Cara: Hello, hello, hello and welcome to talk nerdy it's Monday, May 1st and I'm your host, Cara Santa Maria. This week I talk to one of the coolest chicks I think I've ever had on the show, Ariel Waldman. Alright, I'm super excited about this week's guests her name is Ariel Waldman she sits on the council for NASA innovative advanced concepts. She is the co-author of the National Academy of Sciences report on the future of human spaceflight. She's the author of the book, "What's It Like in Space? Stories from Astronauts who have been there." she's also the founder of spacehack.org and the global director of Science Hacked.

We're going to jive into all of that - dive and jive I suppose - that's kind of a weird hybrid way to say that. We are going to dive into all of that right now on the show. Without any further ado here she is, Ariel Waldman. Well, Ariel thanks so much for joining me today.

Ariel: Thanks for having me.

Cara: Yeah, I'm really excited when I get a chance to talk to, A: somebody I've never met in real life...

Ariel: [laughs]

Cara: ...which is kind of weird because we don't live that far away from each other do we?

Ariel: I know, we tried, we tried... next time...

Cara: [laughing] Next time. Another cool, kickass reporter in the Science World who is taking names and you have this amazing- I don't want to call it your resume- your career has so many facets. I think we're going to spend the entire hour digging through all the cool stuff you do.

Ariel: Yeah there's a lot.

Cara: There's a lot, right? I first saw your byline and this is such a funny thing that happens sometimes because I read a lot of Science. I like to keep up to speed and so I will see writing by somebody and I'll be like, " Wow, I really liked that piece." Then I look at the person's name and start reading more about them. Of course, before we recorded I had to ask you, "Do you pronounce your name Ariel or Arielle?" because I've never heard it said out loud. [laughs]

So, I started by looking at your byline and then the more I dug the more I realized that you have like, literally the coolest job in the world.

Ariel [laughing] I don't know if that's true I've heard some cooler ones. But I try, I try.

Cara: Actually, you probably do coverage of some very cool jobs. You wrote a book called what's it like in space? Stories from astronauts have been there. Maybe that's a slightly cooler job. [laughs]

Ariel: Yeah it was so much fun to put together. I was so happy". When a book finally comes out you're just like, oh thank God."

Cara: Yeah, I'm sure. I've Never had the pleasure but it seems like so much work. I've been picking the brains of many authors that I've had on the show lately about their process and about some of the struggles. it's something I ultimately want to do but, God it's a labor of love, isn't it?

Ariel: Yeah, it is. I can tell you my process probably doesn't look like the majority of others process because I'm just a bit eccentric that way. It's a lot of work but I think, at least in my case, this is not true for all offers for certain but for me if I'm going to do a book I want it to be something is fun. I don't want to feel like it's my life's work in that if I mess any tiny little thing up I'm going to be forever regretful. For me, it was the same as making websites or events or anything, really. "It's really about having fun with it. I think that's how." I kept saying while I was writing it. [00:04:49]

Cara: it's also absolutely reflected in the book itself. It is really fun. It's colorful, it's graphic it's very modern. It has a very cool look to it which I think keeps you super engaged. it has these wonderful little vignettes about all sorts of weird, gross things which we love. Anytime we talk about space I love all of the kind of bizarre little- I don't want to call them factoids- the other day I covered factoids on my other podcast now I'm weird about using it. Although now it means, 'A little fact", used to mean something that wasn't even necessarily true. Now I'm like really careful... [laughs]

Ariel: Like alternative facts or something.

Cara: Exactly, exactly. But, come on -urine icicles?

Ariel: [laughs]

Cara: It's amazing.

Ariel: Yeah, that was a pretty amazing story. [laughing]

Cara: [laughs] ...and so yeah, what made you interested in, I guess maybe it's better for me to ask that question after I have talked about your... would you call your "day job"? This is so confusing, you do so many things. Are you a freelancer, or would you say that your day job is sitting on the council for NASA Innovative Advanced Concepts?

Ariel: I would definitely say I'm independent. I kind of puzzle-piece different projects together throughout the years. NASA Innovative Advanced Concepts is one of those projects that I work on throughout the year, amongst many.

Cara: Cool cool cool. So, did the book come out of your work with NASA? Is the book the by-product the same way your work with NASA is just because you love space? What really first got you so interested in all things outer... outer... there? [laughs] [00:06:34]

Ariel: Well, with the book specifically focusing on astronauts and their stories, a lot of it came from a few years ago. I was appointed to the National Academy of Sciences committee that was looking into the future of manned space flight which, by the way- like getting a job at NASA- I didn't expect ever to be on the National Academies Committee. In fact, it was something that when they first emailed me and asked me to be on this committee that advises Congress and the White House and NASA on the future of human space flight I had never heard of the National Academy of Sciences.

Cara: Wow.

Ariel: To the science community that's so shocking but outside of the science community a lot of people have my same reaction of just like, "What's that?" So, I almost didn't answer their email. I was like, "Who is this?"

Cara: [laughing] That's amazing.

Ariel: So it's kind of embarrassing now that I know just how important they are, but that's true. Through this committee which is looking into how to build a US human spaceflight program over the next several decades that would be sustainable. Through that, I got to meet

more and more astronauts. While the committees' Task is a very serious one we came out with a pretty detailed report about the future of human space flight. I got a lot...

Cara: Yeah, 279 pages, it is.

Ariel: [crosstalk] Yeah, exactly. Thankfully There's a summary chapter up front. You can read the summary and that's good enough. It's got a lot of really cool stuff in it. I don't expect anyone to read all three hundred pages.

Cara: And it's beautiful too! You can download the PDF for free if you go to the National Academies Press. I have to promote for you because you probably won't do it. It's called Pathways to Exploration: Rationales and Approaches for a US Program of Human Space Exploration. That came out just in 2014. [crosstalk]

Ariel: Exactly, so it's an interesting report. It's got a summary chapter but it also has chapters about publicly available data in terms of support for space exploration over the decades. it's got a technical chapter that talks about a lot of the challenges. Different propulsion systems, and radiation issues and it's got a chapter on the rationale for why we should even be sending humans into space in the first place. It's got a lot of really interesting stuff in it, just to sort of page through.

Through this committee, I was meeting astronauts more often and I had a lot of downtime outside of the committee to talk to them about funny, weird stories that they had while they were in space. It was nice for me because it wasn't getting to see an astronaut on stage with a very prepared presentation but getting to hear their silly stories that they would tell their friends over a drink or something. So, I keep coming home to my husband and telling him all these stories about astronauts and their time and space, or yeah- urine icicles, and how they had to snap them off the space shuttle. Hilarious things that made for good hearty storytelling in a sense.

I decided that they make perfect sense to collect and I begin collecting them and I started- for the book- I interviewed about a dozen astronauts asking them to share their most embarrassing stories of their times in space. Then I also researched a lot of the historical interviews with astronauts about their experiences and funny stories.

Cara: I love it. To back up a little, how did you first get involved working with the National Academies?[00:10:46]

Obviously, you said they reached out to you to ask you to be involved in this committee. Was that because of the journalism you have done?

Ariel: I wouldn't call myself a journalist. I write occasionally. I actually write very rarely compared to most people. I think what likely happen was he noted the 100-year Starship symposium that DARPA had ran in 2011, I guess. That was a big conference about how do we build an organization that could potentially support a Starship that would be created 100 years from now Kama so they weren't trying to build the starship. They were trying to create the environment that supported a Starship. This was a joint effort between NASA and DARPA.

I spoke at that conference a lot about how anyone can get involved in space exploration and how it can be more accessible to people with or without formal science backgrounds. I think that's where they first saw in the end the thing that was really interesting about this National Academies' Committee that was brought together was in terms of topic area it was definitely a very diverse committee. They didn't want to have the same movers and shakers that you usually see in human space flight.

They wanted to have an economist, they wanted to have a planetary scientist, they wanted to have a former Secretary of Defense they wanted former astronauts, they wanted space

historians. In that way, I guess they wanted someone to also represent what I hope give me the future of space exploration witches making it more accessible Beyond the usual. That goes beyond even the commercial space sector. Just making space exploration something that everyone can participate in a meaningful way.

Cara: Kind of along that citizen scientist I often talk about.

Ariel: Yeah, exactly.

Cara: Your background is at least partially in the sciences, is it not?

Ariel: It's not, actually. That's the thing that is really my driving force. I went to Art School...

Cara: ah...

Ariel: ... and I got my degree in graphic design.

Cara: I love that. Very cool.

Ariel: So, I came from that world. I was absolutely obsessed with design. I didn't really self-identify as a space or a science geek. It's not that I disliked it, it was just something that was not really on my radar. I was really tunnel focused on design period my goal when I was a young teenager was to become an executive creative director. I thought that that represented such unbridled creativity. Of course, I didn't know everything at the time, that it wasn't exactly all the bells and whistles that I had hoped for. That's what I really strived to do and I started getting frustrated along my career path into design. I was just designing posters and brochures and websites it was all fine but I thought like, " Well, is this really all there is? I'm confined to this set of mediums to express creative communication through."

At one point a number of things were adding up in my life and I decided to move to San Francisco without a job and figure out what I was going to do. I was watching a documentary on the Discovery Channel called, "When we left Earth" about NASA trying to send humans into space. The thing that was so cool to me about this documentary was that when they were interviewing the mission control guys they were talking about how in the early days they didn't really know anything about spacecraft or rockets or orbits. They were having to figure it out as they went along and so I'm here in San Francisco kind of figuring out what to do with myself and going, "Well I don't know anything about spacecraft or rockets or orbits. Working at NASA sounds amazing!"

I told that to a friend, and that friend was like, " oh I just met someone at NASA and I have their e-mail address if you want it." and I was like, " hell yeah." so I just emailed this person I have never met telling them I was a huge fan of NASA. As like a fan of all of like, a few days or something. [laughs]

and that if they ever needed someone to volunteer or whatever that I was here in the day that I emailed them they have just created this job description that read like my resume at the time. Someone who had experience in design and marketing and was connected to the startup scene in San Francisco. They explicitly wanted someone who has no experience with NASA what so ever. Because I ended up getting this job at NASA from that email which is totally life changing. This program was trying to connect communities inside and outside of NASA to collaborate, so they wanted someone who had no experience with NASA to help bridge that Gap and he'll bring communities together to create better solutions in science. It was completely unexpected but that's what really changed my life it made me want to be on the path that I am now Kama which is to make space exploration more accessible and so that I can give more people similar experiences to the one that I had.

Cara: What an incredible story. Isn't it funny when people ask, " How did you get to where you are today?" or. " what's the right path to do what you do for a living?" and it's like,"Uhhhh... sometimes stuff just happens." [laughs]

Ariel: Yeah, that dives a little bit into privilege for sure. But in my case I think I talked a lot about how I sent this email to NASA and I got this job. Well, that's pure luck. I don't often talk about or get to asked about all of the emails that I've sent two people that I've gone completely on answered.

Cara: Yeah, yeah.

Ariel: I'm pretty sure I've emailed Pixar and Google X and who knows what asking, "Can I get a gig there?" and never received a response. Well it's not sound career advice to just depend on emailing random people I do really advocate for, just send people an email and if I don't answer, they don't answer. I've done this countless times throughout my career. When I wasn't designer, I would email the creative directors and every agency I knew and just said, "Can you look at my portfolio and just give me feedback even if you're not hiring." just as a way of meeting people. It doesn't always work. A lot of times it doesn't.

Occasionally, you might hear back from someone and even if it doesn't lead to a job, it might lead to a really good connection and get you into some of the communities you want to get into and the reality with Nessa is that a lot of their email addresses are openly available.

While I can't speak on behalf of anyone at NASA, there are plenty of people- researchers they are who if you're really into astrobiology and you want to drop by and see their stuff, some people might be okay with that. A lot of people are busy but occasionally you find somebody who's like, " Yeah, let me show you everything about slime molds or whatever it is."

Cara: Yeah, and you know you are a prime example of the fact that whatever you've been doing for your life. Wherever the road is taking you- you look back, you've been collecting skills, collecting education, really focusing on your craft- whatever it may be- if you're creative you may be able to apply that to things you haven't thought about before. There's not a perfect assembly line checklist of how to get where you want to be. You can really forge your own way. You can do it in unexpected and creative ways if you go for it.

A lot of times I think people are just really scared to go for it because they think, "Okay that's not the right way to get that job." Or that's not the traditional way. it's often non-traditional individuals who I think had the most interesting careers.

Ariel: Absolutely. I think it's something where I can speak from the design perspective. A lot of people would look at my career and say, "She's no longer a designer, she's not doing all of this other stuff." To me- coming from the design world- so much of design and design training is understanding how to effectively communicate an understanding when you tweak little things it really changes the message and what you're trying to convey and also it changes how accessible something is. How people can interact with it.

The very simple, simplistic thing is door handles. When you change tiny things about door handles, it changes whether or not someone feels like they can open the door Or not. Design is really structured around- the basics are structured around that. To me, coming from the design world I feel like being able to apply that thinking and that way of analyzing everything will make you effective no matter what area you go into. That was sort of my original frustration was being told, "You can only design for print, you can only design for websites." It's like, "Well, why can't you take that way of thinking and analyzing and affecting the world and apply it towards anything whether it's science or even some other discipline?"

I absolutely agree about coming in from a different area and having a lot of very unique and effective ways of doing things. I think this is something that I get personally frustrated with

still to this day is that I think, the science Industry in the space industry haven't fully recognized just how much they can benefit by having people come in who are not necessarily self-identified Space Geeks and Science Geeks but people who are really great at other areas and other disciplines. I think by not creating salaried positions and their companies for an economist to come in or a designer to come in and to let them make the connections that they make, I think we're losing out on a lot of clever creations in science which in my opinion, is reckless.

Cara: Absolutely. New perspectives, fresh ideas because you haven't been bouncing around in the same box for so long. So, it is pretty forward-thinking I think, of NASA to have offered the co-lab program and for you to have had the amazing opportunity to be involved in it. So that really was kind of your entrée into this world that has really taken over. This has become your main focus.

Ariel: Yes, yeah. It completely changed everything for me. I think once I had work at this program I couldn't really turn around and say, "Oh, well I just did space exploration one time for a gig. Now I'll be on my way..." and never to do it again. [laughs] I was just like, "How many people would kill for a job at NASA?" If you just said, "You don't have to change anything about you. You as you are, you can work at NASA do you want it, yes or no?" most people would say, "Hell yes."

Cara: Oh for sure. For sure. And so many amazing things have come out of that. You have had the opportunity to write a white paper for the White House. You actually were honored by the White House. That honor came from the work that you did- or I'm assuming you did- correct me if I'm wrong with either spacehack or science hack day, correct?

Ariel: Yeah, I think it was probably a combination of the two.

Cara: Okay. And so those are probably I would assume, big points of pride for you. Why don't you tell us about how they work?

Ariel: yes so with space hack, spacehack.org is a directory of ways for anyone to participate in space exploration with or without a formal science background. I created it actually after being at this NASAco-lab program because I had heard about all of these ways when I joined us at that people could contribute to space exploration. Things like discovering galaxies or building the next generation of Mars rovers. All these projects I had never heard of then. They were very deep and government websites. They were difficult to understand and so I thought, " the most minimal thing I can do is curate these projects. Translate them into it's better to understand and get them out to communities that I have never heard of these."

This is one of these things that NASA still really struggles with. A lot of times they're speaking in a silo. They are speaking to people who are already converted. They're already Big Space Geeks. And that's great you know, I'm not saying they shouldn't do that but, they do really struggle to get out to people who don't self-identify as space enthusiast but who would be interested in these projects. Spacehack really came out of that.

Science hack day is a weekend event which scientists, designers, Developers and all different types of people get together in the same physical space to see what they can rapidly prototype with science in 24 consecutive hours.

Cara: ooh...

Ariel: ...and so, science hack day came out after space hack. spacehack.org I built in 2008. Science hack Day started in 2010 because I had curated a panel at South by Southwest talking about the frustrations of open science. Specifically talking about how there was a big movement to make open science data available but it was just kind of sitting Gathering digital dust so to speak. No one was doing anything interesting with all of this stuff that was

being made available. A big argument I was making was how this open science stuff wasn't actually accessible until someone built an interface to it or did something interesting with it or played around with it.

so, sitting there in the audience at 'South by' was my friend Jeremy Keith and he was like, " Well, we should do a Science Hack Day for this. So, he created the first one in London that year in 2010 and then I created the next one in San Francisco and it was really around the mission of getting excited and making things with science. We explicitly don't give challenges to people. We leave it open-ended so people make silly things, serious things, we don't really say. it's really just around playing with science stuff. So, we have biologist and oceanographers and geographers web developers artists lawyers writers, we are also pretty adamant about saying that you don't need to have any hackers skill sets. You don't need to have any experience with science. It's just around really that core message of getting excited at making things with science.

Cara: This is amazing. And so you've been able to pull in some grant funding to help you do this. even the way that you talk about it, it's not a small thing. I'm looking at how many of these hack days you guys have done period starting with London and San Francisco like you said, in 2010. Since then, oh my God, Mexico, South Africa, Kenya, Ireland, the Netherlands. Switzerland, Germany, Cypress... this is crazy!

Ariel: So now we are in over 25 countries around the world. I've had the great pleasure of getting to visit a lot of those countries for their science hack days. So yeah, Madagascar, Russia, Mexico, Columbia, China, it's just been absolutely amazing.

Cara: Incredible. Russia, Ghana... You've Been Everywhere. This seems like something that's not easy seems like it's something that takes a lot of work and a lot of volunteers, a lot of sponsorships a lot of help to be able to me make this a free event for the community to be able to come and participate and really affect change.

Ariel: Yeah, I wouldn't say... I don't want to make it out to be difficult. It requires passion, for sure. With the global efforts, I received a couple of small grants from the Sloan foundation and the Knorr Foundation. They have only paid for maybe a couple of months of my time at a time. I work on science hacked day year-round trying to get people to organize science hack days in their cities and so the majority of the work that I've done, the vast majority is completely unfunded.

It's something that I'm really passionate about and equally, all of the events around the world the local events, including the San Francisco event, they're all volunteer efforts and so none of us ever accept pay for actually organizing the event Itself. It's free for everyone to attend which is also really important because I think a lot of event organizers really underestimate just how broke people can be sometimes.

Cara: it's true.

Ariel: I certainly gone through times where if I had to pay more than $5 for something I couldn't do it. So, if there was a $10 event, which is seen as cheap, I was like, "I can't go."

I literally can't afford that right now." I think that's a really important part of it. Getting people to sponsor the event has been really heartwarming, I guess is something. The majority of the cost for each event goes to just providing food for everyone for free. At Hack Day San Francisco, we provide two breakfasts, two lunches, one dinner for free just so people don't have to worry about going out and getting food and being interrupted while they're working on cool science stuff.

Cara: That's very cool. You say it's free for people to attend, that doesn't mean it's free to do. Food is very expensive.

Ariel: Right. With each event pretty much like, 90% of the cost of the event is just providing the food. Each city is responsible for getting their own sponsors. For some cities that might only be $5,000 for others, it might be $10,000. So it's kind of in that range. Because Science Hack Day is explicitly about multi-disciplinary collaboration and getting people from tech and design and science together it means that organizations that would want to reach across industries have been really great sponsors. So, organizations that are like, "We're a tech organization but we're trying to reach more scientists or vice versa." Those are a lot of the companies will sponsor and they'll throw in a little bit of cash so that we can get the five to ten grand typically that is needed to provide food for everyone for the weekend. Other than that, there's not really a lot of expenses because it's a hack day so it's really about people bringing whatever they have and sharing it with people.

It's about prototyping things to any fidelity level. You'll see hacks that are created out of cardboard or software or hardware or wetware and we don't really care, so long as people just prototype it as far as they can in whatever medium that want. We've even had teams that had a piece of software breakdown that was part of their demo, so instead, their demo was, they mimed how the software would work with their bodies. [laughs] It's really anything so long as it's about prototyping concepts.

Cara: It's so very cool. Guys, if you go to sciencehackday.org you can load all the past events you can see that there are upcoming events this year. October in San Francisco, June in Brisbane in Australia. Also, you can look at how to do this in your city. How to work to get sponsors and put on a science hat day of your own in your city. I wouldn't be surprised if some of the people are listening are having a light bulb flickering above their heads right now [crosstalk]

Ariel: Yeah, the thing I would urge for anyone who's like considering doing a science hack day in their City. One, you should totally do it. Too, don't worry if you have no experience like finding sponsors or anything. Even with the San Francisco event, this year will be our eighth event, all of my organizers just grown every time they think about having to ask companies for sponsorship money and it's... again, as with everything that I try and do it really is about making it accessible so you don't need to be an expert to get sponsorship money. A lot of times, organizations are happy to support community events and it's just a matter of asking around and we found really great support from so many different places.

I didn't want to scare anyone off with the fact that you need to get some sponsorship funds to pay for the food. It's actually not that difficult thing to do. It's kind of just emailing people and saying, "Hey, this is what I'm doing, would you like to support?"

Cara: Maybe you know restaurants in your area or individuals who would want to provide that food as well. There are other ways to get sponsorships. There so many ways you can help out. Also, what a cool way to make new friends! So, cool to meet people who are like-minded but maybe who's paths you would never cross because they came from a totally different industry, totally different field, but they're goal oriented like you are and they love- they are makers, they're hackers, they love the same kinds of things. I'm super pumped.

Ariel: yeah, that's completely it. Each city is different and each city has its own sort of motivation for why they personally want to do it. With San Francisco, part of the motivation was here in the Bay Area you have the tech industry the science Industry both here, both representing very strongly. you'd think there would be all these lovely, creative collisions between the two if not even professionally at least just socially and informally and the reality is, it's not really there that much.

I was so frustrated and it came to a head for me when I had some friends from NASA who were visiting Google headquarters. They were walking around Google headquarters and tweeting out, "Oh my God we are at Google. This is so cool!" then you had people at Google talking about, "Oh my God, there's people from NASA here." So cool!" It's completely ridiculous in the Bay Area that you have these two industries that are just enamored by each other and yet they don't interact at all, and so you get these situations where they are like, "Oh my God, I never thought I'd be at NASA!"; "Oh my God, I never thought I'd be at Google!"

I was like, "This is ridiculous! You are across the highway from each other!" So, part of my motivation for creating Science Hack Day in San Francisco was that you have everything here, you have all of the ingredients, people are not getting in the same physical space with each other to collaborate. So, I was just like, "This is ridiculous. This needs to change. I'm doing Science Hack Day and that's the end of it."

Cara: yeah, now I'm heading back yet because I'm looking and there's never been one in LA Kama which is crazy because we have JPL and CalTech and UCLA, and USC, and NOAA and like- all at least in San Diego. You know Southern California... so many brilliant people, so many creative, artistic... we graduate more engineers in the LA area most major cities. It's just crazy. This is crazy.

I feel like I got to get motivated now and do something about this. I'm so excited. Yay! I'm so glad that I've been fully introduced to this. I've had a good education on it. Hopefully, everybody who's listening who is not driving *ahem* is... has their browser open and is digging into how exciting this is. So, Science Hack Day. sciencehack.org, or is it sciencehackday.org? Yes, sciencehackday.org. Guys, check that out.

Cara: we also talked about space hack for a quick minute. This is a beautiful site, first of all. Did you design this? You designed this didn't you?

Ariel: Yes. [laughs]

Cara: It's gorgeous. It's a beautiful site where you can go and you can get lost click through, and look at all these different ways or you can participate personally in these cool citizen science initiatives. I love this. The cover everything, Stars, the Earth, Sun, galaxies, Mars, planets, space time even some biology stuff here. Black holes. And you can click through it learn about all of these different organizations, not always here in America some of them are NASA but some of them it looks like our other space organizations outside of the country?

Ariel: [crosstalk] Definitely have a lot of nonprofits.

Cara: Okay, cool. Yeah, and just a beautiful way to learn about the first, decide on something that you're interested in and then click through to the organizations that are doing these projects and enroll, sign up! get involved! I love this. Citizen science is like, my favorite. Isn't it cool?

Ariel: Again, for me it's all about infusing more Serendipity into science And getting people with completely different ways of looking at the world to lend their perspectives and skills to something completely different.

Cara: Guys, you can donate your computer's idle time to help search for extraterrestrials, if you go to SETI at home. Come on this is crazy. I love it. So I'm assuming you said that you first launch that's quite a while ago, what did you say? 2008?

Ariel: Yes. yeah.

Cara: So obviously, this is not a 2008 website. I will say that.

Ariel: Yes, yeah it's going through a couple of redesigns. I actually built the very first one on WordPress, like in two weeks. I was fresh out of NASA and I was like," I'm going to build this freaking website." and I spent like 2 weeks, nailed it out, did all the writing in the design and the curating and researching and everything and knocked it out and put it up on WordPress. this is I guess true with pretty much everything I create. It's not that I've got super technical skills,I'm just using whatever is immediately available just to get things out there and because I just get so frustrated when something doesn't exist in the world and so I think being okay with prototyping something in whatever way you can is so important.

So yeah,spacehack.org now is a little bit more fancy than it used to be. It doesn't run on WordPress anymore. yeah, it's been through a few redesigns over the years.

Cara: That's how you do it, right? Rapid prototype first, then iterate, and iterate and iterate and iterate until you find something that really really works. that's true for a new piece of technology, that's true for a website. It is cool because it shows the process of what most people... actually I feel like that kind of reasoning applies across fields. If you do anything that's how you do it. You prototype first the new iterate until you get to a place where it's functional. Hopefully then you don't get complacent you keep iterating even after it's working to make it better and better all the time. I love this this is so cool. I talk about citizen science all the time on the show what a great place to find Space oriented citizen science projects all together.

Guys, you should bookmark this. You should share with all your friends.

Ariel: spacehac I do a lot of work with spacehack to make sure that the projects are things where you're actually contributing to the furtherment of space exploration and some citizen science projects I think because citizen science has become such a broad term, a lot of times it also includes things that are just like self tutorials, or self education. Specifically with space hack the project that I try and feature are ones where you can actually maybe discover a new black hole you could actually contribute to a technology that goes to Mars. Their projects we're at minimum you are collectively participating in something that is actually leading to discoveries or Solutions and that maximum you're actually becoming the discoverer.

Cara: So cool. Love it. I love it. And of course because of the work that you did as I mentioned before both at spacehack.org and very notably with science hat day, you were honored by the White House. This is so cool. You are honored as a champion of change. What was that like?

Ariel: [laughs] I don't know if I have words for it. It was awesome. I don't know what else to say. Obama had this champion of change program the try to identify individuals and communities all across the country for different topic areas where they were making real change. They have now had, I can't remember, something like 4000- maybe that's it under estimate- they had in the thousands of champions of change because they had so many different categories, Veterans Affairs and just everything. So they had one for citizen science and
I got invited to the White House which was crazy.

Cara: thats so cool!

Ariel: There's different things that can help people, like grants and funding. also, just getting acknowledged by the White House for your work I think, it's something that we all need that encouragement I think that's why you and I are on Patreon and the like, just having

patrons and people who are supporting you whether it be financially or just kind of becoming a supportive fan overtime I think helps. Especially when you're independent it's hard sometimes to see if you're going in the right direction or if what you're doing is having an impact. You don't always see it and so I was really happy that Obama put together that champions of change program.

not just for my own experience for it but I saw how it help so many thousands of people who weren't always necessarily able to see if they were having an impact or not, so just to get that validation I think was incredibly important.

Cara: Absolutely. Yeah like you said it's about recognition it's about validation. Sometimes it's necessary financially which is why we to go the Patreon route, and why we have to do what you talked about before which can sometimes be frustrating, do the fundraising. Also it's psychologically it's amazing when the work, the tireless work that you do, especially the word that you often do for no money... [laughs] is recognized.

Yeah yeah yeah. And it's so great when we hear feedback even on like Twitter or Facebook when people drop a nice note. That can turn your day around especially when you're just slamming your head against the wall. Frustrated by some project that's not quite going your way. That's such a human thing I think we all feel that way. A nice word around the office, a nice word of encouragement can go such a long way and we often forget that. We should be doing that for peers as well because they feel the exact same way That we do.

But, how cool. How wonderful did they give you like a certificate or a piece of paper or anything?

Ariel: yeah, so I'm literally looking at Obama smiling at me right now from across the room because they gave me a letter from Obama and I signed picture, so I framed it and I got it at my office right now because I'm a complete nerd. [laughs]

Cara: I love it. I love it so much. So then of course because a lot of the work that you have done obviously you are invited often to give talks, you've been able to travel. You've appeared on some television shows. The funny thing is, I was looking at your TV appearances, SyFy and the Science Channel. I clicked on the Science Channel show, " how to build everything"- we were both on that show!

Ariel: You are on it too? Oh my God! Where we on the same episode?

Cara: I'm not sure, I can't remember which- because you know, for people who don't know sometimes when you see these talking head TV shows, where it's just a lot of experts in a row. You shoot all of that content in one sitting and then they sort of parse it out across different episodes. I don't even really remember which I was on. I know I talked about a quadcopter and I talked about an fMRI and I don't know if I did much in space so you might have balance each other.

Ariel: I did, like, space suit and Rover, and an actual rocket.

Cara: yeah, that's funny it was supposed- the original title was how to build a rocket. But then they changed it to how to build everything. [laughs] because of course, an fMRI is not a rocket. Makes a little more sense. But yeah that's so serendipitous. I started laughing when I was clicking through and I saw that. That's great. You've also done some TV on SyFy.

let's imagine greater. It was a campaign, actually and they profiled to you for it.

Ariel: Yeah, so that was a campaign where they were trying to get a lot of Their audience to actually do the citizen science and go to spacehack.org and get more involved so it was an ongoing campaign in between all of the shows saying like, " hey, you like Space and Science Fiction. Get involved!" Do these things. So that was really around the tagline of, let's imagine greater.

actually discover the galaxies that show up in the SyFy shows and everything. So it was really, really great to do.

Cara: How fun! Of course, this brings us back kind of Full Circle to what I opened the conversation with which is sitting on the council Ford NASA innovative advanced concepts. So this is different from the co-lab that you work in previously. What do you do here? Is it- does it have an acronym? Because that's hard to say. NASA Innovative advanced concepts.

Ariel: Yeah, so it is also known as NAIC, so NIAC is pretty much the only program at NASA that funds your Syfy futuristic out there Concepts that could potentially transform future space missions Maybe 10, 20 30 40, maybe 50 years down the line. So they actually fund things that are very futuristic you could still do credible research in today. You got people researching, if we could do human hibernation on the way to Mars, people looking into could we use comments as a type of kinetic propulsion system to travel the solar system faster? Could we send a submarine to the lakes of Titan and have it explore the lakes of methane and ethane?

so really, Concepts that on the surface are definitely out there but yeah there's some R& d that you could be doing today, other than prototyping or just doing the math and researching- does it break down? Number of the projects that go through NAIC, they do the research and then I find out that it's not as feasible as they initially thought. But then we've actually got the research to back it up whereas before we didn't have any research to really say one way or another. With NAIC, they've got a core staff at NASA that's a really, really small team but they also have an external Council which consists of people who represent different areas. The quantum physicist they got, Quantum physicist John Kramer and Frank Drake who...

Cara: [crosstalk] I was going to say...

Ariel: created the Drake equation...

Cara: like what an honor to be sitting on the same council with Dr. Drake.

Ariel: he's such an awesome person. [laughs] He's actually just a very funny person, is how I would describe him. He likes funny jokes.

Cara: And of course, his daughter Nadia Drake is a really amazing science writer.

Ariel: I'm so jealous of her life. Have you Interviewed her yet? Because if not, [crosstalk]

Cara: I'm hoping to have her on the show- we've been in touch To talk about having her on the show soon.

Ariel: All the time I'm just like," I'm so jealous of everything you're doing!" Yeah, but they also got like a Sci-Fi Author, David [00:52:49] Brin and before they had an astrobiologist, Penny Boston on the council. It's about 8 people or so that represent these different interesting areas of science and the external Council doesn't decide who gets funded by NIAC, but they sort of help steer the program in general and advise it. with me specifically, a lot of the work that I focus on with NIAC is getting researchers who don't work in space exploration to apply that research toward space mission context.

Cara: cool.

Ariel: trying to get neurosciences to see if their research might be applicable for human trip to Mars or in the case of Titans submarine, you need oceanographers you need people who might do any work with space in order to sort of, help create projects and so I try and get people who may have zero experience with NASA but maybe a researcher in a completely different discipline to take their work and say," what if you took this work and you put it on Mars or if it became a space telescope?" or things of that nature. Trying to get infusion of people from completely different disciplines to create cool things for space just by taking what they already do and applying it towards space. In the tech industry there was a project that I thought was really fascinating because it was something that is kind of basic to Tech but applied it space and in space it's something that's amazing.

There was this project that took images of the moon and looked at the sunlight and how the sunlight at the Moon, everyday that it took those images and just did computer vision to create better route for Rover's on the moon so that Rovers on the moon can stay in continuous sunlight and they don't have to power down overnight. So it just figured out, how can this Rover stay in continuous sunlight by doing computer vision and routing it around the dark areas?

this is something that in tech is so basic but we've ever done that for rovers in space. While NIAC might seem very lofty and unattainable two people doing interesting work in Tech or research or wherever there's actually a lot of low-hanging fruit, in my opinion I'm just taking the way we do- the way we process certain things in one industry in applying it toward space and making it so that Rover's don't have to shut down overnight. Seems like a pretty basic thing.

Cara: [laughs] yeah. no, it's true and really speaks to what we were discussing before and I think for a lot of the podcast about how necessary having a design I can be especially when you're doing this Forward Thinking about new technologies and new disessa teas for I guess far future space flight and travel. There been so many cool things that I've seen in the news about applying origami two different shielding or to different lense. These ways of doing things that are different than how they've been done before that are often necessary. Even look at curiosity, the Rover. There was a sky crane. that's crazy.

Ariel: Yeah, that was definitely crazy.

Cara: It's crazy and probably, when it was first thrown out everybody was like,"Nope. that's not going to work." but then it was like, "Huh. Maybe it will. Maybe we should try this out." it takes having these crazy ideas
to be able to do something that wasn't technically feasible before.

Ariel: Yeah, well talking about that origami. The starshade. Which is I assume one of the things that you were thinking about with a origami having this big unfurling shade that would help us block out starlight so that we could get images of exoplanets. Starshade was originally funded by NAIC.

Cara: oh, cool.

Ariel: NIAC sort of is there to help get things started and hopefully that actually get taken on two missions in the future. So, with NAIC anyone can apply. all that's needed is a three-page white paper to apply and in my typical way of doing things I decided to make a website that made it easier for people to know how to apply to NIAC and what explicitly NIAC is looking for a when it's not looking for.

every August I think is when the solicitation opens and they taken these applications for about a month or so. So if you go to niacfellows.org you can sort of see if you could apply to it. Or someone you know could apply to it. it's something that I and really happy to be a part of it even though it's definitely a more advanced area that I would be the first to admit not everyone can do research in this area. But it is open for anyone to apply to it so they don't say,"You have to be an academic." To apply to it, or have to be a government worker you can be a garage hacker, really it doesn't matter so long as the research as you're proposing is solid. It's just been great to be able to help to program and try and grow it out further.

Cara: I have to say, this may be. The podcast that I've done, over hundred and fifty some-odd podcast that I've done this may be the one with the most forward facing action items that I've ever done. There's so many cool things that people who are listening can become engaged and involved. That's really secondary to the work that you do. Because you have such a focus and such a passion for helping the citizen of the world make an impact and become involved and fulfill their curiosities and their passions, you are really Paving the road for people to be able to do that. So I have to say thank you for that on behalf of myself and on behalf of my listeners because I'll bet you a decent percentage of people listening to the show right now have a nice spark and will start to dig deeper into some of their passions because they listen to this. So, yeah thank you for that.

Ariel: Well, thank you very much.

Cara: Of course.

Ariel: I don't know how to do anything else. It's really, ever since getting that first chance of getting a job at NASA. It just set me on this path and I don't think I wouldn't have it any other way for sure.

Cara: And so I apologize at the beginning, for calling you a journalist. I always try to be careful because if anybody has ever written anything I don't want to not give them that distinction. Would you consider yourself a science communicator? It's such a difficult thing, when people say," what do you do for a living?" And you have to give them the one liner. [laughs]

Ariel: I struggle with that so much. So actually on that Science Channel show that we were on," how to build everything" they listed me as a space activist. [laughs]

Cara: [laughs] That's so cool.

Ariel: I am always hesitant about- not because I don't think you should necessarily call yourself and activist, I think you're real work should speak for that. In terms of trying to really fight the powers-that-be and make things more accessible that's certainly what I do. I've never found a great title for that. Because while communicator, it describe some of my work and definitely you could argue I can't do anything without communicating. I think trying to make it, as you said actual action items- getting into the communities and doing the hard work of figuring out with the challenges and the blocks are for making things accessible and doing work advising Congress and different governments I think is really needed and important and so I think that's one of many reasons why I struggle to always described exactly myself in just a short and sweet title because I try to intentionally be broad because I think everything is highly connected and if you're really doing communication and not following up with everything else I think that is a different job from what I do.

Cara: absolutely. Alright, so let's review. You guys can pick up her book, " what's it like in space?" It's for sale everywhere. You can go to spacehack.org and get involved in citizen science projects. You can go to sciencehackday.org and either participate in a local science hack day or maybe even start your own. You also have a YouTube channel don't you?

Ariel: yes, I just started it.

Cara: You are very busy. [laughs] So you can look up Ariel on her YouTube channel and of course you're very active in social media. Tell everybody where they can find you. How are you mostly Twitter? Are you Twitter and Facebook?- What's your-

Ariel: I'm mostly Twitter. You can definitely find me on everything as Ariel Waldman, but mostly Twitter.

Cara: Great, great. So everybody send her a tweet say hi. Tell her what you learned and what you're excited to dive into and Ariel, thank you so much for joining me today.

Ariel: yeah, thank you so much for having me again.