THE BROOKINGS INSTITUTION
The *TechTank* Podcast

"Going back to the moon"

Monday, March 11, 2026

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[00:00:00] CO-HOST DARRELL M. WEST: Thanks for joining our Brookings Tech Tank podcast. I'm Darrell West, a senior fellow in the Center for Technology Innovation at the

Brookings Institution. The United States soon will launch a crewed ship to circle the moon and test equipment for a future landing. It has been more than five decades since humans landed on the moon. The return flight raises interesting questions about space exploration and why humans benefit from going back to the moon. To discuss these important questions. We are pleased to be joined by a distinguished expert. Casey Dreier is the chief of space policy at the Planetary Society. He leads that organization's policy and advocacy work and emphasizes the importance of space exploration. Casey, welcome to our Brookings Tech Tank podcast.

[00:00:49] GUEST CASEY DREIER: Thanks for having me.

[00:00:51] CO-HOST DARRELL M. WEST: So I'd like to start just by having you tell me a little bit about your work at the Planetary Society and your emphasis on space exploration.

[00:00:59] GUEST CASEY DREIER: Happy to. The Planetary Society is a kind of a strange and unique and wonderful little organization. Founded in 1980 by Carl Sagan and a couple of other of his colleagues at JPL and, Cal Tech. And it's a public membership organization that just likes space exploration and particularly space scientific exploration. So really into the Voyager spacecraft, really into Mars Rovers. obviously we love humans going to Moon and Mars as well. And what makes us unique is that. Because we're a public membership organization, all of our income comes from individuals and that makes us independent. And so we don't depend on big aerospace corporations to, to keep us afloat and we don't depend on government, funding and grants, which has actually come in quite handy, in particularly in the last year. It's that we get to say what we care about. We get to represent the scientific exploratory, noble aspects of space exploration and to really try to bring people who just are space fans, like me, not just into loving space at a deeper level, but taking them into civic action. and that's what my role in this the organization is trying to turn that into grassroots energy in an effective and sophisticated way to really promote, again, the scientific side of exploration.

[00:02:16] CO-HOST DARRELL M. WEST: So I count myself as one of those space fans. I'm old enough to actually remember the original landing on the moon and just how exciting it was to see that as a young kid. So it's exciting for me that we are on the verge of, going back and I know the last, lunar landing was more than 50 years ago. now NASA's Artemis program plans to bring humans back to the moon and it hopes to launch Artemis II perhaps as early as next month if things, go. Okay. Why is another lunar launch important for us?

[00:02:50] GUEST CASEY DREIER: The way that I think about this is, it's multifaceted and it depends through what angle you're driving value. But at the end of the day, having a very ambitious, technically challenging goal that drives cooperation, peaceful cooperation by default, that requires almost peaceful engagement and cooperation with our allies. In addition to within the nation itself is a fundamentally positive social and geopolitical thing to do. The organizing features of sending humans to the moon are just so complex and so challenging and so difficult that it's, it's like going to the gym for the aerospace and innovation sectors of our economy every day and really pushing ourselves to the limit. In addition to that, you mentioned this, there is a real factor.

[00:03:38] This is hard to quantify, and so it becomes, I think, easy to dismiss, but there is a real factor of inspiration, but also pride and optimism about the future. When you see a joint effort of your nation and allied nations to do something really amazing, there's. Something good for the soul in that, frankly. And we need positive opportunities and examples like that. Things that are unifying activities rather than divisive ones. And that again, that organizing effort of the moon is so immense that it requires so much. Ongoing focused cooperation. And also it requires buy-in, almost necessarily by in a bipartisan way in order to sustain this over the course of more than a two or four year political cycle.

[00:04:24] So just the act of doing it, the act of attempting in itself has just enormous benefits from, to our society and to our broader globe. And then of course there's, the actual benefit of being on the moon, the incredible scientific results that we'll get, learning how to live and operate further from earth and being more independent as a species. And then also just building this infrastructure that enables now this potential whole future host of economic benefits and economic growth through this infrastructure to the moon and the space around the moon.

[00:04:59] CO-HOST DARRELL M. WEST: So I am very excited about going back to the moon, and I think you're exactly right. Just in terms of the scientific payoffs, what we have learned from the rovers on Mars. The new space-based, telescopes, I think human knowledge about space in general has just accelerated even in the last, 10 years. So it's exciting to, continue that. But we also know that there have been national surveys of the American public that sometimes have found that sending astronauts back to the moon and perhaps someday, onto Mars, does not rank very high on the list of public priorities, just given all the other earth-based challenges, that we face. So how can you explain to the general public why space discovery and exploration should be important priorities?

[00:05:44] GUEST CASEY DREIER: Yeah, there's again, there's a couple ways I think about that one of which I think that's accurate too. I we have, I think the proper

relationship and the proper levels of investment too. Yeah. It's, it is more important that we house and feed and make sure we don't have, mass starvation or that we take care of the elderly and the sick. Those are the priorities of a society, and we do those, and I think that's correct. And if space is higher than that. Something is actually probably pretty wrong about our society. I think where some of that in inference and kind of a, what you're getting at comes in is, that people see space. It's so visible. A rocket launch is a singular event that actually if, you or anyone listening has never seen one in person, absolutely add that to your bucket list. It is one of the more powerful experiences you will ever have, but it's really visible. It's strange, right? It's unusual. It looks expensive. And I think people then infer that it requires huge amounts of funding to, to pursue a program to the moon when actually what we're spending is roughly right now, 0.3% of annual expenditures in the United States go towards NASA. Point three, right? If you are rounding numbers this round, NASA rounds to zero in our annual expenditures and every six days or so, Social Security spends the equivalent of NASA's budget. Every 12 days or so, Medicaid and Medicare spend the equivalent of, NASA's budget, right? These are much larger programs. Housing Urban development has 10 times NASA's budget. So we have, that priority is actually represented. Small increases in that 0.3% back to up to 0.5 or 1%. Would actually have huge outcomes in terms of what we can do in space and still maintain that.

[00:07:29] Again, I think that proper kind of moralistic relationship of what we spend on, this kind of like long-term, deep investments and capability workforce, scientific innovation in the nation, mixed with our practical needs. Going even further than that. Some of those survey results, and I think particularly maybe you're referencing the 2023 Pew research poll. I think there was a similar one in 2018 from Pew, and then Morning, morning Consult in 2021 had something similar that asked the public to kind of rank what NASA does in terms of priority. And I think that's really fascinating too, because you see at the top three things consistently across all those poles. It's fundamental scientific exploration, earth climate monitoring and protection from asteroids that can kill us. Very practical and very reasonable things that I frankly all agree with. And interestingly, going to the moon or Mars is like way at the bottom in terms of what the nation thinks NASA's priority should be. And I think the problem there, and this is actually the opportunity. And it's really mixing and making sure that what we do with sending humans back to the moon addresses these fundamental capabilities, particularly scientific research. They can really work in scientific motivation, scientific exploration as the motivating factor, and that's driving individual mission outcomes. For these future Artemis missions, I think you actually then address what the public is asking for, which is, what are the practical and helpful things going to space does for our nation. It keeps us alive, monitors our climate, the planet in which we live and advances science. And I think that's the messaging challenge and, frankly, that's always

been a problem with, NASA internally is divided between human space, flight and science as a structure and, that's where some of this comes in.

[00:09:11] CO-HOST DARRELL M. WEST: No, I think those are all excellent points and certainly the scientific advantages are a big part of the benefits of the space program. A lot of people also don't realize there have been concrete economic benefits that have come out of this space program like GPS, started. there're some of the advances in wireless communications come from there.

[00:09:33] GUEST CASEY DREIER: Solar panel efficiency, right? Yeah. NASA was green before any other agency, right? 'cause you can't use diesel fuel in space. yes. Huge innovation and, also social benefits. NASA in the 1970s pioneered some of the first communications satellites. we didn't have. Communication satellites before 70, 60 or so years ago. That was all pioneered through NASA investments and then also working with developing countries at the time like India to bring telecommunications and access and to spur their space. Program development that's created navigation, as you said, but also things like, again, earth monitoring satellites and understanding how our weather works and understanding the climate that's going on in our planet, not just at Earth, but understanding how climate changed at Mars, which became extremely cold and dry and arid. And then also how the climate changed at Venus, which had a runaway greenhouse effect. And in fact, the idea of a runaway greenhouse effect. Was inspired by observations of Venus at the beginning to explain why this earth-like planet became so incredibly hot, that it's hotter than enough to melt lead. These are extreme conditions of climate that we see on both Mars and Venus, and it's our Goldilocks situation where we have too hot, too cold and just right where Earth is, and it's good to know what those edge cases are.

[00:10:52] CO-HOST DARRELL M. WEST: Yep. We definitely wanna know how the earth compares to some of these other, planets, so hopefully we may avoid some of the, scenarios that have developed there.

[00:11:02] GUEST CASEY DREIER: Indeed.

[00:11:02] CO-HOST DARRELL M. WEST: So there've been many efforts for a second series of, landings that have fallen through over the years, Artemis is noteworthy in the sense that it's, I think, really the first program since Apollo to have the support of back-to-back presidential administrations, which I think was important to Maintaining the momentum to actually carry through the program. What are the factors that you think have made the Artemis program possible today?

[00:11:28] GUEST CASEY DREIER: Absolutely, and it's worth dwelling on that. There, there were two other real attempts to return NASA, astronauts to the moon. One was under George HW Bush on the 20th anniversary of, Apollo back in the late eighties. And then under interestingly, George W. Bush, after the Challenger disaster in the early two thousands when NASA was reevaluating itself and its priorities. Both of those initiatives failed and were canceled by the subsequent. Presidential administration. The fact that we have Artemis now existing through Trump to Biden, even the Trump to Biden shift was the, what else did those two administrations agree on? And, the Biden administration basically accepted Artemis unchanged. That was remarkable. It was, and I think the difference there is that there was a intentionality to the design of Artemis to make it politically stable. The other, it's not like they didn't try, I think, back in the 80s and, early 2000s, but there was such an awareness of those failures. There was a desire, and I think a lot of lessons learned from those failures. And you found a way to basically build a big enough coalition. So if you see, if any of your listeners see critiques of Artemis, or various program aspects of it being really expensive or a bit of a Frankenstein kind of assemblage of various different spacecraft and programs and things, and it's not efficient. That's the cost of political stability, right? in a democracy where you have geographically discreet representation, through the annual appropriations process, you have to build sustainable things by giving a lot of immediate benefit to a diverse set of coalition representatives around the country, members of Congress and commercial industries, scientific interests and so forth, and. That's, I see this as the Moneyball, equivalent of a space, program design where you just, it doesn't matter what your ideals are, if you can't get to first base, you, you're not gonna get a run. Ultimately in baseball, if you can't sustain a moon program for more than four years, no matter how beautiful and perfect and optimized the engineering plan is, it doesn't matter, right? 'cause it just, you won't be able to build anything that fast. And so that was a big part of it. The other factors that really I think are important to this is you had the end of the space shuttle and so you opened up a wedge. They called this a budget wedge of funding within NASA that needed to be, that could then be more easily applied to something else, and you have the near end of the International Space Station, which has been, I think, upward there for over 25 years now. it's a program that really began in 1984, so we're, it is like a 40 plus year effort and that's gonna wind down in 2030 or 2032. And so you need this next step to, to move on to, and that available money plus kind of the end of what's, what we would call low earth orbit or just earth orbit, human programs. The moon is the place to go there. There's really no other immediate place. Mars is would be wonderful, but it's, exponentially more difficult to get to. So it's a factor of these programs. And I might even add commercial space capabilities, giving. The, at least on paper, the ability to lower the immediate upfront cost to the taxpayer to offload some of those investments onto matching funds from the private sector to, to lower this, the cost requirements and that's another key aspect of

this. So I think I answered five different things or so, or changed. but it's like a lot of these things finally coming together basically, and that enables this. And there's been enough kind of political momentum that things have shifted very, firmly in, in favor of lunar exploration.

[00:15:04] CO-HOST DARRELL M. WEST: Actually, we call that a complete answer in the sense that you, covered a number of different factors as to why this is a special moment. There are lots of things that have happened to have come, together. One of the things you, did mention I would like to explore a little bit further is the role of commercial companies in the U.S. space program. I actually have a book coming out early next year on U.S. space policy, and one of the things I'm looking at is the commercialization of space. And the growing role of, these, companies. So I'm just curious how you see the role that the partnerships with the private sector are playing in space exploration now. How does NASA work with these, private firms?

[00:15:45] GUEST CASEY DREIER: Yeah. So boy, how, much time do we have? there's no denying the fact that in the last 10 years we have seen, I think it's fair to say, a revolution in the capabilities and ambitions of the private space sector primarily led by SpaceX. This has allowed NASA to offload a lot of the financial risks of investing in new programs. So the old school way that NASA would work, pretty much up until 2010, 2011, was that NASA would contract with a big aerospace firm like Boeing or Lockheed Martin. They would jointly design a big project and NASA would have really deep oversight into what was happening, set all of the requirements. They would build it, at whatever it would take, they would try to stick to a contract goal, but if they went over, NASA pays the difference. And then when they're done, NASA takes ownership of the hardware and, does what it does with it. The big shift now is that NASA's going into a fixed price contract. Sometimes with more milestone based payments, so you know, you don't get paid until you actually demonstrate that you're making progress along a, development path. And NASA at the end doesn't actually take ownership of the spacecraft. They, use it or lease it, or it's a service provided to the space agency and then the IP and the hardware is retains and is owned by the company. So this is why SpaceX can fly. tourist into space to do what it wants, or launch a car into Mars orbit or a solar orbit, I should say, past Mars. And it's what they do, they own the rocket capability. So this protects if, there's any cost overruns, the, company. Is on the hook to pay those, not, the taxpayer. And that's great, in a way that it really protects the, the investment of, taxpayer money. It prevents these projects from spiraling out of control and eating up, NASA's budget. And it pushes kind of innovation. It aligns the incentives of these companies to say, as long as we deliver the product up to spec, it's up to us how to make it work.

[00:17:47] We don't have NASA peering at every single decision we make. We can be faster, more agile, we can try new things. Perfect example of this is, SpaceX pioneering reusable rockets, landing rockets themselves, and then fueling them back up and launching them again. Huge savings and money was seen as very difficult to do prior to that. It is difficult to do the downside though, and this is where I think this is where I have a somewhat ambivalent view of, how this has gone. There's really important and valuable benefits that NASA's gotten, and then of course there's a huge existing market. For a very specific thing or a handful of things, which is launching rockets to earth orbit, right? So there's commercial companies, you have DirecTV, XM Radio, a variety of other kind of satellite communications companies. Most people have never heard of that build their own multi, a hundred million dollars spacecraft and then launch them into earth orbit for their business models. There's a pure commercial market. That exists independent of, what NASA does in earth orbit. there's earth observation companies, taking, we're seeing this, I think we're recording this now during the initial days of this incursion into Iran. and you can pull up the New York Times and you can see the before and after of missile impacts, on various facilities around Iran because those are all purchased by commercial providers.

[00:19:00] We have, there's a lot of local and kind of economic interest in buying pictures of Earth. The way that I kinda like to frame it is anything that kind of, if there's a market in space, it's for anything that goes up and then turns and points back down, right? The market is on the earth. Space provides a domain to give a certain kind of literal and figurative perspective on what it's doing. What NASA has done with Artemis however, it's taken these kind of initial successes of SpaceX, particularly SpaceX, but also these kind of other earth observation platforms and so forth, and said, what if we just expand this everywhere? And that's the big unknown to say there is no market right now at the moon. Right? there's no real desire or, you go to the moon and there could feasibly be future things to do there, but there's not one right now. so NASA is still, it's a monopsony for the most of it, that, NASA's the only buyer of these kind of private and commercial markets out there. And they're, offloading and they're setting a lot of fiscal risk onto the companies that provide these services. and NASA's done this with. The, space suits for the moon, NASA has done this for the lunar landers themselves. These are commercially procured lunar landers from, SpaceX and Blue Origin. NASA has done this for, payload delivery onto the surface of the moon. You name it. Basically everything has been a fixed price or somewhat a milestone based payment, this kind of modern relationship. But what that actually does is that it offsets the risk. But it also introduces new types of risk that NASA's not used to dealing with primarily. They depend on these companies to eat their own overruns, but not every company is a SpaceX run by the richest person in the world, or Blue Origin run by like the second richest person in the world. Some of these smaller companies that are providing like.

The spacesuit capabilities or the, payload deliveries services to the moon. These are small, they could easily go out of business. They don't have the kind of big amounts of capital that SpaceX and again, Blue Origin do, but I think we're also seeing a reputational risk. Elon Musk, may surprise you as somewhat of a divisive figure these days. Jeff Bezos is as well. And I think what's shifted where NASA was always a kind of a group effort, right? A national symbol that it's. It's something that we all do together or it owes itself to the taxpayer. what SpaceX does is up to Elon Musk and what Blue Origin does is up to Jeff Bezos. And those are idiosyncratic personalities, to say the least.

[00:21:30] And I think as those personalities fuse into that activity of space, you actually have what you know, space being associated maybe more with Elon Musk these days and Jeff Bezos than NASA. And I think. We're not really prepared to think about how that changes things because my entire life, your entire life, pretty much up until the last few years has been a situation where NASA has mediated that relationship to space exploration to the public, and it doesn't have that anymore. Another complete answer for you.

[00:22:01] CO-HOST DARRELL M. WEST: That's a very complete answer. And I actually, share your concern both in terms of the opportunities of private companies, and you're completely right about the reusable rockets and how that has lowered the cost of launches and therefore created lots of new opportunities. But there are some, risks and I wanna, suggest one other possible, risk, which is in addition to space exploration. There are new efforts underway in terms of space tourism, space mining. Trump is putting a lot of money into space defense. So the question I have and the worry I have is how can we balance all those things with space exploration itself? Is there a risk that scientific discovery gets devalued? Not because people don't think it's important, but there's so much money going into these other things, tourism, mining, and defense.

[00:22:55] GUEST CASEY DREIER: Yes, and I don't think we even have to speculate about that. I, think we functionally saw, at least on the Trump administration side last year, they came out with a budget proposal to literally cut NASA's science activities in half, 47% cut, which would've turned off roughly a third of all operating spacecraft scientific from Earth orbit out beyond Pluto. Turn, literally just turn these spacecraft off to, to tumble into darkness. eviscerated funding for fundamental research, destroyed it actually cut to 0% completely would've ended NASA's education programs and outreach programs to like rocket clubs, and, small grants for, high schools students to, go to launches and to start learning how to be or undergraduate, institutions and training. So we don't have to speculate too much because it was all seen as, the shift is,

was all very much onto the commercial side as a consequence of that. And then, yes, I think the, in terms of the kind of the showiness or the newsworthiness of, or the desire right of, can you make money in space? Can you go and turn space from a, this kind of, I guess I'm a Sagan, child of Sagan. I guess for anyone who remembers that this space was just this wondrous, Awesome thing. Like in the original sense of awesome. And it was a, you can go back to Arthur C. Clark, this mid 20th century relationship of, space to, the human, psyche, which was this transcendence, right? That going into space would literally make us better. It would turn us into angels, right? 2001, the Space Odyssey, that it was something. Profound of space. And there's something that just sits really wrong with me when space just actually no, it's actually about resource extraction. and that's like the motivating thing.

[00:24:45] And it's not that there can't be that obviously, like there should, space is it's, one term for this huge expanse, right? Literally infinite. And we have a situation where, yeah, like of course there can be economic. benefits from space. Of course there can be, resource allocation and yeah, it's a lot cleaner to, we don't have to mess up the earth if you wanna do a resource extraction in space, but to shift it as your sole motivation, I think. Really misses the point and actually removes a really important fundamental, relationship I think of, what space is, right? It's, you go back, space is literally the heavens, right? we figuratively, but this is also, we are, we're sending things into the heavens and we, our entire species for its entire existence up until 70, so years ago. Could only literally could only dream about what that was and what was up there. And now we have this ability for ourselves to traverse our figurative heavens and to learn and explore and understand vast things that we have never could have even imagined before. And the world, the universe and cosmos are stranger than we ever possibly imagined, is bigger than we ever possibly imagined. That's really good for the, I think, the society to have a source of just new and generative information to. Have an opportunity to confront the infinite, it's good. That's a good humbling activity, right? For people who like to meditate or any kind of like relationship to, the divine space is almost like a secular role for that. So to treat it merely as this kind of. practical extraction area. What does it do for me? I think really diminishes the opportunity we have there, and that's where I see, this kind of broader shift of science. It embodies that first part, right? Science is what's out there. Let's find out, oh, look at the interesting dot in the sky. What if we built a robot to go there? That's basically what Mars is. That's really, truly inspiring and uplifting to, to know we can do that. And to diminish that to, to destroy that, to abandon it completely. Not only is, has immediate destructive consequences and practical consequences to our nation, but says something really bad about our kind of collective soul, for lack of a better term, that we would see something so big and promising and uplifting and turn our backs to it.

[00:27:00] CO-HOST DARRELL M. WEST: And this is one of the things I really appreciate about the Planetary Society, both you and your colleagues. Try to keep us focused on the inspirational side of space, the scientific, benefits. I know, some people in the group were active on the national budget cuts upfront and speaking out against that, and kudos to you. And actually that effort turned out to be very successful because Congress has restored at least some of those, almost

[00:27:27] GUEST CASEY DREIER: All of it. Yeah. I think NASA budget went instead of going down 47% got a 1.7% cut last year,

[00:27:34] CO-HOST DARRELL M. WEST: which is amazing to think that actually happened. But yes, I know you and your colleagues actually were a big part of that, so thank you on the part of those of us who are space fans. The last thing I wanna cover with you is the other thing that is happening in the space world other than commercialization is the militarization of Space. So there's a lot of competition between the US and China. we know China plans its own moon, mission by at least 2030. I'm curious how you see this rivalry between China and the United States. Doesn't matter, matter who gets there first and should we be concerned about the militarization of space?

[00:28:14] GUEST CASEY DREIER: Yeah. So I'm, I'll have my opinions on this and then there's actually, there's like a, what's driving a lot of this today in politics is definitely the great power competition theory or motivation is back, right? I think there's been a latent, particularly among broader space community. A lot of people in government, there's a, latent almost desire to return to this Apollo era because they see, oh, you look at Apollo spurred on by Soviet advances in space exploration. And JFK sets this, goal of going to the moon and returning before the end of the decade. And you have a, huge marshaling of resources on the order of mobilization for a war. Like it was a massive. mobilization of resources, NASA was built overnight. Functionally, its budget increased by a hundred percent the first year, then another a hundred percent the following year. It peaked about if you adjust for inflation. NASA's budget peaked at about $70 billion a year, or almost three times what it is now. and it fell almost as fast, right? Because as soon as you win the race, what do why do you keep spending that much money in NASA fell to, a much smaller portion, but it had this expectation of, what if we just had that again.

[00:29:23] There's a latent desire to see geopolitical great power conflict as a way to get attention and resources for, space. It's working. I think, for Artemis for sure. It is definitely the. Organizing focus of this administration, but also a good number of members of Congress, and it's always now pitched as a race with China.

[00:29:45] Interestingly, when Artemis was, initiated under the first Trump administration competition with China was a big part of it, but it wasn't framed as a race. And that was wise because we had a race and we won. And then it didn't really work out well for the space program beyond that, but it's a very effective way to, to get attention for it. China's definitely has an, a very ambitious and very capable space program that it is putting huge investments into. they're. Easily the, second most capable nation in the world after the U.S. now in space, leapfrogging Russia, which is declining, and they are going to the moon. Now, is that what happens if they get there? First? Well, they can't get there first 'cause the United States got their first over 50 years ago. But if they get there first, again. This is where my, I don't think it will be a, huge deal personally, A number of other, kind of political commentators are framing everything that we can't let this happen. The moon's a big place, right? There's lots of place for people to land. resources are, spotty at best, and we don't exactly know where they are. There's, a lot of theoreticals. I'm more worried that, and arguably China itself is not. It doesn't consider itself in a race, they're doing what they're gonna do. So it's a one-sided framing is, the other funny thing about this. But that said, this is all, is a proxy for militarization. So a little bit of history space has always been a source of, you can call it militarization or national security, maybe is more appropriate way back when Sputnik first launched in, 57.

[00:31:16] The Eisenhower administration was actually, in some ways relieved because that then set this expectation that you could fly over other nations in space, right? They almost didn't want to go first. 'cause the you, had this idea of airspace. You can't just fly into another nation's airspace. in space you're orbiting, you can't help where you go, right? You're just in an orbit and you're high enough up and you have to orbit other nations, which means you can spy on them. You can take pictures, you can listen to communications, you can do what, whatever you'd like. By launching Sputnik first, the Soviet Union set the precedent that you can fly over other nations, at least in space, and immediately there on out, the Eisenhower administration initiated a secret space program to create a variety of spy. Capabilities in space for, monitoring the Soviet Union. And that has continued independently of NASA over the last 70 or so years. And so a lot of like military communications, validation of nuclear weapons treaties, you name it actually the military even contains its own independent, weather satellite system just for its needs. There's a separate. And completely independent space program run by the, DOD, now known as Space Force, and which runs actually the GPS system as part of the Space Force system. So there's a, it's always been there. I think what's changed in the last, I'd say 15, maybe 20 years, is that there's more of a conflict awareness, potential conflict of space. So it's not just monitoring. Now, the outer space treaty forbids weapons of mass destruction in space, but anything in space, when you're

orbiting again, you're, moving 17,000 miles an hour. Everything is what they call dual use, right? So a peaceful satellite launched by Russia.

[00:33:06] If you get close enough or just decide to smash into your, enemies or your adversaries spacecraft, you're suddenly a ballistic. You're moving at ballistic trajectories, you can destroy them. Signal jamming, right? Other types of activities you can do, and I think with the war in Ukraine. There was a huge shock to the global system when they realized how important constant battlefield access was for communications. And not just from big military satellites, but now commercial companies like SpaceX's Starlink, right? If you're gonna operate drones and these all kind of new autonomous systems and ascend these very accurate missiles everywhere. You need constant and high data bandwidth, high levels of observation in space, and I think Ukraine clarified in a way. That no other event had in recent memory, how critical it was to have space assets that were also resilient to these types of attacks. And that has really upped the game, I think, the political discussion and, unleashed a lot of money and a lot of, desire to put more into space. And then of course now it's being. Seeing China's now gonna do that to counter us, and Russia's gonna do it now to counter both of them. And so you start seeing kind of an arms race in space. Again, not with nuclear weapons, but with these other types of kinetic and other, military vehicles.

[00:34:26] CO-HOST DARRELL M. WEST: Casey, this has been terrific. I really appreciate you sharing your thoughts with us, today. I appreciate both the history lessons, that you have provided, as well as your sense of the, current situation at Brookings. We write regularly about space exploration as well as digital technology, and you can find more information on our Brookings Tech Tank blog located at brookings.edu. Thank you very much for tuning in.