, but what it saves you in the long run has to be enormous, I think in the long run. I think what we did paid for itself hundreds of times over. We constantly had people from uhm...Congressional delegations and review groups...who's the ah...I am trying to think. The acronyms I have lost over the years that sort of the investigating arm of Congress – who are they?

Barry Reichenbaugh: GA...

37:45 Dennis Walts: GAO, yeah...we had to deal with GAO and I mean it was once a month somebody was coming out here and we had to show them what we were doing and you know...justify what we were doing. And of course, every one of them wanted this to be done fast, cheap, and high quality. [Laughter] I said, you know you can't do that. Pick any two, but you can't

do it fast and cheap and high quality. So, that was probably the least pleasant part of my job – was dealing with all of the...and GAO – this goes back to the AFOS days. GAO wanted to shut AFOS down before we got it implemented. What we learned from all of that – I was in the regional office in Kansas City at the time and we essentially had to make the region work before the rest of it got to working. And I put together an AFOS task team that was able to do that. And then we sort of expanded that beyond Sandy, who was out in Salt Lake City – Sandy McDonald was out in Salt Lake City at the time and he was doing similar stuff out there. So, we were kind of getting our regions going separately and you can't do that with a national system.

38:59 You've got to have all the management and technical and operational support from the field offices, but a national system has to be run nationally. And I think we learned a lot from that. In fact, GAO wanted to shut it down and said "this is not going to work." We had ours up and running in the central region. I got a call – I think it was like a Sunday night – from Doug Sargeant – it was either Doug or Dick Hallgren saying, "I want you here in Washington tomorrow, because we got hearings down on the Hill and we want you to tell them what you've done in Kansas City." They said, "They will believe you because you come from the field. They don't believe us anymore, because we're from headquarters." So, you know you come in from the field and you're a hick and you know...shuffle your big toe in the dust and they believe you. So, and that that worked out really well - GAO said we're going to shut it down and within 24-hours, we had Congress turned around on that one, saying you can't shut it down. This is – it may not be – AFOS may not be the final step, but we can't take future steps without going through this step. We've got to take steps to get there; you can't just jump up to the highest level on the first try. It won't work.

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