

Geointeresting Podcast Transcript Episode 31:

A conversation with NGA Research Director Cindy Daniell and research scientist Jennifer Durdall

GEOINTERESTING: Welcome to Geointeresting. Today on the podcast you will hear from two women in NGA's Research directorate — one running the research and development portfolio for NGA and a scientist discovering the latest in hyperspectral signatures. NGA's Director of Research Cindy Daniell and research scientist Jennifer Durdall might be at different stages of their career but are strong advocates for women in the STEM field. Dr. Daniell has more than 30 years of experience in both industry, academia and the Department of Defense community — holding previous positions at DARPA and SRI — an independent, nonprofit research center. As NGA's Director of Research, Dr. Daniell is focused on the technology development of image processing, computer vision, artificial intelligence and the integration of these technologies. Jenn is a graduate of Virginia Tech and has been with NGA for about 10 years, during which [time] she's coordinated research and facilitated joint experiments with partner organization[s] in Australia, Canada, and Great Britain and worked to promote the adoption of new geospatial-intelligence technologies as part of a multidisciplinary team tasked with improving tradecraft. Currently, Jenn works in the agency's spectral pod, one of NGA's main research focus areas. Listen up for advice on joining the government and their journeys in the intelligence community's research ecosystem.

JENNIFER DURDALL: So, Cindy, how did you get interested in math and science?

CINDY DANIELL: Well, actually, I can't remember [a] time that I wasn't interested in math and science. I don't know that it had specific time or specific reason, but I just remember always being fascinated by numbers and by the logic involved in numbers and by the patterns that were involved in numbers. And they were just so interesting to me. And, like I said, I can't remember [a] specific motivation. It was just kind of organic.

JD: Did you do a lot of experiments when you were a child or play around with things trying to understand?

CD: Some, but it was more math and science oriented. But yes. Absolutely. We loved all those experimental kits. I loved being the private investigator playing like I was [a] detective and trying to zero down on exactly what caused something to happen. Remember all of that?

JD: Yes.

CD: Yes. How about you? How did your interests begin?

JD: Kind of like you, I can't think of a specific time — there are moments in my past where, looking back, I can maybe see a glimmer of my interest blossoming. I remember I had to do a book report on a scientist when I was in like fourth grade and I thought it was the stupidest thing. None of the scientists that I wanted to pick were available because I was last in line to pick my scientist, so I was assigned Robert Oppenheimer, and I just was fascinated by him as a man, him as a scientist and the science that he did working on the nuclear weapons program back in the day. So that was really interesting to me. I guess in high school we had an engineering teacher who was really motivational. He always wanted us to experiment and solve problems and try things for ourselves. And that was neat, but I always wanted to figure out the 'why?' I never really liked the numbers part of it. Math is not my strong suit. But the reasoning behind things is really interesting to me. Since you always were interested in numbers and math, what did you want to do as a kid? What was your dream growing up?

CD: So that [is] also very ambiguous because I had so many ideas, and there were so many things that I wanted to be, and they weren't all math and science so that would be very hard to say. But I wanted to be everything from —

believe it or not — an astronaut to a fashion designer. Honest to goodness, it's true! There were so many jobs that I thought were fascinating. What science holds is the sense of the unknown all the time, where you are constantly looking for something that you don't understand, and you don't know how to do it, and you're trying to figure it out. And so I think that might have been part of the reason that every career looked interesting to me. There's some aspect of it that I was interested in. So that's me! How about you?

JD: I was never one of those people that knew exactly what I wanted to do when I grew up. I still don't know what I want to do when I grow up. You know, I wanted to be an Egyptologist at one point.

CD: Cool!

JD: I wanted to be a nuclear engineer.

CD: Okay.

JD: Robert Oppenheimer?

CD: Yes.

JD: I don't know — it's been a long process trying to figure it out, and it's hard to pick just one thing.

CD: Exactly! I think that's what happened when I was young, too. It was hard to zero in on one because [they're all] so fun and interesting.

JD: Yes, exactly.

CD: I just knew that I didn't want to do the same thing day after day. That's what I knew.

JD: Yes.

CD: So yes, some really smart people like being a dentist. You're filling [cavities] every day, and they're still really smart, but I want to do a different thing every day.

JD: Right, yes.

CD: So, that's probably what attracted me.

JD: Although I've always wanted to do something that I've been good at.

CD: Yes, true.

JD: I like being challenged, but I don't like feeling like I'm always scratching to be better and not adequate.

CD: Granted. I absolutely concur with that.

GEOINTERESTING: So while you were in school, and you were getting to the end of your degree and getting in to your senior year, you had so many options open to you, so many things available — especially being a scientist; the different ways you can vector and trajectory — and so what made you want to join government over industry?

JD: I guess it's kind of in my blood. My dad worked for the government. He was with the USGS and with the Weather Service before that. My mom used to be a legislative assistant in Congress. So it just always seemed natural, and D.C.'s kind of a government town. So that's what a lot of the job options are here

CD: Yes.

JD: It had a lot of attractive aspects on a personal level in terms of work-life balance and the flexibility and the permanence. I had a lot of internships when I was going through school, both in high school and in college. I interned at Night Vision Labs, as well as the Naval Research Lab. So it seemed like a natural progression.

CD: Yes.

JD: So what about you? I mean, you were in industry, and now you're in government. How did that happen? And what would you tell people that are considering coming to the government?

CD: So I like [government work] very much. I jump back and forth. I was industry, then DARPA government, and then industry again, and then NGA government. So, I like going back and forth, and now it's happened twice in both directions because I bring a little bit of both sides to the equation when I'm on the other side. And it's very interesting to see the differences between them and to pull the experiences you have from one to the other. And so I like it.

JD: How do they differ? What are the major differences between them?

CD: Oh my stars. I would say the major difference that I notice on a day-to-day basis is that industry is motivated — and almost everything you do there — by a capitalist-driven feeling. And I worked for two; well, SRI was a non-profit. HRL was as close as you can be to a non-profit. It was a research lab. It was supposed to be for profit but not really, and so — But even in those cases, you're driven by the bottom line. You're driven by the dollar, and that really, really has an effect of almost a Darwinian evolution in everything you do, a Darwinian evolution. And the career fields, they — the positions that exist ... if the positions aren't becoming — they're not of interest to the actual output you're producing at that time ... You know, from [the] 1980s through '90s, 2000s, until now, science [has] changed greatly, and the things that were important then are not as important now. Material science didn't exist in the '80s. So, my point is those positions are the ones that are not being utilized as much will die away, and the ones that are becoming new will start to evolve. So just positions and people — everything evolves, and staff can maneuver much more quickly and adroitly in industry than they can here in government, I find. And, primarily, I think it's the capitalism drives everything to evolve — and again — in almost a Darwinian sense.

JD: That makes sense.

CD: I don't see that in government at all.

JD: Really?

CD: That's not true — I see small parts of it in government but not nearly to the degree in industry.

JD: Okay. That makes sense. I was going to say that it seems like what you're describing in terms of careers that are — what am I trying to say here —

CD: In demand ...

JD: Right. Die away in government as well. We're constantly changing organizational structure and revectoring and going through the Heilmeier questions for projects and things like that.

CD: You do but just slower; on a slower pace. And it's not just careers, but it's processes. I guess that's more of what I don't see in government — the processes are [INAUDIBLE], and they're the historical processes. They're always there, and they're much slower to die out here than they are in industry, where you've got to make payroll.

JD: Right

CD: And people are going to get laid off if you don't. And so you move and pivot and agile much [more] quickly in industry. And I like that aspect. It would be nice to see a little bit more of that in government — I guess I can say that.

[LAUGHTER]

JD: Yes, I'd say so.

CD: But I love both of them. I wouldn't be here if I didn't.

JD: I've never really worked in industry, so hearing that perspective is useful. So in terms of advancement in the field — and as director, your field is quite large; encompasses a lot — what excites you most?

CD: Hmm. What's coming up on the horizon? So I would say, honestly, what excites me the most is the integration of disparate fields coming together — you know? Seeing different parts of the world starting to work together. I'm trying to think of a good example here off the cuff, but — Wavelets were an example of mathematicians and engineers who used to never talk to each other coming together and finding out that they could apply this mathematical technique into an engineering world. And it spawned the whole new concept of wavelets. And there are many other, even more disparate fields, that are starting to talk to each other — you know, robotics and biology -- And now people — there's a robotics and biology — they're coming together [to] form a company because they're building prosthetics. And prosthetics are really biological robots in a sense, and you've got to interface with the nervous system. So you've got hardware and software and biology all coming together to build — and new material sciences — to build a product, and that from ... You know, especially in the 1950s, everything was more stratified, and so now, science, as time goes on, becomes more and more amalgamated together. And the sciences are really crossing paths and the disparate fields, and that excites me.

JD: The new possibilities that come together at the fusion points.

CD: Absolutely, yes. You don't you think about things that you see from your perspective, and they see it differently from a different fields. So yes.

JD: That's where growth happens.

CD: Exactly.

JD: At those points.

CD: Yes, good insight. Perfect. How about yourself — in your work, do you have anything that jumped out on your horizon lately?

JD: So I think a lot of what you mentioned applies more narrowly in the field that I work in as well. The spectral field — the overlap between sensor types, sensor systems, data systems, and just the explosion of data that we're getting as commercial becomes more and more at the fore. You know? Having data in such large quantities is something that we've never really enjoyed before, and we don't know how to handle it. We're trying to learn how to handle it. And it just opens up so many possibilities and so many new frontiers of things that we can explore and understand and see in whole new ways.

GEOINTERESTING: We'll return to our podcast in just a moment. But first, a word from this episode's sponsor — the NGA Student Intern Program.

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JD: So what a piece of advice would you give to a woman trying to rise in the ranks and get promoted either in government or an industry — kind of across the board? What's been the best for you?

CD: So, my number one — it was never necessarily given to me — but my number one: be confident. Confidence. That's, I think, critical to just, really, treat yourself well. And think highly of yourself and realize that you have something valuable to offer, and just put yourself out there with an air of confidence, and try not to let anything else bring you down. Be very confident. But one strong piece of advice that was given very early in my career in my first performance evaluation was — most people in their performance evaluations write what they're going to improve on. Like, "Well, I really need to take C++" and "I need to do this," and "I need to become DAWIA certified." I'm going to improve on this, and these are things I'm going to do to get better. So my advisor — my professor — told me, "Stop. Turn that over." And he said, "Just play to your strengths." He said, "Whatever your weaknesses are, just don't even mention them. Just put those aside. Think of what your strengths are, and then play to your strengths." If you're a good storyteller, you're a good briefer, just try to focus your career on your strengths. People realize that and focus on that and don't even mention what you need to improve. I'm really not a good coder, and I've got to take more C.

JD: Yes, that's interesting that you got that advice as well. When I was first here at NGA, one of my supervisors told me something very different. I had written in my performance evaluation all the things that I thought that I did well and all the things that I thought that I did poorly because I was trying to give a balanced objective view.

CD: Of course.

JD: She told me, "Don't do that. That's not what this is about. You want to put your best foot forward and take credit for the things that you've done." I also tended to give credit to my team, which I think it's important to give credit where credit is due and to acknowledge the contributions that everybody has made. But when you're writing a resume or your performance assessment, take credit for the part that you played.

CD: Right.

JD: Is what she told me.

CD: Right. Don't forget how important you were.

JD: Right, yes.

CD: So, in that same vein, on a similar line of reasoning, what is the piece of advice you would give a woman who was just entering her career now very early. For me, I can't remember those days. What was it like?

[LAUGHTER]

CD: I'm kidding.

JD: I guess there are two main pieces of advice. One would be to always take opportunities that are offered even if they look unattractive.

CD: Oh yes. That's good.

JD: So when I was first starting here, it took a long time for my clearance to go through, as it takes forever everybody's to go through, and my billet was no longer available by the time my clearance arrived. And so I got a call saying, "You can come onboard but not as a scientist. You can do taskers in [the] front office." And that sounded so unappealing, because I was all excited about getting in and doing the science.

CD: Exactly

JD: But I agreed, and I spent a year in the front office doing taskers, and it really gave me a perspective on the agency and the mission and our directorate. And I think it was a really valuable experience, as much as I wasn't looking forward to it.

CD: Good for you.

JD: And I've seen that happen in other things, as well. I've been in positions where I didn't feel like I was excelling, and this gets to the second piece of advice — find mentors, not just at high levels of leadership, where you can chart your career and understand where you want to end up, but, also, find mentors that are closer to where you are in your current career path, because they will interact with you on a more personal level. They'll see you more often, and they can tell you what your strengths are even when you don't know them yourself and help you position yourself better to play to those.

CD: What do you think in the future lies for your field?

JD: You know, it's really hard to say because we're at such a crossroads with that influx of data that I was talking about with commercial coming onboard — kind of like when people really started using the internet and all the changes that we were able to see when GPS was integrated with online services and the totally new fields that came out of that. I think having the science that we've been doing, along with the increased number of sensors and the increased level of data, will really open up questions that we never even thought to ask.

CD: Very interesting — the unknown unknowns.

JD: Yes.

CD: Yes. So mine's very similar. Right now, we think things are embedded — like you said, GPS with mapping services. But I think that's just the tip of the iceberg. I think everything's going to become far more embedded and

implicit in our everyday life. Soon there will even be bionic chips that are implanted with you with updates — that you are living it within this embedded computing with you and everything you're doing. More so than we are now, much more so, will all become very integrated. But, on the other hand, I think, along with that, we're going to get to the point where these new AI systems and machine learning systems — right now, when they fail, they fail spectacularly, right?

JD: Yes.

CD: And their failure modes are unpredictable, and that's what I do think will start happening. People are going to be able to get a handle on explaining AI and give some reasoning to it and figure out they'll be able to give the space where things are going to be failing and why; and why things are happening the way they are.

JD: So you see us continuing to move in that direction and not looking at the spectacular failures and pulling back?

CD: I do. Yes. I do, because humankind in general pushes forward. You know, from the very beginning, we always push forward to frontiers. I mean, there's always two steps forward, one step backward; two steps forward, one back. But the arc is going to be continuously forward and going that direction. I think that, also, it will become more integrated, so the humans will be more interactive with the AI systems. So we won't be separated as much as “This is the robot doing this, and this is you doing that.” That's what will become more fluid, very fluid. And you won't even realize when it's you and the robot happening, which is scary.

JD: Yes, a little bit. As long as we don't get to the singularity or Skynet or ‘The Matrix,’ we'll be fine.

CD: Yes. Yes.

JD: So is that vision what motivates you? Or is there something else that drives you to do what you do?

CD: Oh, you ask the hard questions. So yes, I think what energizes me is the fact, and in general, there's a new challenge ahead every day, and so that would be the local motivation. The global motivation is really the national security. I grew up similarly to you. My dad was in Reserves. He wasn't active duty Air Force, but he worked civil service and was in Reserves. And so, I grew up near a military base, Elgin Air Force Base, and [INAUDIBLE] was all around us. And many of my friends had dads that went overseas and didn't come back and things like that. And so the national service has been ingrained in me since being a child. So that's the overarching motivation, to be honest. But on the local sense, in day-to-day activities, there's always a new challenge for us every day, and I think that drives you forward to come in and try to understand how policy is now interacting with the algorithm that you want to design and why they won't let you do it. And so this is something they never taught you in school, but it's really part of your job. And so it motivates you to figure that you're doing something new and different, I think.

JD: Yes.

CD: It's fun, also. Here's the motivation, I know, is to ask the questions. That's what motivates me. Because in school, you're always taught to give the answers, alright? And so I had one professor in graduate school, and she had homework that she gave — four questions, and then the fifth problem, you had to design your own problem. Every week, you had to design your own problem. I was like, “Great! Piece of cake — I'm going to get 20 percent of my homework every week. I'll get at least a 20 percent! I'll just write a problem.” And I found out through that class that was the hardest part of everything you did — was designing your own homework problem. And she said that's exactly what she wanted to teach us. And I think that's what motivates — is learning how to ask the right question and how to ask the good, deep question that really is pertinent and gets to the issue that you want to understand.

And she said, "I wanted you to learn because in school, except for my class, you're always taught to give your answer." She said that when you get out of school, they're never going to give you the problem and say, "Give us the answer." You're going to go to work and you're going to have to discover the problem. What is the problem? What is it that you need to figure out? And so that motivates me — asking the question; asking the right question. And I always ask my son when he comes home from school every day; I never ask him — and this is a quote that somebody else made; I just copied it — I never say, "What did you learned today at school?" I always say, "What did you ask today at school? What kind of questions did you ask your teacher today at school?" Because that's where they need to learn how to ask questions. So how about yourself? How do you keep yourself going?

JD: I think it's the idea — loyalty is not quite the right word for it — duty, I guess?

CD: Yes — national service, kind of?

JD: That and the idea that I've been assigned to task, or I've taken a task on myself, and I have a team, and people are counting on me to do my part.

CD: Yes.

JD: And I've always been a bit of a perfectionist. And I want to do my part well. I want to get it done right, and so that's what I'm going to do.

CD: That's important; definitely important.

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