

Eric Berger:

Walking up the stage, so I think that we're good. Now we got a real treat for you today. We're going to have Lori Garver come up, and we're going to have a great conversation about commercial space. Now, to the extent that you may be aware of Lori or familiar with her, she was the Deputy Administrator at NASA during the Obama administration. But, she's much more than that. And her legacy really isn't that. Her legacy, I think, was in space last month when you had not one, but two Crew Dragon launches. And one of those missions was the first private mission to the International Space Station.

Eric Berger:

Of course, Elon and SpaceX deserve a lot of credit for that. They built the hardware, they did the hard work. But there's just as an important piece of that, the policy piece. And there were lots of people in DC who were pushing against that vision a decade ago when that groundwork was laid, but Lori was really the champion for that vision. And so, Lori, why don't you come on up and we'll have a discussion about where NASA was, and where it's going, and some other things, as well.

Lori Garver:

Thank you.

Eric Berger:

So, I think the first thing I want to do is just define what commercial space is because you always hear the argument, well, we went to the moon in the 1960s and it was private companies that built those spacecrafts. So NASA's still giving money to SpaceX today. So what is the difference now versus then?

Lori Garver:

Sure. There are procurement mechanisms that the government typically uses for a really high technology program they like to call cost plus, which is a FAR based program, federal acquisition regulation. And when you do that, the government gets to set the requirements and make changes, and the companies get paid no matter when they deliver, and they can always add more. So cost plus is the cost they bid it, plus any other amount you want to add. And usually those programs double in cost and schedule.

Lori Garver:

So what we were interested in doing was a partnership. We call it a commercial partnership, which meant the private companies had skin in the game, and they had to put their own resources in, and they only got paid a fixed amount. And that was something that was started actually in the 1990s to try to do this for low Earth orbit space transportation, because the government's been doing that for 50 years. But NASA was reluctant to turn that over to the private sector for astronauts.

Eric Berger:

Yeah, for sure. And I think one of the really powerful things about the fixed price contract is you only got paid if you actually delivered. You got the little money up front, but you had to actually build the hardware and deliver it to get a check along the way.

Lori Garver:

Yes. And a partnership is a little different than a fixed price contract, too, because fixed price, sometimes the companies still end up getting more because NASA changes the requirements.

Eric Berger:

Yeah. So, when you-

Lori Garver:

Or the government. It's not just NASA. This is typically done, and the Defense Department is-

Eric Berger:

Yeah. So when you were at NASA, as you say, they'd been going into low Earth orbit for almost 50 years with people, NASA had. And so as you're coming along and trying to implement this more public private partnership, what was the reaction in NASA? Because I know in large organizations, if you try to change things when things have been done the same way for a long time, it maybe is difficult. I don't know.

Lori Garver:

Well, the relentless momentum of the status quo exists for most government contracting because people who are paid to do something aren't interested in someone lowering the cost and then being able to do that, and therefore you're not going to make your money anymore. Fair enough. But the government should be about getting the taxpayer the best value. And NASA had actually decided to do that a few years before. So I came in 2008 with the transition team for the Obama administration, but the Bush administration had decided to do it this way for cargo. And NASA had pretty much accepted to do that with cargo by the time I got there again. I was also at NASA in the nineties.

Lori Garver:

But for crew, the astronauts didn't want to do that. And most of the companies that are involved, it's the self feeding cycle. Dan Golden, who was the head of NASA in the nineties, called it the giant self licking ice cream cone. Why would someone want to get off that sugar high if they can keep lapping it up? So it was not popular. I was not popular. And members of Congress with the jobs in their districts from the traditional contractors fought the change, and never really funded it fully, and really tried to cancel it.

Eric Berger:

I was a journalist at the time at the Houston Chronicle writing about space, and I can just confirm Lori was not popular. You've got a book coming out called Escaping Gravity, and it's coming out in June. And it tells a lot of the story about trying to make this change. And one of the things reporters love about Lori is that A, she'll talk to us, and B, she'll tell us like it really is. And you tell a lot of great stories in that book. I'm wondering if there's maybe one story you want to relate here about your experiences then that captures the challenge of pushing commercial space forward.

Lori Garver:

There's so many about the challenges. I was particularly having a difficult time with the delegations that were most wedded to the existing way of doing business, and a one on one with Orrin Hatch and the Utah delegation comes to mind. But he's recently passed, so I won't dwell on that one. I finished it in the book before then. But in your face was his style. And so, I want to jump to where we were at NASA,

starting to trust SpaceX in delivering cargo to the space station. And we had a time when, I think it was the second mission, the thrusters had a problem after launch, and it wasn't going to be able to dock with the space station. Well, this was a huge problem because I knew that any successes that SpaceX kept having just meant we could live another day until the first failure, because if they failed, the haters would've shut it down.

Lori Garver:

So I was very nervous about this problem with a thruster. I was at the Cape, I went over to SpaceX where they were working on it. We only had about 40 minutes to get it done before you'd miss the opportunity to dock. So I'm with the lead NASA people standing in the back, and now this is a new kind of contract. So SpaceX is responsible. And I think the key people at NASA, one of whom now works for SpaceX, was reacting more, I felt, like a grandfather than a father. He was letting them make their own mistakes. And I'm going, "Don't you think you ought to just tell them? Tell them what they need to do?" Because I was really invested in it working.

Lori Garver:

And I have described it in the book as they're taking their grandson fishing. And instead of being the dad who takes over the rod, they say, "Why don't you go see if there's some fish over there?" And I knew at that point, NASA was as invested in them succeeding and that's what it took to succeed. And by then I thought, okay, we're going to have ... And by the way, they got it worked out. They docked with space station within the time period. And I thought then, okay, that's another step to us letting them fly astronauts.

Eric Berger:

Yeah, that was, that was the second demonstration flight of Cargo Dragon, and that was ... yeah, pretty hairy. It was close. It was a close call. So we've come a long way in less than a decade in terms of NASA's attitude toward commercial space and the Commercial Crew Program you help start. I want you to talk a little bit about how Commercial Crew in particular has changed how NASA, and even how Congress, I think, policy makers view it. Because if Cargo Dragon didn't exist, we would now be reliant on Russia to fly to the International Space Station. And that just would not work. Right? I mean, can you imagine dealing with them in this environment, and trying to get our people to and from the space station? So talk about how and why Commercial Crew has been so instrumental to changing that perception of what companies like SpaceX can do.

Lori Garver:

Well, it was difficult to really be able to make the change because she was retiring at this time, and all the jobs, and contracts, and just people invested in the Space Shuttle program. That was what we did at NASA. That was something that the American people counted on NASA to do. NASA's plan to replace the Space Shuttle was long over schedule and over budget. And so our plan, it was called consolation, was to replace that with this partnership program called Commercial Crew. And I think I'm reluctant to say nothing would've ever happened with that program if we hadn't canceled it, but it definitely ... I'll just give you the perspective in dollars. That was a 40 billion dollar program. And we spent six billion dollars over five years to get two companies to deliver Commercial Crew.

Lori Garver:

Historically, if you look at NASA's budget and the number of astronauts we've flown, we've spent about a billion dollars per astronaut. We've flown about a billion ... We've flown around 350 people in space since Apollo, and we've spent about 350 billion dollars. SpaceX is now charging 55 million a seat. So to the extent that we think the government should be paying for government employees to go to space to do something, buying a seat for 55 million from a U.S. company that, by the way, that investment has allowed them to win back market share for launching satellites that the U.S. had basically lost entirely to the French, Chinese, and Russians, has allowed our economy, our national security, everything to be enhanced.

Lori Garver:

And so the astronaut piece was important to NASA, but to me as a public policy initiative, it was really all about lowering the cost of getting into orbit, getting the taxpayers the best value, and allowing NASA to spend its billions on things that are unique to its mission. And those things tend to be when astronauts are involved, what people think of like going back to the moon or eventually going to Mars.

Eric Berger:

Yeah. And it's, there was a NASA ... NASA did a study several years ago looking at if they had independently developed the Crew Dragon capability for Cargo to deliver to the International Space Station. If it had done it, done the traditional model, the traditional model contracts, and so forth, it would've cost four to 10 times as much as what NASA was paying the private industry to do. And so there are very real cost benefits. And we're going to talk about the good side of that, and also the bad side of that. I don't know if you notice, but Elon Musk is not the most popular person in the world, and he has ... want to talk about whether ... how much we should hand over our space program to him.

Eric Berger:

But first of all you lived through the Commercial Crew Program and those wars, and that was a difficult problem, moving the government, and a lot of people on the hill who did not want to move with you on that. But, you've since gone on into Earth science. You're the founder and CEO of Earth Rise Alliance. And I'm wondering are there lessons you learned from dealing with Capitol Hill and on commercial space that might be applied to dealing with, seemingly, in track with problems of climate change policy?

Lori Garver:

Yeah, I think there are some general things that NASA drove that can be meaningfully transferred to other very important things. And climate change happens to be what I'm really focused on now, and how space really, what we learned about the Earth's climate we have ... about 80% of that knowledge has come from satellites and being able to have that perspective of space. But the biggest thing from Commercial Crew that helped is to realize these dictated, I have said before, socialist type programs that NASA was used to running. Apollo, we set a goal, we just put money on it. We put people on it. We will plant the potatoes in March. That's what we have been doing in human space flight. But it took us trusting, I think, the ... Not just SpaceX, certainly. Boeing, here next week, is about to test their crew launch vehicle.

Lori Garver:

It takes us thinking of allowing more than just government employees the ability to tackle some of these problems. And climate change, where governments have been, and this administration, certainly, doing their best to rally the troops. I guess I'm in favor of putting some goals out there and letting more

people find innovative ways to solve them. And because of the space program, really, I think we have the ability to see our planet. I say in the end of the book, the most important thing we learned when we went to space was ... Certainly when we went to the moon, the Apollo astronauts to a person said it. The most important thing we learned was about planet Earth, and that we are in this together. And that unique perspective has allowed us to communicate instantaneously. Now we can have every person on the planet with an idea be able to contribute.

Lori Garver:

We should allow nonprofits, the private sector, academia, and the government to work to solutions. And the point for Commercial Crew was it's the end state that we asked for. We asked for you to transport astronauts to the space station. If you could do it, we'd pay you when you get there. Okay. Well, why not set goals? We all know what they are. Lower greenhouse gas emissions. It's similar to every aspect of our lives. People want healthy ... the ability to live in a peaceful and healthy environment. Well, why don't we look at some end state goals and try to let more people deliver solutions? That's, I think, the true success of what we did at NASA.

Eric Berger:

I would absolutely agree with that because where NASA wants to be today is, it says often, it wants to be one of many customers. It wants to buy services, as opposed to, from a top down standpoint, dictate what it wants industry to build, and then be there side by side industry every step of the way. Instead, you could just say, look, we want to lower CO2 levels, or CO2 emissions, or methane emissions by this month, this much, and we'll pay a premium to do that. But it's incumbent upon you to come up with the best ways. And because that's really the magic of the commercial space industry today. Your modern day counterpart Pam Melroy frequently says the U.S. commercial space industry is the envy of the world. And she's absolutely right. That is what is keeping us ahead of China in space, is the innovative solutions that we're getting from entrepreneurs in this industry.

Lori Garver:

It was so striking when we put out our first budget request in the Obama administration, and it asked for this change, to have the private sector do this rather than the government, Congress was furious. And yet when I went overseas, that was the response I would get from reporters asking what was the response overseas? I would say envy. And then you knew you were on the right track.

Eric Berger:

Yeah. And Congress was furious.

Lori Garver:

They still are a little bit.

Eric Berger:

Some of them. Yeah. So let's talk a little bit about harnessing the good parts of commercial space while managing the risk to the government. Because when you're not doing it ... And by the way, the current administrator of NASA is Bill Nelson, former astronaut. Last week, said cost plus contracts are a plague on NASA. And the significance of that is he authorized most of those cost plus contracts when he was a

U.S. Senator. So there is definitely a changing attitude coming. But as the government doesn't like cost plus contracts, it loses control.

Eric Berger:

And so I want to talk, first of all, about whether the innovation we've seen in Commercial Crew and commercial space would be possible without the Elon Musks and the Jeff Bezoses who have invested literally billions of dollars of private capital that a corporation like Boeing, or Lockheed, or Northrop would not have done.

Lori Garver:

Yeah, it is fascinating how this evolved because I was at NASA leading the policy office in the 1990s. And the head of NASA at that time, we'd known the Space Shuttle should be retired. We'd already had the Challenger accident. The replacement program was going to be a public private partnership. And Lockheed Martin won phase two of this. And they put in 350 million of their own money to do a demonstrator mission. NASA put in about 900 million, and this was over a couple of years. And then they were going to be responsible for taking that to full ... This was just a test demonstration, to take it and get the investors for it, and make a go of it with the private sector. This was pre internet bubble. This was year 2000 when people still thought we would ... That was that burst of communication satellites that we thought were going to happen and lower the launch costs. But we did not foresee the billionaires being the company that ... the companies-

Eric Berger:

Before you talk about that-

Lori Garver:

Yeah.

Eric Berger:

What happened to the Lockheed Martin venture? Tell us-

Lori Garver:

Well, so they had a technical problem when they were testing their composite tank, and they blew the tank on a test. And it would've cost ... in research to the book, the range is from 30 million to 300 million to fix it, depending on who you ask. And because it was a partnership, and Lockheed had already paid 300 million, they didn't want to do it. The government didn't want to do it. And the giant self licking ice cream cone said, "Let's just keep flying shuttles for four billion a year." So they canceled it. And so we did not foresee because it was only right after that, really, that both Jeff Bezos and Elon Musk started amassing billions of dollars and investing in space companies. So it's a little bit unique right now because I think it would still be hard, as Boeing has found, to justify these investments to shareholders who want a shorter term return.

Lori Garver:

So I'm probably not as bullish on commercial space generally and thinking that cost plus contracts are a plague for everything that we do because it's not possible for publicly held private companies to invest hundreds of millions of dollars without a real serious market plan, and on technologies that are

unproven. It's actually just, we had not realized that people would amass hundreds of billions of dollars, and the very people who were doing that would want to start space companies. So, that's the way it has played out so far.

Lori Garver:

Boeing entering the Commercial Crew Program meant that you got a lot more supportive Congress because they tend to have a very robust lobbying program. But they haven't made it yet. It took SpaceX to actually deliver so far. But we were very ... I know I was very happy when the traditional, big aerospace company Boeing bid, because I think that was a tough call. And I think if they look back on it, they wouldn't do it again.

Eric Berger:

Yeah. So, you talk about not expecting a return on investment. Jeff Bezos founded Blue Origin in the year 2000, and they haven't reached orbit yet. So, this is not a fast turn on investment that these guys are making.

Lori Garver:

They were not in it to get rich. The joke used to be how to make a ... how to become a millionaire in the space business, and it was start as a billionaire. And luckily, neither Elon or Jeff took that seriously, but sort of. Was true 20 years ago.

Eric Berger:

Yeah, Elon turned that on his head-

Lori Garver:

Yeah.

Eric Berger:

Because he was worth a couple hundred million dollars when he started SpaceX.

Lori Garver:

True, true.

Eric Berger:

So I want to talk about the downside of this because I think critics of this justifiably ... I've talked to them. I remember talking to program officials at Marshall Space Flight Center in Alabama, and they're like, "You can't trust Elon Musk. You can't turn this space program over to him. What happens if he decides he doesn't want to do it anymore? What if he walks away?" And he's not ... Jeff Bezos seems a little more stable. But he's out on a yacht, he's doing things, and Elon was buying Twitter. So how do you address the concerns of those who say, no, man, we can't trust these billionaires with our most important ... If you think about it, in a few years, every U.S. National Defense satellite, every military satellite, every NASA science satellite is going to be going into space on engines built by either Musk or Jeff Bezos. That's your space launch industry. So, Lori, how do trust these [crosstalk 00:24:10]

Lori Garver:



And they were previously built by Russia or Ukraine. So it's a still improvement. And the early ones were built by taxpayers. I think that competition was the key. We never wanted to just select one provider. If we had selected one provider, I guarantee you, it was going to be Boeing.

Eric Berger:

Yeah.

Lori Garver:

So we wouldn't have made it yet. I do remember my first meeting with Jeff at NASA, and it really did cement for me this was the right path, because otherwise it really was only SpaceX. And that was not okay. I was never in the tank for them. I'm still not. I'm blown away by their capability. And I do think that the private sector, as these folks drive the costs down, there are hundreds, as you know, of commercial companies now making money and doing important things on orbit. I've got a chapter, it's not all about the rocket. The rocket is just the transportation. The interesting stuff is what we do on orbit. And that's where the real money is to be made and the real benefits to society.

Lori Garver:

So I do think economically and for national security lowering the cost, that was our goal, and increasing the reliability. But the ... It's what you do up there that matters. And in my view, you have, for instance, Sierra Space. They are a private company, not billionaire owned at this point. They've got private equity. They have a contract to start flying cargo to and from the space station probably early next year. They want to follow that up with crew. There will be more. But it's a risky thing. But it was less risky than just going with the Russians.

Eric Berger:

Right. And you're right. Competition absolutely is key to getting the best of behaviors from both people. I'm wondering as we wrap up here, what should policy makers be doing to incentivize commercial space companies to make decisions that are beneficial for society, good for taxpayers, good for NASA, not just to ... not to send Jeff Bezos into space, but what should these companies ... How can we incentivize these companies to act for the good of the country?

Lori Garver:

Well, I'm a huge fan of right to left thinking, keeping your end state in mind. And in space program, that's pretty easy to do. We know what end state we want in different sectors, and the transportation one was very simple, to set those goals and let others meet them. The government likes to get involved in pulling the strings, not just Congress in the administration we like that, too. These bureaucracies, they get used to the friends that they like in certain companies, or they think they're going to go work there themselves. There's that natural ... We like to say it's a positive that we all work well together, but we have to, I think, and I took my role in the government very seriously, that I worked for the taxpayer.

Lori Garver:

And I tend to think that people maybe who stay in for 30 years get too disconnected from that, and I've come and gone a couple times. And I think that it's very healthy to keep the customer in mind. And I even had to tell a few astronauts, "You're not the customer." You're getting paid. The customer are the taxpayers. And NASA is not a typical government agency. We are not in the constitution. And so we have



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to find value to contribute that does help contribute to the welfare, security of society. And I think NASA has done that very, very well over the years. But we have to keep vigilant and focused. And I think when Congress has ... a few people in Congress have different interests, elevate the discussion. People love NASA, and NASA has an ability to lift us all up, and to see our planet and our lives from a different perspective. And so, I just would urge us not to get mired in the politics because NASA is one of the least partisan agencies, but it does tend to still be parochial.

Eric Berger:

Yeah. Well, Lori, thank you so much for your time.