Jinny Nathans: This is Jinny Nathans on June 6, 2018. I'm in Denver at the WAF/NWP meeting and I am speaking with Steve Koch. My first question is when did you first become a member of AMS? And the follow-up is how over your career phases has your relationship or use of the resources of AMS evolved or changed?

Steve Koch: I approximately would guess that I joined AMS in 1974, but that could be off by a couple of years. I've had a lot of interactions with AMS over the many years since then, in terms of my service to the AMS, in terms of benefits from the AMS. Probably the greatest benefits have always been from attending conferences and enjoying the conversations with scientists there. Also from the literature, the various publications of the AMS. My service has been as associate editor, or serving on a board or a group such as a forecast improvement group a couple of years ago. So I've had varied services, but generally speaking what AMS provides is a community, a collective of individuals with different backgrounds and experiences, but which broaden your understanding and experience as well, so there is a lot of benefit in that. The other thing I think the AMS offers is recognition. The awards that are offered are prestigious, and as a lab director I make a concerted effort every year to nominate people for those awards, in fact I'm a fellow of the AMS as an example of that. So that's many benefits and also the community aspect and finally the service.

JN: Thank you. As a lab director, could you talk a little bit about what you do and how you work with the people you work with, and the opportunities to mentor other people?

SK: Certainly. I'm the director of the National Severe Storms Lab, I've been the director for seven years. I was a director of another lab in Boulder called Global Systems Division, part of Earth System Research Laboratory. Before that I was actually a tenured associate professor, and before that worked at NASA Goddard, so I've had various government and nongovernment experiences, and the opportunities to mentor and tutor and guide people have been multivariate because of that. So whether it be mentoring students, undergraduate and graduate students, or postdoctoral scientists or research scientists at a laboratory or cooperative institute of NOAA, I work for NOAA, I've had various opportunities to mentor. Sometimes they overlap, currently I'm mentoring graduate and undergraduate students at University of Oklahoma. It's not a requirement in my position as a lab director, to do that's voluntary, but I enjoy that opportunity to mentor, and I put a lot of emphasis on mentoring, particularly on succession planning, so that people who come in are well trained and have been advised by those who've been in those positions for years. The mentoring comes in various forms, there's a very formal kind, advising a graduate student, to something less formal where you may have an undergraduate student who has a senior research project and you advise them and tutor them on how to begin to do research, to having a newly graduated PhD scientist with a postdoc appointment and encouraging their independence and creative thinking. So I have had many opportunities to engage in all those aspects as well as mentoring government employees who are maybe in management positions. I'm a lab director so underneath me are other management division branch chiefs and team leads. We meet regularly and there's a lot of learning that occurs about management and supporting their people, providing leadership. Servant leadership, so you encourage people in their career development and in broadening their perspective. I think mentoring is a very very important thing.

JN: It seems from the interviews that I've done that it's been very important, both at certain times for people to be mentored and then they will turn around and give that back to the people that they mentor when they're in the more advanced position, so that seems to be a feature of AMS members.

SK: If I could add a little bit about that, and this may touch on another question that you were going to ask me about my first research experience…

JN: That was the next question.

SK: So if I can tie two threads together in my response, I would like to say this, I got my Bachelor's and Master's degrees at the University of Wisconsin and as an undergraduate with a Bachelor's degree I had very little self-confidence and really wasn't sure what I was going to do with this degree at the time, but there was a faculty member there, Dr. Charles Anderson, who took me on and had confidence in me even though I didn't have it in myself, and presented me opportunities to grow independently. Now it's interesting because he was also developing the Department of Afro-American studies at UW, and in fact he was I believe the first African-American PhD in meteorology from MIT, and he taught me a couple things. Number one, you can have dual responsibility like that where, those were very turbulent times back in the early '70s, socially, politically speaking, and he was at the forefront of that. So he was fully engaged, and at the same time he was able to provide me mentoring and tutoring, not so much in the details of what I was doing, but in terms of general guidance about how to approach field studies, how to approach the analysis of my data, how to present myself for the first time at a scientific conference. So I really admired that, and that reflected back in how I treat other people, because some people have little self-confidence and without hanging them out too far where they can perish, I like to give people a lot of freedom to experience and try things out with a bit of guidance and nodding from me as to how to approach a problem, a task, a question. That was very important to me. Another in the area of mentoring, later on I took--my first job was at NASA Goddard Space Flight Centers, 1980 and my immediate supervisor was Louis Uccellini who I met back at Wisconsin, there's another story there, but...

JN: I was going to ask about that, because I know that Louis was in Wisconsin.

SK: I'll come back to that, but I wanted to touch on Joanne. So Louis Uccellini and Bob Adler were section leaders of the Severe Storms Branch. She was the branch manager, the director of the laboratory was David Atlas. It was a powerhouse group, and there were many other powerhouses in that group besides them. One thing about Joanne Simpson was that she did not insist upon meeting with me regularly. She had, just like Dr. Anderson, she had confidence in me. She said the only thing I expect you to do is stellar science. I'm not going to watch your time, I'm not going to watch to see that your use of the English language is perfect. I'm not going to see that you cross all the little checkmarks on your box of things to do, but I want you to know that you better make a really good impression. That was a little bit… It was pretty awesome, but the fact of the matter again is that she had confidence in me, and then I felt the freedom to fulfill that obligation, to satisfy her confidence in me if you would, so that I could prove to her that I could meet up to her expectations.

So that aspect again of expecting the most from people but providing them the resources enabling them to accomplish that, which is what she did do. She kept me from the forces that imperiled my creative scientific research, for example, which was always at risk. She was a buffer, she protected me from that. It became more of an academic, it was NASA but it was more of an academic research environment, and that lasted for quite a few years under her and Dave Atlas. Eventually that did change but I learned from that if you give people the freedom to explore and give them the resources to protect them from administrative baloney and connecting dots and checking things off of boxes, that people can really do excellent things and so I was rewarded for that when I was at NASA. So I learned that from her, and by the way she was the first woman to get her PhD in meteorology, so the fact that I worked for two people who were firsts, who were very important.

JN: She was actually the first American woman. There was a Norwegian woman who was the first.

SK: Yes, I stand corrected.

JN: I should not have corrected you, but--

SK: No, you should have, actually. But that I knew that particularly in the AMS structure she was recognized as the first in the United States right.

JN: Absolutely.

SK: And the reason that's important is, it goes back to the mentoring, is that you know underrepresented minorities in atmospheric sciences, we talk a lot about these things, we talk this talk but do we really walk the walk, do we really do much about that? And so over the years I have put great emphasis on mentoring underrepresented minorities and encouraging their growth and giving them opportunities to excel, moving to higher levels of management or scientific leadership. I think that that interest I have in doing that came back from those roots with Anderson and Simpson and others. I guess while I'm on the topic, you wanted me to ask about Louis Uccellini. Do you want to come back to that now?

JN: Yes, I was going to ask you to talk about him, because you said you would later.

SK: So the topic here is one of networking. To be successful in the field of meteorology, my perspective, and I always teach this to my students, is build up networks, build relationships. Even though the job you're doing for someone may seem like it's menial, trivial, what's the point of it, it can actually in the long run come back and benefit you. The story here with me personally goes back to Dr. Charlie Anderson again. I'm going back to the time when I was a junior in college, and I was impoverished, I needed a part-time job, and he talked to me about working in his lab. He said I'll pay you, I think it was eight dollars an hour, and all you have to do is support Louis Uccellini on his master's thesis by doing what he tells you to do, and I'll pay you. And so I said great, I need the money, I need the experience, double win. And so my perspective on the experience, although Louis's may be a little bit different, was that I did a lot of work with processing barograph data, digitizing it, putting the data into computer systems,

helping him with the analysis of gravity waves, which led to his master's thesis, which was a seminal paper on gravity waves. And I finished that work, he went on for his PhD, I left Wisconsin to go to University of Oklahoma for a doctorate in '74, and he stayed on for his doctorate there under Don Johnson and worked on isentropic analyses and jet streak dynamics.

But I remember getting a call from him when I had finished my PhD at OU, the year was 1979 now, and I was on a postdoctoral appointment at Cooperative Institute for Mesoscale Meteorological Studies, CIMMS, which just was founded that year, I was actually the second employee of CIMMS, and I was sitting there wondering what am I doing here, like a lot of postdocs wonder, there's a lot of questioning about where they're going in their career, where this is going to lead to, and I got a call from Louis. He said you've got to come out to Goddard and interview for a job out here. So this is a networking example is him saying, even though the job I was doing would seem pretty trivial and menial at the time, it came back to, he greatly appreciated what I did for him. He offered me the opportunity, he helped me find that job at Goddard with Atlas and Simpson, and that started my career. And there other examples, since that time with him personally where he's helped me in my career. So I think it's always important to bear in mind that your opportunities in life may depend upon who you know, how you've networked people. Otherwise you're an unknown and you may be at a disadvantage when obtaining a new job. So that's a little bit of that story.

JN: That was a very interesting story. In some ways it's the kind of story I have heard a lot on this trip. But again, it's fascinating the way people connect and sort of interlock.

SK: One more thing I'd like to say about that is when I took on the job at Goddard, which was offered to me, I took it on, I worked under Louis. So he actually assigned me my first task, he showed me what it means to have a real job, by the way. So he gave me a task as a team member, for the first time in my entire life I was a team member. So unlike most PhD students, who are never really team members, they're working for themselves and for their major advisor, I'm part of a team now. But after I fulfilled my first obligation to him as a NASA team member, I began to explore data that had to do with convection initiation, and before I knew it I was studying gravity lines. And he gave me total freedom, not just the freedom to do that, but strongly encouraged me. I guess it makes sense as he had done this for his masters, but it combined with his budding interest in jet streak dynamics and unbalanced dynamics that began to tie gravity waves in with jetstream behavior. And so, with Louis bringing on really key scientists to the lab at Goddard Laboratory for Atmospheric Sciences, I was able to intermingle with people like Mel Shapiro and Mike Kaplan and Dan Keyser, people who were really supreme dynamicists, who I could learn a whole lot from. I put my gravity wave ideas into the context of something much more significant than that, and I began to develop the reputation and that air of expertise on gravity waves related to jet streak dynamics. So it went well beyond where I could have ever imagined it would have gone at the time.

Going back to the team thing, I know one of the questions had to do with your first job and how you responded to that. Again, in my personal situation I went for a PhD. So from that perspective, as opposed to another degree, from the PhD perspective, the first thing you generally think about is do I want to take on a postdoctoral position, or do I want to apply for a faculty position, or is there even a possibility of a permanent position in research at some

laboratory. There's the three primary things that you have as opportunities, and I did seek out some faculty positions, but at that particular time I knew that to become a tenure-track faculty person meant a lot of stress. What recent graduates with doctoral degrees realize very quickly is you have to develop a research program with funding, you have to develop courses, you have to teach courses, you have to serve on department committees, you have to advise and mentor, you have to go to conferences and I could go on and on and on with that. And it's a lot of work.

What the postdoctoral appointments typically do is give you breathing room between getting the degree and becoming a kind of professional scientist. This is what I had at CIMMS, but it's only a one year appointment. Typical postdocs are one or two year appointments. The third opportunity was what NASA Goddard offered, was this opportunity to do research, begin to develop some proposals, get some funding. But you're salaried. So it was the ideal situation to be able to do research, you're not involving yourself with students really, but at least you're doing research and not having the burden of doing all the academic things at the same time. I eventually came back to that, but my own personal experience with taking on a first job was being in a laboratory environment, where you are given a lot of freedom and a lot of support--I mean we brought on contractors who could support me in some of the technical aspects of my research--gave me more time to do more things and not worry about some of the other things that come with an academic position. That is really a blessing, there's not a lot of those opportunities in the United States, where you have that kind of quasi-academic environment, but without all the stresses of being a tenure-track position.

JN: That was really great because it was a very clear description of the three possible paths, and what was involved with each. So that's very helpful, and also really interesting to hear about your work with Louis, because I interviewed him and he talked about that time when he was going over to work with Don Johnson and also the gravity wave, so it's a piece of the puzzle that fits right in.

SK: You have two different perspectives on that from the two of us, I think. Hopefully they're not in contradiction with one another.

JN: Not at all. [laughter] I guess that the question I would be also very interested in hearing your answer to is, was there any particular journal article that moved you one direction or another, or toward the author, or anything like that?

SK: I sketched out some things over lunch hour.

JN: I guess I asked the right question.

SK: No, you didn't, because I really wasn't prepared and this is probably--I have to say upfront, I have five, not one.

JN: Okay.

SK: But there are so many others, and I restricted myself only to AMS journals, I didn't go to any other journals.

JN: That is absolutely fine, and this is all very informal, so.

SK: These are aged, I mean, you can tell when I give you the references that they go back a ways, and the reason that I picked these older ones was because of their coming from the 1970s and '80s, because I was at an influential part of my life where I was finishing up graduate school, postdoctoral, thinking about my future. I was looking for, actually to be honest with you I was looking for violently different perspectives on atmospheric science, things that could form the basis of the paradigm shift. I am in that small group that really believes that there certain things that could happen in atmospheric science that really put us on a whole new plane, what they call a different page or a trendsetter, or paradigm shift. And so these papers in my view are ones that pointed the direction to a new way of looking at the atmosphere and new research possibilities. They are in no particular order. This is probably a very favorite one you hear a lot about is Klemp and Weisman 1982, Journal of Atmospheric Science, that's the RKW theory for what produces strong updrafts and meso-convective systems that can produce damaging high-impact weather, and the theory itself is relatively simplified but it's been used, probably hundreds of times in papers in the atmospheric sciences ever since then as explanation for behavior of convective systems.

Another paper that came out in 1968 was written by Edwin Danielson, and both of these were in the Journal of Atmospheric Science, and this one had to do with really a revolutionary look at isentropic flow relative to exchange processes at the tropopause. Why was that so interesting to me was, he was explaining how chemical and other constituents like potential vorticity could be transported between the stratosphere and the troposphere. Ozone, PV and other constituents, called stratospheric-tropospheric exchange processes or STEP. And this idea that there's no solid boundary between the two spheres and that how that occurred was through a systematic process associated with transfer circulations around upper level jets. So to me that was setting a viewpoint, a perspective, on how jets relate to transport processes and turbulence.

Along the same lines in 1986, 18 years later, a paper was written by Dan Keyser and Mel Shapiro in Monthly Weather Review, and this was an article which was dealing really with somewhat idealized conceptual models of upper level frontogenesis. That's Keyser and Shapiro, 1986. I've used that so often in my teaching and my own papers that I've published as conceptual models for understanding jet streak transfer circulations, thermally direct or indirect, and depending upon the nature of the upper-level dynamics it really has helped to conceptualize the synoptic scale dynamics to students in my viewpoint much better than quasi-geostrophic theory, just puts it into a context, a conceptual understanding.

The fourth paper is related to the two I just mentioned, the one by Danielson and the one by Keyser and Shapiro. That's one by Mel Shapiro, 1980 in JAS, and it was turbulence in tropopause folds, so Shapiro's paper connected the exchange, the STEP process, with tropopause folding, and how that tropopause folding was related to these upper level frontal dynamics. Those papers actually set in my mind a perspective, a possibility of a paradigm shift, and it happened when I started working with Mike Kaplan and to a certain degree with Mel Shapiro and Dan Keyser, which was the idea that certain transfer circulations can give rise to unbalanced dynamics, that the only way to restore balance in the atmosphere is to shed [inaudible] gravity waves. So that developed in my mind, I became a leader in that mode of thinking of inertial

gravity waves are not just something you read about theoretically, but are very very important in producing organized convection, tornado outbreaks, as well as downstream development at the larger scale, features at the synoptic scale.

The final paper I'll mention quickly would be the one by Klemp and Lilly, now there's a lot of papers I could have chosen with Klemp and Lilly, but the one I chose was in 1975, JAS, and that was a paper on downslope windstorms. To me it began to open up a better understanding of hydraulic flow and how certain governing parameters of fluid dynamics can be used to explain flow behavior in extreme weather events like Boulder windstorms. So those papers were very seminal papers for me, this is just a few.

JN: Thank you, thank you for giving more than one. I can see how they interrelate, and how you would have your argument follow through them, so I appreciate it and I'm going to ask you for your citations, thank you. Is there anything else you'd like to add, we're a little beyond time and I don't want to keep you.

SK: Let me see… In the interest of time I'll say probably not.