

Center for Strategic and International Studies

TRANSCRIPT
Online Event

**“A Mission to Mars: A Conversation with Her Excellency
Sarah Al Amiri, UAE Minister of State for Advanced
Technology”**

DATE
Tuesday, August 31, 2021, at 9:00 a.m. EDT

FEATURING
Her Excellency Sarah bint Yousef Al Amiri
UAE Minister of State for Advanced Technology and Chairwoman, UAE Space Agency

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Director of Federal Government Affairs, Citi

CSIS EXPERTS
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Beverly Kirk: Good morning, everyone here in the United States, and good evening to those joining us from the United Arab Emirates. Thank you for joining us for a very special Smart Women, Smart Power event. I'm Beverly Kirk, director of the Smart Women, Smart Power Initiative, and fellow in the International Security Program here at CSIS. We are very pleased to welcome Her Excellency Sarah Al Amiri, the UAE Minister of State for Advanced Technology and Chairperson of the UAE Space Agency, for a conversation about the historic Hope Spacecraft mission to orbit Mars and international cooperation in space. Minister Al Amiri is also the chairwoman of the Emirate Scientists Council, the Chairwoman of the Fourth Industrial Revolution Council, the Chairwoman of the Dubai Future Academy Board of Trustees, the World Economic Forum has honored her as one of its 50 Young Scientists for her contributions to science, technology, and engineering. Today's event is being held in conjunction with the CSIS Air Space Security Project and the CSIS Middle East Program. The Smart Women, Smart Power speaker series is possible thanks to our founding partner Citi. We are very grateful for Citi's continued support of this initiative. And now it's my pleasure to welcome Kristin Solheim, director of federal government affairs at Citi. You will be hearing her voice and seeing her photo just because of a bit of a technical problem. Kristin, thanks so much for being here.

Kristin Solheim: Oh, thank you, Bev. And sorry I'm not seeing you all in person, but it's a real pleasure to be here this morning for another Smart Women, Smart Power event for 2021. At Citi, we proudly call ourselves the leading global bank because we're present in nearly 100 countries, including the UAE. And we talk a lot about our distinct business advantage that global footprint offers us, but we also believe it provides a really unique perspective on the challenges and opportunities around the world. And this year is certainly no different. Citi's been supporting this event series for six years, bringing together women leaders in foreign policy, national security, and the business community to talk about some of the most pressing issues our world is facing. And today we are thrilled to have a young and brilliant female scientist in our midst. Minister Sarah Al Amiri will join us for the conversation. And I'm very excited to hear about her fascinating career. I know we all learned how to work remotely, and some of us have mastered the technology to be productive in 2020 and 2021, but Minister Sarah Al Amiri took it a step further and she and her team sent a spacecraft to Mars, millions, and millions of miles away here from Earth. So, she is an overachiever, to be certain. I can't wait to hear more about that mission and her fascinating career, so I'll turn it over to Nina to get us started. Thanks.

Nina Easton: Great. And thank you, Kristin. And thank you to Citi. We so enormously value your support. We started this program nearly seven years ago to amplify the voices of women in national security, to give inspiration to girls pursuing that kind of career.

And you've been right at our side the whole time, so thank you so much. And welcome, Your Excellency. It's so great to have you here. It's really an honor. And Her Excellency, I just want to make everybody aware, has asked me to call her Sarah, so that's what we will call you. Thank you so much and welcome.

Minister Sarah
bint Al Amiri:

Thank you, Nina. It's a pleasure being here, and this is an excellent platform that I've learned from in the past, and I'm looking forward to our discussion today.

Ms. Easton:

Great. So, Sarah, I'm just going to dive into this past year because before we get to what – your career that led you here this has been quite an enormous year for you. To fill everybody in, the UAE now has a spacecraft orbiting Mars. And when we were all hunkered down in the midst of COVID in July 2020 – I believe July 15th, to be exact, Sarah – Sarah was, I think, probably biting her nails, a little nervous, watching the rocket ship that took this spacecraft to Mars take off from an island in Japan. Sarah, tell us about that day. Where were you and what was going on inside your head and your – and your heart?

Min. Al Amiri:

So, it was a few days after July 15th, on July 21st. And it was nerve wracking leading up to that. We were actually scheduled, like you said rightly, Nina, to take off on the 15th. And the weather was not cooperating at all at that time. At that moment what went through my head is: Seven years of working on this program, from the initial thought of going to Mars to having a spacecraft on top of a rocket awaiting launch to head to another planet is just – it's very hard to describe. Just the feelings that goes into this, it's very hard to describe what it is. It's pretty much a large chunk of your life flashing in front of your eye, and work that you've put your heart and soul and every hour in to get to where it is today, resting on top of a rocket, awaiting a very powerful launch to get out of Earth's gravity and to head to another planet. It was a very surreal experience. It was nerve wracking at times. There was a lot of apprehension. There was a lot of excitement. And it was as me and the team call it, it was a rollercoaster ride that had amazing highs and then points where you hold your breath and just hope for the best, knowing that you've done everything in your power to get to where you are today.

Ms. Easton:

And were you at that island in Japan, or where you watching this remotely?

Min. Al Amiri:

So, I was at the island in Japan. A small team of us managed to get to Japan to meet the team that was there for about four months preparing the spacecraft, living in relative quarantine during that time in the pandemic. But I was really glad I was there, a bit of sadness that I wasn't with the whole team. You usually experience launches with your whole team that was part of the journey moving forward, but it was just an amazing experience to live through this.

Ms. Easton:

So, after it took off, how long could you see it with the naked eye? And how long, I assume, with telescope technology you could watch it?

Min. Al Amiri: So, we did rely on the naked eye. It was about for a few minutes, about five minutes during that time that we were seeing the spacecraft. We were glad that the day was crystal clear, that we were even able to detect with the naked eye the separation of the first stage, which is the first sort of sigh of relief that we got there. And then after that, and I think with the wonders of Covid, we were able to remotely access the screen that shows the health and safety of the spacecraft while we were there at the launch site, to just watch and see if there's any vital signs from the spacecraft, that the spacecraft deploys its solar panels, that it's alive and working and functioning and heading towards its destination.

Ms. Easton: So, the next biggest moment for you was – came in February, I believe, when you had those, as you've described it, I think, nail-biting moments about whether it would go into orbit around Mars. Take us up to that. Where there any moments before that where it was a little touch and go? Or any concerns getting there? And then tell us about that moment.

Min. Al Amiri: So, our journey was relatively uneventful. Just sending something that's completely new, by uneventful, yes, we had a few glitches here and there, and hiccups here and there, but nothing that is not expected – which is good. Which is what you want when you're heading to another planet before you enter into orbit around that planet. This is a heavily rehearsed sequence. We've been rehearsing getting to Mars. We've tested it on the spacecraft on the ground. We tested it while the spacecraft is in the path. We have a replica of the spacecraft on the table that we also test that sequence. So, this was a heavily rehearsed sequence. So, you have a part of you that is confident, that you as a team with the collective power of people with years of experience that have done things right, and have done things wrong and learned from it, behind you. So, you have that confidence that you've done everything your power, but at the same time the success of this mission rests on a 30-minute burn of most of the fuel that you flew on this spacecraft. And it's the worst position that the spacecraft could possibly be in, to get into orbit around Mars. So, it's that continuous sort of balance between, yes, we did everything in our power, but we can't control the outcome beyond this point. We had no real-time communication with the spacecraft because of distance between Earth and Mars. And therefore, any glitch of any sort, the spacecraft needed to react on its own. And I think that's what factored into a lot of that apprehension during that time. And I think a teachable moment for all of us was you can do everything in your power and understanding, and you can mitigate risks, and you can be the best designers out there and have the best team out there, but you can never guarantee success in certain – in these situations. And it was an amazing learning opportunity for me. It was an amazing learning opportunity for a lot of my colleagues, who then became friends on the back of this mission. So, it's – I always call such missions and such planetary exploration missions, due to their complexity, a human-building journey, and a personality-developing journey, on top of all the technical aspects that go into it.

Ms. Easton: How so? How is it a personality-building journey?

Min. Al Amiri: It's like I said, there's a lot of unknowns that you're operating with, just by the nature of the business. You need to live with a lot of risk. We went into this very early on knowing that only half of missions succeeded. You're building a spacecraft for the very first time. So, what we have today around orbit, we never sent another one out there. We don't understand its performance apart from what we've studied here on the ground. So as much as you turn a lot of the unknowns into knows, the space of the unknowns is quite large. And doing that on, again, an international – so, sending a spacecraft to Mars, you're doing it on an international venue. You're doing it in front of the world. And it's just an immense learning opportunity and an immense learning journey that goes into it. So, it was – for me, personally, it was a technical endeavor. And, again, it was a character-building endeavor moving forward, throughout the last seven years.

Ms. Easton: And it was also quite a feat for the second-largest economy in the Middle East, the UAE. But it was also an international effort. So, could you talk about some of the other partners behind it, from the Japanese rocket ship to University of Colorado, Boulder's role?

Min. Al Amiri: Absolutely. So, doing this for the first time you need to rely on experience and expertise so that you're able to maximize scientific return. We had an objective of gaining more experience in design and development of complex technology systems. We'd never married scientific objectives with technological development in one program. So, these are all aspects that we require as an economy that's growing and flourishing, and as an economy that is infusing technology as one of the pillars of development moving forward. To be able to do that, the only way you do it – is like everywhere in the world – is to work with people with experience and develop those capabilities. We didn't have the experience as a country on building planetary exploration missions. We had experience prior to this mission working on designing satellites that go to Earth. Again, factor of complexity is roughly five times more complex than any of the other programs that I've worked on before. And therefore, partnering up with the University of Colorado Laboratory of Atmospheric Space Physics, with a group of amazing researchers and engineers and scientists who've done this before, who've made the mistakes and know how to avoid them, and had the successes moving forward. And we just amalgamated an entire team across two institutions. We operated as the Emirates Mars Mission team, as the Hope Mars Mission team, and worked hand-in-hand on designing and developing the spacecraft to the state that it's in at the moment. And on top of that, again, it made a lot of sense to make sure that we used a launch vehicle that is reliable and that can get us to our necessary orbit without incurring additional burdens on the program. And therefore, after a selection process, we went with our Japanese partner and selected the launch vehicle after Mitsubishi Heavy Industries. And that's not only – that's, like, the top layer of any international collaboration in space. Like, you know, there's a lot of components that go into

space systems. And across the world you utilize companies from everywhere to be able to source a lot of these components that go into your spacecraft. And it's just – I love working in the space sector because of its internationality and because of the diversity in thinking from a technical perspective that flows into any mission design and development. And that has immensely impacted the success of this mission and allows us to think of a new approach of designing and developing. Like, you know, it took us less time to develop such a mission, as a much lower cost and price point. And just getting those different perspectives of design or development experiences, risk appetites, together allowed us to redesign the process by which you design such a spacecraft, and the process by which you select your scientific questions, and the mechanisms by which you go about managing such a program. And allowed us to meet our tight deadline and allowed us to meet what we've been told very early in the mission, that you're not getting an additional budget. And there's no way out of this, and it's just – and I'm really glad. I think those constraints were a bit of an annoyance early on, but I'm really glad those constraints were imposed on the project team in terms of the timeline, in terms of the costs, because it allows us to innovate in ways that we wouldn't have. Because you sometimes take time for granted, and you sometimes take budget for granted.

Ms. Easton: And you didn't have time because you were – this is part of the jubilee celebration. Talk about that. And why did you name this orbiter Hope?

Min. Al Amiri: It is part of the jubilee celebration. It is a mark of transition for the country. Like I said, we are continuing to transition as an economy. We completely understand the role that science and technology across the spectrum, the role that research and development plays, the role that technological advancement in industries today, and the deployment of technologies in industries today, can play in further sustaining our economy and ensuring that we continue the growth pattern and continue the stability that we have within the country from both an economic perspective and also from a social perspective. And that drove us towards having such a mission and drove the team within the UAE to have such a mission as one of the cornerstones and one of the pillars by which today we are seeing scientific findings. And it's a completely new experience when you're handling data for the very first time and finding artifacts that is not written in books. We've never experienced that before. And it's just such a mind, I think, shifting moment to be able to experience that full circle, and understand the magnitude of what scientific discovery really is.

Ms. Easton: Yeah, so we'll go back a little bit later and talk about that rise of the knowledge economy and the role of women and girls in that as well. But let's go back to the Hope mission. Again, the name Hope. Why?

Min. Al Amiri: Yeah. So, if we go back to when this program was conceptualized in late 2013, the region was coming on the back of a lot of instability. And a lot of it was due to the youth not having a voice, not having opportunities, and not having basic

access to stability within the region, and access to opportunity. And for us, it was a – putting together – the UAE's government and prime minister was putting together a program that, one, empowers youth, that make up a large portion of this region, and empowers them on a very risky program. At the time that we started this mission I think we were all 30 and under, the project team.

Ms. Easton: That's amazing. (Laughs.)

Min. Al Amiri: Average age, I think, today is 27-28. We've aged a bit. (Laughs.) And it's – it was – it was quite a mark – sort of mark of hope that, yes, entrust the youth. Yes, provide them with the opportunities, provide them with the tools. And see how they rise by using science and technology as a mechanism to infuse development. And that was the reason behind the selection of the name.

Ms. Easton: That's very powerful. And what percent of those engineers are women? Was it 30 percent?

Min. Al Amiri: Thirty-four percent are women. And what's remarkable for me is that the science team that I used to lead during the development started off as 100 percent women. As a diversity push, we managed to get 80 percent women into the team. So, everyone was there. We never went into this – as you know, we were rushed into this program. We never went into this with a sort of, sort of let's check the box and make sure we have enough women in this. It was more of an approach of finding the right people in the right job. And it's not surprising from that context, because we continued – at least over the course of the last 15 years there's been such a large rise in the number of STEM graduates who are women out of universities in the Emirates, and also out of students that are studying abroad from the Emirates. And we continue seeing that rise, which is good until you reach gender parity. But we continue to observe those numbers to ensure that we have gender parity, because diversity in science is always important. You never want to skew one way or another.

Ms. Easton: Tell us why. Why is it important?

Min. Al Amiri: Different – it goes back to what I spoke about earlier. Science thrives on asking questions. And asking questions – the basis of that is differences in perspectives, differences in experiences, differences in the way that you think. And that's why diversity plays such an important role in pushing science forward, and pushing exploration forward, that we need to be conscious of ensuring that there's diversity in teams. And I've seen that across teams, where there weren't – and I'm talking about diversity not only in terms of gender. I'm talking about diversity across the board. And I've seen that in teams that I've worked – that don't have a lot of diversity. And you see teams that have such a nice sort of amalgamation of perspectives be quite innovative and quite understanding of – and it's quite a different environment to work in.

- Ms. Easton: I love hearing that from you, Sarah, because a lot of companies today talk about that, you know, diversity drives innovation. But to hear that on the ground. And I love that, as you put it, it's about questioning. The root of innovation is questions, right? And you get better questions if you have diverse perspectives. I think that's incredibly profound and fundamental.
- Min. Al Amiri: Exactly, Nina. You wouldn't be able to advance without that. And I think all of us as leaders, as team members, need to ensure that our – whatever it is, and I do that across my teams, not only on developing and mission to Mars – is to ensure that there is always a voice heard and there's always differences in perspectives. Because that's the only way that you, one, see blind spots and avoid having a lot of blind spots. And, like you said, that's the only way you can innovate.
- Ms. Easton: And now Hope is, obviously, still going around in orbit. And tell us about – I love the mission of Hope, which has some relevance to Earth and our climate issues. What is the fundamental mission? What's the scientific question that you're looking to address?
- Min. Al Amiri: So, we're looking at three different science questions. On Mars, first, we are observing the weather system in Mars, throughout an entire Martian year during all times of the day. So that's a gap in knowledge that we're filling in because prior to this mission we were able to observe Mars' weather, but during only two times of the day. And, like, we know it's not comprehensive to study any planet's weather system during two times of the day. So, we're getting that full understanding of the weather system on the entire planet. Two Earth years is equivalent to one Martian year, and therefore we're able to cover all the seasons during all times of the day. We also look at loss of hydrogen and oxygen from the upper atmosphere. Loss of that, of course, is historically one of the reasons that we – that they theorize that we don't have liquid water on the surface of Mars. And escape is one of the – one of the factors that has played a part in the transformation of Mars from a wet planet to the planet that we see today. And the third question that we're trying to do is we're understanding changes that are happening. So, cloud systems formations, dust storms that are happening in the lower atmosphere, the weather system in Mars. And if any changes happen in the lower atmosphere, how does it impact loss of hydrogen and oxygen? And that will allow us to better understand a gap in the knowledge of what role did Mars play in the loss of its atmosphere and escape of hydrogen and oxygen? So, we continue today to observe the planet during all times of the day. It takes about 10 days to cover the whole planet at all times. And as we are moving forward today, the team is processing a lot of the data that has been captured during the start of the science phase of the mission. The purpose that we're going full steam ahead and processing this data is we want to release at least two to three months' worth of datasets at the beginning of October so scientists around the world can benefit from it. And then from there, our science team will start analyzing that initial batch of scientific data to see what they've found.

Ms. Easton: So, I was joking with you before we started. It's probably that loss of oxygen and hydrogen. It's not from aliens driving fossil-fueled vehicles. (Laughs.) But, that said, I assume you see some relevance to what's going on in the Earth's atmosphere that this might conceivably be helpful in understanding.

Min. Al Amiri: From a macro perspective, studying planets that are like Earth – that have atmospheres like Earth, that sort of looked like our planet – and Mars is the closest object that we can go to, or send a spacecraft to, and study extensively that, quote/unquote, “resembles” Earth. That allows us to have sort of a macro lens on what happens to planets, what happens to their evolution, what could happen to our planet. So, it gives us better understanding. And it's really hard to pinpoint exactly where the correlation is, because if I talk about the Emirates Mars mission, a lot of the other spacecraft that are currently around Mars, the kind of science that they're doing is novel science. And what that means is that we have theories, but we've never captured extensive real datasets to be able to validate and verify our theories. And that's why it's very hard to find a correlation. And I think that's the beauty of space exploration. You don't really know what you're going to find out.

Ms. Easton: And speaking of which, we were talking about – so you are going to be getting some public – you're going to publicly release some of your findings in early October, but you hinted that you have found something – and hopefully you can talk about that here – that you didn't expect.

Min. Al Amiri: So, one of our instruments can capture images in the ultraviolet. And Mars, as we know, doesn't have a magnetic field like Earth. It has small pockets of, like, magnetic material that creates a form of the magnetic field. And that allows for auroras to form. And the auroras cannot be seen by the naked eye, but they can be seen using an ultraviolet spectrometer that we have flown on our spacecrafts. And so, we have some scientists on our science team that have done that kind of research. It's not 100 percent correlated to the three science questions that I spoke about, but we were able to observe, using our instruments, those discrete auroras. And today, just with our current observations, we're able to capture data and characterize a form of auroras on another planet that will give us better scientific understanding on their formations and how they evolve throughout the night cycle on Mars. And it's quite impactful for science. And for us, it's nice, surprising science to get on the back for us. Bonus science, as I told you, on top of what we are going there to discover.

Ms. Easton: So, are there amazing photos we're going to be able to see, amazing imagery?

Min. Al Amiri: Absolutely. So, we had very nice images taken so far of Mars that could be seen. Some of those will be attached also to the scientific findings to better explain. And for me, the most beautiful image was the very first image that was captured about Mars. And it was quite beautiful because – so I spoke to you about,

for example, the cloud systems on Mars and how they form over different locations, and why it's important to study it at different parts of Mars. And luckily enough, we were able to observe a lot the things that we talk about conceptually, that you can only see using an infrared wavelength of ultraviolet, you saw it there on that very first image. So that, for me, was sort of a visualization of what we've been talking about for so many years. And provided very nice indication on what the science is going to be like.

Ms. Easton: That's very exciting. Could you just give us some context? There's other – other vehicles have orbited or are orbiting Mars. What's going on? What countries are doing what?

Min. Al Amiri: So, there's several countries that have spacecraft that are alive, either on the surface of Mars or orbiting the planet. And like Earth, we continue to study Earth and we are here, and we continue discovering new things. There's a lot to study about Mars. And for us – so there's an Indian mission there. There are several missions from the United States there. There's a Chinese orbiter and a lander and a rover that's currently on the surface. And that – and there are also European spacecrafts that are orbiting the planet. Those extensive sort of datasets are complementary. And we ensured that our mission is complementary to other missions but fills in a gap of scientific knowledge. And by sharing this data, and other countries around the world as well share this data, and we pushed really hard to ensure that there's no embargo on our data. So, our scientists don't get a lot of time to analyze the data, other than processing it for use, before we put it out to the public.

Ms. Easton: So, it's raw data and there's an advantage to that?

Min. Al Amiri: It's raw data. It has levels of processing that scientists can grab off of our website in October and start doing their own analysis, while our team is doing their analysis as well in parallel. That maximizes scientific output, because you collect a lot of data, and you look at what's interesting to you in those datasets. And, like we saw with the auroras, you will always get bonus artifacts that are captured together with what you're looking at. It's like when you're looking at a telescope. You'll see what you want to see, for example, if you're looking at a launch. But you'll be able to see other things together with it. So, you're maximizing the utilization of scientific data. And I think it's very important when you invest a lot in scientific experiments – sending – like, collecting data out of scientific experiments. I think it's very important to share those datasets, because there's only so much you can do and extract from, that it's based on your own objectives and your own hypothesis. But there's a lot of scientists around the world that can also extract valuable information out of those datasets, and benefit. So, the most people that are working on datasets – I think this echoes across all sectors. This is not a space sector aspect.

- Ms. Easton: Sure. It's wonderful to hear. Let's talk about your journey if we could. You talked – in the past you've talked about looking up at the sky when you were 12 years old. What did you see and what inspired you?
- Min. Al Amiri: So, the – I always speak about the – I enjoy the vastness of space, if that makes any sense, and the boundlessness of space. So, it was always a philosophical journey that – and a philosophical thought journey of the significance of space. And I was really interested in understanding what are the galaxies? How many stars are there, planets? And just imagining sort of the plethora of worlds that are out there, and that are quite starkly different than where we live in. And that has been a fascination all along for me with space, but it's always an area that I never dared to work on. We didn't have a space program at the time. That was some time in the early '90s, I believe. We didn't – I don't think we had a satellite even in space at that time. So, it wasn't something that you would go, like, yeah, I want to be an engineer that works on a space program. And, lo and behold, I was fascinated by engineering. I loved the world of computers and how computers were built and wanted to design my own computer and therefore set my sights on computer engineering – the next best thing after space. (Laughs.)
- Ms. Easton: And tell us about, yeah next best thing. Tell us about your studies in computer engineering, your degrees and where you studied.
- Min. Al Amiri: So, I studied at the American University in Sharjah back home computer engineering, with both my undergraduate. And then a few years into working part time I finished also my graduate degree in the same program. Upon graduation I fell on the Mohammed Bin Rashid Space Center completely by accident, by answering some random ads on "we are looking for computer engineers if you'd like to apply." I believe it was the first place that I applied to after graduating. I went in there, interviewed. They were finalizing the very first satellite that was launched, Dubai SAT-1. I was grateful to be part of that program, and then – and the subsequent programs moving forward. So, I started my journey there working as a software engineer. And it was just – I love how serendipitous that was, how things, like, fell into place. And it was an interesting journey.
- Ms. Easton: And you – and at the time – wasn't that the beginning of the space program for the UAE, celebration of its 50th anniversary?
- Min. Al Amiri: So, the long-term aspect of that was to develop capabilities of engineers. So, we were all hired as fresh graduates. We worked on design and development of various aspects of the spacecrafts or the ground system. The institute – the center was established in 2006, I joined it in 2009, prior to the launch of the very first satellite. And we continued on our Earth observation design and development spacecrafts. And then the Mars mission was a large leap for us in terms of capabilities and in terms of sort of pushing the balance forward. And

it was really interesting, that decision and the way that it was made. It was actually a request that we got from our prime minister of moving from Earth observation to planetary exploration. I think at that point I didn't really understand why, but today it is – it is what you called a shock to the system, by which it was a turning point for us within the organization which you can either amplify the speed of development and amplify the output of development or you can stagnate as an organization. So that was an interesting sort of influx and interesting point in retrospect that is – that is a very important learning for myself in understanding –

Ms. Easton: How about you personally? I mean, what was your reaction to it? Like, this is crazy? Or this is something I want to be on board?

Min. Al Amiri: No, I – my – so the first people who are working on this are myself and our project manager Omran Sharaf. I think the first day that we were asked about this was the day of the launch of our second satellite, Dubai SAT-2. And weirdly enough – and we both always talk about this – we didn't think it was crazy, for some reason. (Laughs.) It was just, OK, so you want a feasibility study on whether or not we can go to Mars? OK, let's look into this and see how we can do it, and what is the design approach? And what are the aspects that could be developed? What capabilities do we have or what capabilities do we need to pull in? Who are the partners that are potentially out there? And so on. So that was the mechanism that we usually worked on, which I think was very good in the spirit within the team, to take on something that may sound crazy in retrospect and be able to sort of structure it into a program.

Ms. Easton: And you have two children. I think you said your little boy is a Star Wars fan? (Laughs.)

Min. Al Amiri: My little boy enjoys Star Wars. He's now thoroughly into Avengers and the different worlds. And he speaks to me about shifting universes and getting to planets. (Laughs.) It's quite an interesting journey that I've seen my children go through and the language that they've spoken about. They've lived through this mission. My son, I think, was three or four when I first started working on this program in particular. And I see this in the children of those that have worked on this program, on how it's impacted them. And what's really good about this is I've seen this in the children of people that are not working on this program within the Emirates. So, you see a large impact in language, in what is possible. And it's OK if somebody comes up and says, I want to be an astrophysicist, as an example. That was something that –

Ms. Easton: Has the country seen movement in the numbers of young people studying just anything from STEM to astrophysics?

Min. Al Amiri: Yes. There has been a large drive in STEM. And we've always, by the nature of the businesses and the sectors that we have in the country, we've always had

large numbers of engineers graduating. But I've seen a large increase in the number of people graduating from natural sciences, which is very important for the sustainability of any knowledge-based economy. And today I was sitting with an intern who was working with us working on astrophysics. Even this year for people completing their graduate studies a lot of them have submitted for scholarships to, again, study astrophysics. That was an area that I never imagined people would get a degree in, let alone a graduate degree in.

Ms. Easton: So, obviously, you've seen a lot of women do that. You know, do you see – even if there's opportunity there, we often see in the United States women – there's sort of an inner restraint that a lot of women have about pursuing this, whether it's culturally or otherwise. What are you seeing among the women around you? And what advice would you give to women who don't think that this is something they should pursue, or can pursue, or, you know?

Min. Al Amiri: So, the two examples I just gave you were both women. So, I am seeing a large influx in women, especially participating – or, moving forward with a graduate degree in an area of science and natural sciences. And it's – my perspective on the whole sort of aspect of whether or not you can do something is a personal sort of inner choice, if that makes any sense. If you want to listen to biases or if you want to completely ignore that those biases exist and push forward. Yes, challenges may exist along the way. One, challenges pertaining to the field itself and then, two, perhaps even challenges with people that have inherent biases around you. But if you sort of deafen yourself to those, I think it's easy to push forward – not easy. But it's easy internally to get to the strength to push forward and circumvent those. At the end of the day anywhere its output what's important, it's impact what's important, and how to move forward with it rather than hindering and putting blocks for moving forward.

Ms. Easton: And what's your – I guess, what's your inner conversation with yourself when you're facing a huge obstacle – like, for example, going to Mars? (Laughs.)

Min. Al Amiri: (Laughs.) Depends on the day, to be honest. It's keeping your eye on what the overall objective is, and what you want to get to, and why it's important in the larger context of things. So, for me, that's what's important. At the end of the day, I believe that I'm part of society and therefore it's my mission to contribute to society in any way possible, using the maximum amount of my own skills to the maximum of my ability. And that's what I hold myself accountable to in any role that I perform. And it's always that sort of taking a step back and understanding, OK, why is this challenge important to circumvent in the larger scale of this? How does it answer to my own values, my own purpose in life, to my own role within society as a whole? So that's one conversation. Another one is usually external. So, it's not always your own inner voice that you derive strength in. It's the people that you surround yourself with because you can sometimes be blind to whether or not you're driving yourself hard enough. And I have a group of people around me that are brutally honest, and to the

point, and will call me out. And that, for me, has been a – is a valuable part. And I would do the same to them. And that's a valuable part of my life, to ensure that it's not only an inner conversation. Because you can – you can go askew personally. But it's always – it's both an internal one, and also an external one, to ensure that you're continuously driving forward.

Ms. Easton: So, it's a – it's people who call you on when you're resisting moving forward, is that what you're saying?

Min. Al Amiri: Yes. And people who call you out when you don't challenge yourself enough and tell you: No, you can circumvent this challenge. Why are you giving up on it? And that has been – I'm quite grateful to having these people in my life because, for me, there has been moments where – which is normal – where it's just gotten really hard. Even on this mission, there were points where it's gotten really hard. There were challenges that we were faced with where you took a breath on what did we get ourselves into? And it's really important to have that – I don't want to call it a support system, but more of a driving system, to ensure that you're continuously delivering on what your committed to, especially if it's something that is important to you.

Ms. Easton: So, as we sort of move up on – I'm running out of time – I did want to spend some time on the future. So, you've got – tell us about where Hope goes from here. I think there's talk of a spacecraft – landing a spacecraft on Mars. And there's also talk of a lunar mission. Could you describe what's coming up?

Min. Al Amiri: So, we are looking at the larger perspective of things with regards to the space sector. And I'll take a step away perhaps from space exploration into the space sector itself, and why that sector is important for us in the country. The space sector does have both a social implication, as we've seen from the Emirates Mars mission. It has a scientific driver implication with which it feeds into academia, and it feeds into driving a lot of people into STEM and creates a lot of opportunities. There's a third lever that's very important, where it also drives economic benefit. Taking all these three different aspects together is our mission today at the space agency. And that's marrying exploration missions together with commercially viable datasets and products and services into developing smaller satellites and that have commercial value and are able to provide us with data that feeds into different sectors and creates a necessary ripple effect. That's the focus area that we're currently working on today. The lever by which the exploration missions will play into is continuously developing capabilities. Like I said, an interesting lesson learned is that sort of trigger ignition. Exploration is that ignition that you give towards your economic diversification and the sort of simulation of your space economy and the private sector within the space sector. And then everything else then is able to indirectly feed off of that and be able to create those necessary challenges. So that's the approach that we're taking. And as we continue to design not only the commercial missions, the commercial opportunities for the private sector,

and also what are the right exploration missions to be able to serve those purposes. And each mission will serve a different purpose. And what I love about it, all of them further scientific discover regardless of what purpose it serves for us here on Earth in terms of the development.

Ms. Easton: Great. And I have to ask you, we've had a number of astronauts – women astronauts on our Smart Women, Smart Power. Do you envision yourself going into space someday? Is it hard to be down on the ground when, you know, others are out there?

Min. Al Amiri: For some reason, I don't. I did at a point in my life, but at the moment, no. I enjoy the area of the space sector that I'm working on. I don't think I'm cut out to be an astronaut, or perhaps has the necessary passion or drive to be one. There are great women and men around the world, and here in the Emirates, that are pursuing those careers. But for me, it's – I have quite a passion in bringing together those different policies that drive a lot of transformation in the country. I think I found the sweet spot in STEM that I love working in.

Ms. Easton: And it's great. Knowing yourself is probably an important confidence builder too. And it sounds like you really know yourself. And, Sarah, just final words on where you see exploration of deep space playing into Earth's future, and the future of us?

Min. Al Amiri: As we continue as human beings to be inquisitive, space exploration will always be something that we endeavor to do. And it's something that is quite important for us to understand our own planet, as it is studying anything here on Earth. Exploration will continue to be on the agenda globally for governments, and also for private sectors that are using it as mechanisms by which they stimulate development and push development forward. It's something that we will continue to be committed to as humanity because of our inquisitive nature, but also because of the benefits that we've seen from exploration that are the amazing unknowns that we discover.

Ms. Easton: Sarah, we wish you so well in your Hope Project. I think it's so aptly named. Thank you so much for sharing your story and the story of the Hope Project with us. We'll be watching you, especially starting in October.

Min. Al Amiri: Thank you, Nina. And thank you so much for hosting. It's been an amazing conversation with you today.

Ms. Easton: Thank you, Your Excellency. And thank you to everybody watching us. Please join us for our next Smart Women, Smart Power event. And don't forget our podcast, Smart Women, Smart Power, you can find at the CSIS website and beyond. So, thank you so much for all – to all of you for joining us.

