

Interviewer: Well Dr. Dittmar and Dr. Kelly, thank you both very much for joining me as a young person who was a bit of a space nerd growing up. I'm really excited to talk to both of you and to get your perspectives on deep space exploration and the future [00:00:30] of human exploration and where we're going from here. So to start us off, and I'm going to turn first to you, Dr. Dittmar, and then I'll turn to Dr. Kelly, but can you share with us your background, how you got started and what drew you to aerospace?

Dr. Dittmar: So I sound like everyone else in my generation who's in space, which is that I saw the Apollo landing. And actually before that was following the space program because my father [00:01:00] was very interested in it. So I remember John Glenn's flight. I can't say I remember Alan Shephards, but I do remember John Glenn's and I remember the Gemini program. And then certainly for the Apollo 11 landing, we were hauled out and placed in front of the television set to watch it. I know they really understood it at the time I was actually more impressed by my father and mother's reaction to what they were seeing than I was to what I was seeing, which I thought was neat, but I didn't have enough of a framework [00:01:30] to really place it in context. I was 12, right? So just kind of young at the time, but that certainly played a role and it stimulated some of my interest in science. Later on when I was in high school, I was interested in science, but I had some difficulties with math initially.

And so I was counseled as were many women of my generation that I should, if I was interested in science, I should [00:02:00] just stick to the soft sciences and maybe go into psychology or social work, or I did music a lot and so I should do music. Then I went into college and found my way into human factors, psychology, and then eventually into engineering. And so I really kind of evolved into it. I didn't start from a perspective where I was really focused on aerospace. I graduated eventually with a PhD, lot of work in commune of science and human factors and became an academic. And it was actually when I became an academic that I started working [00:02:30] with NASA. So I really kind of backed into it. I can't say I was inspired to jump into aerospace because in fact, I was told there was no role for me for a long period of time and I had to find my own way.

Interviewer: Oh, it's fascinating because you think about all the hard science that's involved and just as you said, math wasn't exactly your strong suit, but that didn't deter you. Someone who is not a mathematician or a scientist [00:03:00] I mean, I can appreciate that, but I find that's remarkable that you were able to continue to grow and learn and really just make your career and as an engineer and really keep pressing forward. Even when in a sense like the deck was stacked against you and you were being kind of deterred as it was from pursuing that. And Dr. Kelly, the same question for you. Can you tell our listeners a little bit about your background [00:03:30] and how you got started and then what drew you to aerospace?

Dr. Kelly: Like Dr. Dittmar said, probably similar story. I was fortunate enough to actually grow up at Kennedy Space Center. So saw all the Apollo launches and the schools were filled with everything space. So I say often that I have space in my blood because I really truly experienced it firsthand by seeing it at JSC, it's where the astronauts train. [00:04:00] But when you see that launch and you have all the science and engineering, and at that point, math around you, it was an incredible opportunity educationally. And so I absolutely loved it. And then career wise, I married at 20 and moved to Colorado and finished my Bachelors in Electrical Engineering and went to work for Martin Marietta in Denver, in the robotics and advanced controls group. [00:04:30] Worked there for a number of years and then went to work for Swartkop at Eglin Air Force Base, working on advanced controls for weapons systems and also conducting technology development for various weapon systems with the air force research lab at Eglin.

Then I took a little detour and worked for two startup companies working on ultra wide band technology. And that's a technology that is [00:05:00] really, really high data rate and low power. So it had been used in classified environments for the military for decades, but had not made it to mainstream. So that was really cool, little sidetrack. And I had stayed in touch with the folks at Swartkop, which actually became Jacobs. And they did the contract here at the Johnson Space Center. And I've been here ever since I rejoined Jacobs and here at the Johnson Space Center, getting [00:05:30] to do fun things with NASA here. Pretty awesome journey.

Interviewer: Mm-hmm (affirmative). No. Excellent. Yeah. Yeah. With robotics. And then being part of like the next generation of humans space exploration, it's just, I imagine that's a dream come true. So Dr. Dittmar, and this kind of segues into our next question, starting with you, can you tell us a little bit about your current role and what do you enjoy the most about your position?

Dr. Dittmar: Sure. So my current role, I'm [00:06:00] the president and CEO of the Coalition for Deep Space Exploration, which is an industry trade group. It was founded about five years ago, and it was an extension of an earlier communications and outreach effort that had been undertaken by several companies that were involved in the previous moon program, the constellation program. But we wanted to reboot it and make it a much broader coalition that would address [00:06:30] not just human exploration, but also space science and eventually space commerce and technology development. And so one of my great pleasures has been growing it from the initial five companies to now 65 companies.

Interviewer: Wow.

Dr. Dittmar: And also they're really focusing on the diversity of that growth so that we now have very large established companies, such as Jacobs and Boeing, Lockheed Martin aerospace, Aero jet Rocketdyne, Northrop Grumman, but also [00:07:00]

a lot of mid tier suppliers who not only supply those programs, but also supply other players, both in defense and in sort of the more commercial space sector.

We've got folks that are supporting the science, of course, Lockheed supports many of the science missions as does Aero jet Rocketdyne. But we also have a number of entrepreneurial companies, companies that are currently doing work on the space station and have aspirations to do work in deep space. [00:07:30] They're using the space station to do technology development and test some of their products and their manufacturing processes. So it's been very enjoyable to have that opportunity to be able to do that. That's one of the things that I really enjoy a lot about it. I enjoy spending time with businesses and just listening to what their challenges are and trying to help them. I'm a big believer in supporting the industrial base in the industrial backbone in the United States. It same backbone, whether [00:08:00] it's an aerospace or defense or Noah earth observation.

I mean, all of these efforts, space is so woven into our day to day lives now that we have a whole National Space Council that's been developed just to address the fact that space is now a whole of government approach and domain. And so working with those companies is very rewarding, but I also do a lot of mentoring and I find that very rewarding. And then finally [00:08:30] just being able to speak on behalf of NASA's programs of record and try to just remind policy makers and influencers and the public, why it's important to continue to invest in these efforts, it's important to U.S leadership, but also important to knowledge and discovery of knowledge. And that's exciting, right? I mean, every time we turn around today, NASA made an announcement that they've found surface water on the moon and that has potential implications for [00:09:00] a lot of what we'll be doing at the moon, both for human exploration and in space science. So it's just an exciting field to be in.

Interviewer: No, absolutely. And I think sometimes people don't understand the breadth of discoveries and how space exploration informs a lot of products and things that we do here on earth. And it's interesting that so many businesses are participating in that discovery. And the [00:09:30] fact that space is kind of a very interesting test case scenario for some of these technologies. Dr. Kelly, same question for you. Can you tell us a little bit about your current role and beyond just the description that we'll have on the podcast, but a little bit more about your current role and what do you enjoy the most about your position?

Dr. Kelly: Sure. So I'm general manager on our contract here at the Johnson Space Center, and we partner with NASA across all the human space like programs from ISS [00:10:00] to Orion, Commercial Crew Program and elements of the [inaudible 00:10:05] mission. And we also partner with NASA to provide all the curation services for extra material samples. So that usually gets a wow from folks who don't know that Jacobs does that from all the moon rocks, the meteorites and cosmic dust. And then we conduct research to determine the mineral content on the moon and Mars, and also explore the origins of the solar system. And

that is such a diverse [00:10:30] set of things that we have the opportunity to work on. And I think what I enjoy most about my position and what I do here is the team that I get to work with and the partnership that we have with NASA is really very, very special.

It truly is a deep partnership. And then the incredible variety that I get to be part of every single day. I don't like doing the same thing every day and no two days are the same. And then when I also step back and think about what we get [00:11:00] to do that having long term impact for space exploration, but also life here on earth. And I'll also say if I take a step back and look at what Dr Dittmore does, the impact she's having for all of us in industry, the voice she is, and really bridging the entrepreneurs, the medium size, and then the larger companies, it truly is spectacular to have someone like her that is the voice in a lot of different places for the industry in the impact that we have.

Dr. Dittmar: Thank you so much. I appreciate [00:11:30] that.

Interviewer: So, Dr. Dittmar, now that we've kind of taken a little look at the background and in your current roles, just kind of start our discussion kind of looking forward. I guess the question is why go to deep space? And I know that's kind of a big question, but can you give us some thoughts on why it's necessary for us to keep pushing forward and why go to deep space besides just the coolness factor [00:12:00] of course, of exploration, but why go?

Dr. Dittmar: So a few years ago, I sat on a committee of the national academies of sciences, engineering and medicine that was constituted to study human space flight. And so it was called the human space flight committee. And we published a report in 2014 called pathways to exploration, which was really an assessment of NASA's plans for returning to deep space. One of the things that we were challenged to [00:12:30] do as a committee was to look at the value propositions for human space exploration. And as we dove into it, the problem which you've already sort of alluded to here is not that there were too few of these reasons, but too many of them, and it's like peeling an onion back, and there are interrelated. And there isn't a lot of hard data for any one of them, but when you take them as a whole, then you start to see sort of their richness of the endeavor itself.

So just [00:13:00] a few of them, one of them is that going to deep space just demonstrates that we can do hard things. And for the United States, it demonstrates that we haven't lost our appetite to do hard things, we are willing to engage in what is one of the most exacting engineering efforts known to human beings. I mean, space will kill you five ways and more than that. And so the engineering margins are very, very, very fine and thin. And the work that needs to be [00:13:30] done is sort of an inordinate precision. And so just being able to approach these things and do hard work and signal to the rest of the world, that we're willing to invest our time, our money, our lives in the case of those folks that actually venture out and that also work with a lot of pretty dangerous processes to get this done.

I mean, that's a really important signal. It signals American leadership and our persistence, over a long period [00:14:00] of time. And that's important, not just for our friends, but for those that don't wish us well, just a few other thoughts, going to space we're faced with climate change here, right? On our earth and it's accelerating. And the effects of it are accelerating and NASA and Noah together, do some great work along with a lot of associated institutes and scientists around the world in doing earth observation, and trying to learn about the processes on our own planet. But human activity [00:14:30] makes it a little hard, right? We can study what we can measure, but going to other worlds, pristine worlds that have undergone climactic change, for example, Mars and learning about Mars that teaches us about our own planets.

I don't know if you know this, but the modeling of some of the outer solar system moons tighten and some others is what actually taught us about the theoretical possibility of nuclear winter. That [00:15:00] came from a lot of extra solar system, or, sorry, not extra solar system, but deep solar system studies of planets. Human space flying it's important because basically we can do a lot more as humans, it's at higher cost, but we can do a lot more as humans than sort of robots can do in learning. And the other thing about it is, I think it's important because we have as a species we've always migrated, right? I mean, [00:15:30] that's what we do. And so people talk about it as being in our DNA, but that's very real. And as we migrate, we change.

So we've adapted in response to novel situations and novel environments, and that's contributed a lot to our own growth. It's also contributed a lot to our own survival. And so, our drive to sort of go over the next hill has always been both limited and propelled forward by our technology and what the state is of our technology at the time. And we've just reached this point, [00:16:00] I think in our development where our technology is barely, but there, up to the task of beginning to take us into deep space. And so I think part of why we go is to see who we are, but there's just a lot of reasons. I mean, technology development is a huge reason. Opportunity for collaboration is a huge reason, opening up economic opportunity in space is a huge reason. So going back to what I said at the beginning, it's not [00:16:30] that there are too few reasons, is that there's so many reasons that the question it's hard to answer in some ways. If you're looking for a single "the, why?" I think you're going to miss the point.

Interviewer: Yeah. You look at places like Callisto and Titan and maybe Europa and I mean, and then of course, Mars, I mean, there's a lot of real estate out there. And you were saying with the technology, I mean, it's so close and I recall they [00:17:00] were saying something about, I believe the Apollo 11 moon landing that the computers on board, the Eagle are less powerful than today's average calculator or something.

Dr. Dittmar: Oh, far less. Far less powerful. Far less. Yeah. Far less.

Interviewer: Yeah. And if those guys can get to the moon on something like that, then that'll be hubris, but there's no telling what we might be able to achieve in space.

Dr. Dittmar: Right. Well, and the other thing I want to mention too, is the search for [00:17:30] life and we spend a lot of time on this, but we are the point between grand observatories and telescopes that are being launched or are already out there, or they were planning to launch as well as human capability to start going to other planets, return to the moon, and they go beyond that to Mars. We really are at the point where in our lifetimes or our children's lifetimes, we may be able to definitively answer the question of whether or not life arose elsewhere, certainly in our solar system and possibly beyond our solar system, when it comes to some of the really remote [00:18:00] imaging that we can do. And that's extraordinary. I mean, that's globally impactful, right? That changes the view of who we are and our role in the universe and opens up unbelievable possibilities. And we're right on the cusp of that.

Interviewer: And then Dr. Kelly, what are going to be some of the greatest challenges that need to be overcome in the next decade for space flight?

Dr. Kelly: [00:18:30] So there's one from the standpoint of protecting humans, which is the exposure to radiation, that's a really, really tough problem and that has to be solved. The other one is propulsion for deep space exploration and being able to come up with a method that we can either make on the moon and not take a whole lot of propulsion to get to Mars and be able to do something in a way that's never been [00:19:00] done before.

The other side of it and I think Dr. Dittmar is much more prepared, I'll say with your background to speak on this, but it's, we as humans have never experienced that type of isolation before. And so the human psyche and all that it takes to be able to survive and thrive on a long duration mission, the shortest time would be nine months to make it to Mars. And then you have to wait to be able to make the return trip. There is no [00:19:30] way for us to fully simulate that and any analog on earth. We're certainly doing a lot of work in that area, but I think that's, from my perspective, a very big unknown, we'll take it in chunks, but part of it is we'll just figure it out on the way. I just- [crosstalk 00:19:47].

Dr. Dittmar: I was going to say, I agree with that completely.

Dr. Kelly: Yeah. There's no magic analog on this earth that can even come close, yet certainly tremendous amounts of research are being conducted to [00:20:00] do our very best to prepare us for what we cannot imagine.

Interviewer: So, Dr. Dittmar, can you share with us some of the exciting projects you and your teams are working on right now?

Dr. Dittmar:

Well, we've started our own podcast. So, happy to participate on yours and I'm grateful to have been invited. Ours began back in the summer and it's called, The Deep Space Podcast. [00:20:30] And it's just been a lot of fun, right? We've given some of our entrepreneurial companies opportunity to come and talk about what excites them about space and why they got involved and how hard it is to close a business case when you're trying to build a business that's got space as part of its valued chain, and we've had other folks come in and talk about science, and we've had people come and talk about space policy. And right now we're building a series that [00:21:00] features young professionals from some of the large established aerospace companies that are supporting the government programs that NASA's building to go into deep space, including Jacobs.

And so we're looking forward to finishing those and getting them out. And that's just been a great project. It's been fun for all of us and really like the opportunity of giving people a voice and an opportunity to speak about what it is that they do and they're passionate about. And that's just been a lot of fun. We're also involved with an organization called The Pearl Project [00:21:30] that focuses on doing outreach to diverse populations and diverse student populations, is particularly interested in trying to give resources to and help mentor women who have entrepreneurial interests. And I've done a couple of courses with them to try to help bootstrap those young women into entrepreneurial efforts in space. And that's been a sort of a fascinating effort. [00:22:00] We also just have constant engagement with a lot of different audiences as a trade group, right?

We're certainly focused on our members, but also do a lot of work. We're on call for congressional staff if they have questions or if they want some inputs on things that they're considering or trying to do fact finding on. I serve on the UAG, the user's advisory group for the National Space Council, which has just been a wonderful opportunity [00:22:30] to provide input to our nation's leaders as they think about how best to position the United States and how best to leverage the assets that we are developing and identify the ones that we need to develop. And I'm there. I mean, and I'm also on the FAA Commercial Space Transportation Advisory Committee, and in all those roles, I'm there as the CDSC spokesperson. So it's a pleasure and an honor to be able to [00:23:00] represent our members and continue to sort of speak out on behalf of the space industry that makes all of these things possible.

And so to support NASA in its role and its various missions going forward. The thing that sort of drives the coalition forward is we have a deep conviction about the importance of the government programs and continued government involvement in these things, but also a deep conviction about opening up to newer entrants and to commercial entrants. [00:23:30] And even to folks who aren't directly related to space, but who have things that they can bring to the table to sort of help advance the sort of grand enterprise that we're all involved in.

Interviewer: And then Dr. Kelly to kind of dovetail into Dr. Dittmar's comments, what are your thoughts on how we can encourage more young women to pursue careers in space exploration?

Dr. Kelly: I think that starts long before they're young women. [00:24:00] I think it starts early in school at a very early age from preschool really all the way through high school, providing opportunities that exposes girls to have hands on experiences, whether it's a biology experiment, a chemistry experiment, some that's hands on, building a little robot or writing software and being able to create the wow factor and creating the inquisitiveness of what if? [00:24:30] For example, a cell phone, what does it take for you to have your cell phone or your iPad or all the YouTube videos that you watch or whatever else it is that you think is really cool? What are the components from an engineering, science, math perspective, human factors, or psychology. There's so many dimensions. If you look at what it takes for a career in aerospace, really, it isn't just, [00:25:00] I know this is heresy. It's not just stem. There's a lot of other things, other disciplines that contribute, stem is very important, but it's not the only avenue to a space career. And we need all of that at the table.

Interviewer: And my couple of last questions are for both of you. And I'll start with you, Dr. Dittmar, who inspired you when you were student or when you were a young professional?

Dr. Dittmar: [00:25:30] So I'm going to give a couple of answers, probably the single greatest impact on me when I was a student, was my mentor in graduate school, who was an experimental psychologist named Dr. Joel Warm. And Joel was known for being a task master. He was demanding, he was difficult, he was curious, he was passionate, [00:26:00] but what he really focused on was excellence and persistence and attention to detail and be driven by the data, not your opinion, not somebody else's opinion. Spend the time to think about how to interpret what it is that you're seeing. Talk to a lot of people sort of, seek out additional information. And I was really fortunate to have him [00:26:30] as a mentor. I used to say I was raised by wolves and I meant Joel and his colleagues, Bill Denver and some others who really just trained me to be data driven and to not have fear, right?

To stand and deliver. And that has nothing to do with my space career and everything to do with my space career. But his influence on me is out sized and actually [00:27:00] as I get older, who knows, grieving, I may passed a few years ago, but as I get older, I'll be eternally grateful. The other two people that I just need to mention are my parents. My father was a chemical engineer and served on world war II and had a leadership approach that was really kind of based in service. And he was very passionate about work and told me once that he would never [00:27:30] stay in a job that he didn't love. And that had a huge impact on me.



And my mother was a nurse graduated near the top of her class from Duke University at a time where young women for the South were just supposed to go to school to find husbands, served at the red cross also during world war II. And she too had this sort of service orientation, but she really encouraged all of my interests in science and math. I can remember doing fractions on the fogged in glass, in our living room, right? And [00:28:00] she would just sit there and encourage me and I remember both of them taught me things in different ways and those had sort of a great impact on me.

Interviewer: And Dr. Kelly, the same question for you, who inspired you when you were a student or young professional?

Dr. Kelly: I'll have to say my high school calculus teacher, neither of my parents finished college. And when it came to advice on what to major in, asking either of my parents was not really super [00:28:30] useful, my mother wanted me to go to college and certainly I got tremendous encouragement from her to do that, to have a good life and be able to care for myself on a lot of levels. But as far as what to major in, that wasn't the place to go. So I went to Mr. [Mims 00:28:47] one day after class and asked him. And his advice was this, "you love math, and you're good at science. Do yourself a favor and become an engineer. You'll have a lot of options in life." And such a short discussion, [00:29:00] but truly impacted the choices that I've had the opportunity to have in life.

Interviewer: I believe you went on to become a roboticist. And then now here you are at the Johnson Space Center, and it's pretty fascinating there career trajectory of-

Dr. Kelly: Kind of coming full circle when you look at growing up at Kennedy Space Center and now being at the Johnson Space Center, it's pretty awesome.

Interviewer: Oh, absolutely. So my last question for you both today [00:29:30] is what is an accomplishment from your career that you would like to be remembered for? And you'll caveat this, this could either be something that you've already accomplished or something that aspirationally you hope to accomplish. What do you want to be remembered for when people look back at your careers and you both have had remarkable careers when you kind of take a look back at everything you've done and everything you hope to do, what would you like to be remembered for? And Dr. [00:30:00] Dittmar, I'll start with you.

Dr. Dittmar: I think it's not a single achievement. It's more, I'm interested in space in part because it's about creating an optimistic future. I hope, for humanity. And so the process of getting there involves a lot of mentorship, and I would like to be remembered for having been a good mentor [00:30:30] from having been a dedicated mentor and someone who cared about mentoring and helped advance the careers of others toward that future. I guess I'd like to be remembered for having some degree of vision anyway, and a leadership style that, again, model on my parents was sort of a servants service leadership style, but that was nonetheless effective. And I think the last thing I'd like to be

remembered for, I'm not one to blow my [00:31:00] own horn a lot, but if I have served and I hope continue to serve as a role model for women, but really for others, I mean, for whomever, but certainly for women, both in the technical fields and in the social sciences, then I would be at peace. If I was remembered for those things, I would say that is a professional life well lived.

Interviewer: Well said. And Dr. Kelly, the same question for you, an accomplishment [00:31:30] from your career, you like to be remembered for?

Dr. Kelly: Very similarly, not an accomplishment per se. And I'll say it's aspirational. I hope to be remembered from a leadership perspective of setting the tone and be part of creating a culture that is high performing and that creates really the inspiration. Everybody is driven internally, but creates that environment of doing their best and supporting each other, and yet driving to excellence. And [00:32:00] certainly getting to do this with NASA is an environment to do that very well. And then the mentorship, be the Mr. Mims for somebody else. And whether it's through the outreach or any other capacity of mentoring, we never know necessarily the impact we make on others. And so hopefully that will be something that I get to be part of.

Interviewer: Excellent. Well said. So Dr. Dittmar [00:32:30] and Dr. Kelly, I want to thank you both very much for your time today and your insights and for sharing very fascinating time in the life of the American space exploration industry. And you both are well situated, you're right in the middle of it. And so it's a very bright future we have ahead of us. And in large part, thanks to professionals such as yourselves. So thank you both. I know you're very busy, but for sitting down with us and your insights, and hopefully [00:33:00] there are people in our audience who share this with their kids and with the next generation of space explorers, and will take heart from what you've said. So thank you for sharing.

Dr. Kelly: Thank you. We really appreciate the opportunity.

Dr. Dittmar: Very much so, and also enjoyed talking. It's just been really, really delightful conversation.