INTERVIEW

WITH AMY ROSS

Purdue University alumnus Amy Ross currently works as a space suit designer at NASA's Johnson Space Center.

AMY ROSS

Before you went into engineering, did you have any other ideas of what you wanted to be?

Becoming an engineer was one of my three main choices. I also considered becoming a veterinarian, because I love animals, and a librarian, because I love books. I decided on engineering as a means to get into the space industry.

Going into your undergraduate study, did you have a clear idea of what you wanted to do in the future, or were you unsure of where you were going at that point?

I was sure of what direction I wanted to go in, but it's funny because I ended up in a very specific kind of a job. There are not many space suit engineers running around on the planet. At that point, I knew I wanted to work at NASA, but as far as what I wanted to actually do at NASA, I did not know. So, yes, I had a direction in mind, but not a specific one.

Did you do any research as an undergraduate student that helped you figure out which specific field you wanted to work in?

I did do some research. We were trying to understand how materials that started to bubble would travel, and we looked at various thermal systems. It wasn't necessarily in the same direction as the work I'm doing now, but it still had its benefits—I still learned quite a bit from it. Researching gave me the chance to interact with a professor and to do some independent work. So it had many benefits, even though I didn't really use the knowledge on that specific research field in my career.

What experience did you get from doing this research?

I learned the value of doing my background research. I also did a lot of reading and research to learn what work had come before me, and what the work I was doing would contribute to the existing field of knowledge. Because I work in research and development, that discipline continues to be necessary daily. Know your history and know how your work contributes to your field going forward. My research at Purdue was an opportunity as an undergraduate to try to understand both the academic side and the research and development side of engineering, and what graduate studies might look like. It didn't really contribute directly to my work at NASA or my co-op, but it did give me an understanding of research and development, which played a part in leading me to where I ended up.

After graduating with a BS in mechanical engineering at Purdue, you went on to obtain an MS in mechanical engineering from Purdue and an MS in space studies from the University of North Dakota?

I earned my master's in mechanical engineering right after my undergraduate degree. Then a few years later, while I was working, I did a distance learning master's through the University of North Dakota.

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What was it like transitioning from undergraduate studies right into a master's degree?

For me, the two experiences were quite different. As an undergraduate, I was used to having my group, my posse. A group of us were all on the same co-op schedule, so we had all the same classes at the same time. We were a support system for each other, but when I went into graduate studies everyone else was all gone, so it was a different kind of social and academic environment for me. However, I still liked many of the classes a lot. What graduate school did for me was that it cemented in my mind the stuff I had been trying to understand in my undergraduate studies. Being an undergraduate is like drinking through a fire hose—graduate school gave me a little more time to think about things, so they became clearer in my head.

What work were you specifically doing in your master's program?

I did a project-based master's program so I would be more in control of my schedule, because I wanted to get out and go work for NASA. I worked on the kinematics of a space suit shoulder and tried to describe how that system moved.

How did you get involved in wearable technology? When did you know that it was what you wanted to focus on in your career?

I took advantage of the co-op program to move around in NASA. They assigned us to our first tour, and then from there we got to pick where we wanted to go, so I got experience all over the place. I went out to the White Sands Test Facility, I worked in the crew office, and I worked on the Space Shuttle robotic manipulator system in the Mission Operations Directorate. I thought that since there was an Engineering Directorate there, I needed to at least try and see what they did over there, since I was an engineer and all. But I wasn't sure if I was going to like it. I kind of thought I was going to work in mission operations, but then I went over to engineering. They were working on space suits, and I thought space suits sounded fun, so I worked on space suits for a summer. Once I started, I realized it was what I really liked to do.

Moving on toward the work you're doing now, what is the inspiration behind the Z-1 and Z-2 suits?

Kind of going back to that point I was talking about before, you really need to understand what happened before you so that you can build upon it. I worked with Joe Kosmo. He had worked with the space suits for well over 30 years before I got to the lab. So I spent a lot of time talking to Joe and reading up on what kinds of suits had been created there and what we learned from them. We also had a prototype in the lab that he produced, which was kind of the culmination of all the work that he had done with the earlier prototypes, called the Mark III. Working on the Mark III has been a lot of my experience at NASA, as far as working on space suits goes. I've learned a lot from that suit. There are always things you can improve. And there were some different requirements placed upon the Z-1, so we got to do some different kinds of construction. The best of those two main lines of work, the Mark III and the Z-1 lines, influenced what we did with the Z-2. So Z-2 is really more of a combination of Z-1 and Mark III instead of just a follow-up to Z-1.

In other interviews you have mentioned that your favorite part about working with space suits is getting to test them. Are there any specific tests you really enjoy doing?

We run a variety of tests, but my favorites are the reduced gravity flights, because that is the one place where you can really see how the suits move in the gravity environments they are intended to be worn in. Some of the other tests that we do have aspects of gravity associated with them. We do weight relief, we can do active off-loading, we can do water tank testing, but those things aren't really part of the gravity environment. To see the suits move in the gravity environment where they are intended to be worn is really fun and educational. You can understand what works and what doesn't work when you see the astronaut move in that environment. That's my favorite part.

Are there any especially memorable tests that you have run or supervised?

I think I was a brand new engineer when I ran my first microgravity, or reduced gravity, aircraft test. So I wasn't even allowed to do tests by myself on the ground, but because my mentor didn't like to fly on the plane, I was running a full on suit test in a partial gravity environment all by myself. One of my subjects took it upon himself to do a handstand in the suit, and I was so afraid he was going to break it and that I would be in big, big trouble.

I imagine that your father, Jerry Ross, and mother, who also worked in a company associated with space technology, were big influences in your working for NASA. Were there any other individuals who influenced your career trajectory?

Obviously, my dad had a big part to play, but Jack Kochner, who was the co-op coordinator at the Johnson Space Center at the time I was co-opping, was a really good mentor in that he encouraged you to find where your skill set best fit. I think that is one of the things that helped me get to where I am now. I'm not a design engineer, I'm not an analytical engineer, I'm not many kinds of engineers you typically think about when you think of space suits. I have at the core of my hardware system a soft, squishy, opinionated human being. I am able to work a human-centric design process, and I know a lot of people who cannot do that. A lot of engineers want to have an answer they find on a page—done, known, move on. I am never done.

I think that my dad had a great influence on me, too, because he loved doing spacewalks. So we talked a lot about working on the suits, using the suits, and the basic hardware involved. I spent time with him at work as a high school student and watched him do work in space suits. Of course that had a big influence on me. Then, Jack's influence to go where you best fit really was a key to my finding the freedom to explore beyond my preconceived notions of working in Mission Operations.

Do you have any advice for undergraduate students who are trying to get involved in, or are currently doing, research?

I would say that doing research is valuable in that you get to apply what you're learning. When I came to NASA, I didn't really know what engineers did. I have since learned that some engineers are managers, some engineers are design engineers, and some engineers are analytical engineers. Some engineers are project managers, too. There are all kinds of different roles that engineers take on. So getting to do hands-on work and starting to understand what the different roles are—what the nuts and bolts of the jobs are—is so valuable. That is where you really understand what kind of engineering job you're looking for and what kind of engineer you want to be. That also helps drive what kind of classes you want to take. There were some classes I took, such as a class on ergonomics, that I never would have taken if I wasn't interested in being a space suit engineer. Whereas, if you want to be a design engineer, there are different classes you have to take. So research helps direct your undergraduate or graduate work if you get in and do the work yourself. There is a big difference between doing the classwork and using the classwork. And that's where (not only the co-op and research programs, but also Society of Automotive Engineers and Rube Goldberg and different kinds of projects that go on) you get to work with a team and take all this education you have and apply it to something. So that is the real value—that's something you should come out of college with, not just academic knowledge. As I've said before, I would rather have people with B's and C's who did some kind of Society of Automotive Engineers car work than someone with straight A's who doesn't have practical experience.

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Interviewer

Sunny Asaf is a sophomore in the College of Liberal Arts, where she is studying anthropology with a minor in animal science. She served as the coordinator for this volume of the *Journal of Purdue Undergraduate Research*, in addition to performing as secretary for the Purdue Anthropology Society and participating in the Wilke internship program, where she worked with Dr. Elizabeth Rowe in evaluating menstrual bleeding in primates and its evolution.