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[00:00:00] AH: Okay, so it's a pleasure to be joined this morning by Dr. James Outzen from the the National Reconnaissance Office. So, I wonder just to begin, James could you tell our listeners a little bit more about who you are and about how you ended up doing what you're doing?

[00:00:17] JO: Yes, absolutely. It's really a pleasure to be with you today and appreciate the chance that we'll have to talk a little bit about the National Reconnaissance Office and where we came from and where we're headed, as an organization. I've worked at the National Reconnaissance Office for about a decade and a half now. I'm actually a CIA employee and the NRO or National Reconnaissance Office is staffed by officers from Central Intelligence Agency from Department of Defense and uniformed services and a cadre of DODemployees.

So, about 20 years ago, I took my first assignment at the NRO. It was a fascinating place to work and I've had the opportunity sense to come back and serve as the historian for about a decade and now oversee a center there that's responsible for historical studies, lessons learned, display of artifact, sharing of artifacts, like we have done with the Spy Museum and other outreach kinds of activities. So, that's what brought me to the organization. It’s been a real privilege in my life to have this opportunity.

[00:01:21] AH: For our listeners, could you just sketch out what the NRO is and what it's all about. Help our listeners get our heads around the NRO.

[00:01:29] JO: Yeah, I'll be happy to do that. Actually, the NRO was established, it'll be 60 years ago, on September 6 of this year. So, we're celebrating our 60th anniversary. Over those 60 years, we've had responsibility for end to end development of the National Reconnaissance Satellites, commonly referred to as spy satellites. So, the NRO was established back in 1961, with the express purpose to bring together reconnaissance satellite programs that were originally housed within the Central Intelligence Agency, the Air Force and the Navy. At the time, there was a recommendation to consolidate those programs into a single organization that could

really be focused on developing reconnaissance systems, and not only developing them, seeing them through the launch and then continuing to operate them. That makes us a little bit different when you look at the development of space technology in a national security setting.

We not only, and this is true today, continue to do the R&D for satellites, we are responsible for building the satellites, for seeing them through to launch and then operating them after their launch. So, we have that end to end responsibility. And the systems themselves give us capabilities to both image, so imagery satellites, and then to listen, or signals collection satellites, where we intercept communications, and then other kinds of signals as well. And what this architecture, this National Reconnaissance Architecture has always done is it allows us to see more, to hear more, to get more pieces of the puzzle that we put together to understand an intelligence problem or an intelligence issue, bring those pieces of the puzzle together and present them to decision makers, through finish intelligence, and allow those decision makers to make better decisions that they have information.

If you go back to the beginning of the National Reconnaissance Agency, Eisenhower was President in the 1950s, and, of course, he had led our efforts in World War Two. One understanding that Eisenhower had is that intelligence information was critical in making better decisions. With the Soviet Union in place, we didn't have a lot of opportunities to gain insight into Soviet capabilities, and Eisenhower knew that needed to change. He became an advocate for first, as you know, with the U-2 program, going under development, and then later with the development of reconnaissance satellites. And the sole purpose, and these are his words to avoid another Pearl Harbor, and it makes sure that we didn't have a surprise, again of that magnitude, because of a lack of intelligence information. He became a prime mover, a prime supporter of intelligence programs, and in particular, satellite reconnaissance programs.

We can't talk about current capabilities. Those sources and methods, as they're called are still classified, but we can talk about the use of satellite reconnaissance technology in the past that is outdated, and that allows us to declassify the technology and tell the story. So, I can give you an example of where our reconnaissance systems have made a difference. After the launch of Sputnik in October of 1957, of course, the nation was gripped by this Soviet satellite that had been launched. And the primary concern as you know, on the national security setting was that

if the Soviets could put an object into space, they could certainly, now have the capability to launch a nuclear weapon against the United States.

As a consequence, the US government reexamined its investment in missile technology, launch technology, satellite technology. As part of that review, it's an interesting little episode that occurs. Linda Johnson, who was Majority Leader of the Senate at the time, also retained chairmanship at the senate preparedness subcommittee, and that subcommittee took up the examination of this question of Soviet capabilities. Now, one of the conclusions of the subcommittee, and Johnson went out to describe this to the public, is that the Soviets perhaps had advanced their capability to develop long range nuclear weapons, intercontinental ballistic missiles much more quickly than the United States had. At the time, it was called the missile gap that they were outpacing us, and there was a gap between us and the Soviets.

Up until we launched our first successful photo reconnaissance satellite, Corona, we did not have concrete evidence of whether or not the Soviets actually had more ICBM capability than us. But within a couple of months of the first Corona launches, we were able to have concrete evidence that that missile gap did not exist. I'd like to share just a little experience that I had with interviewing the first director of the National Reconnaissance Office, who was at Department of Defense when this missile gap debate was going on. During the 1960 election, John Kennedy and Richard Nixon were beating each other up in their debates and out on the stump over this question of whether the Soviets really outpaced us. Dr. Joseph Charyk, the first director of the NRO, had an opportunity when Kennedy was elected to actually go in and brief the new president elect about the status of the missile gap. Charyk told me this is what happened when he sat down with President Elect Kennedy. He said, “Mr. President Elect, I know this question has come up of a missile gap, but we have concrete evidence from our imagery reconnaissance satellites to show that this missile gap does not exist. In fact, the United States is really outpacing the Soviets.”

The way Charyk described this to Kennedy sort of put his head back and laughed a little bit and said, “Well, I guess I got that wrong, didn't I?” And the point being that the campaign was over, the issue wasn't relevant really anymore when it came to being elected. And they were able to move on. But what it does show is that just within a matter of weeks really, after the Corona satellite was launched, we put to rest conclusively this question, an important question about

our capabilities versus the capabilities of an adversary. And by having that information, if you're president of the United States, you can make much better decisions when it comes to your foreign policy, but also your development of your own military capability. That's just an example. It's back in the past. It was an important outcome from National Reconnaissance. But the same is true today, what we are trying to do is get information that helps defend the interests of the United States, and help us make better decisions as a country when it comes to investment in our own capabilities, and also how we address defense issues in the US.

[00:08:43] AH: I'd like to come back to nuclear strategy and arms control. But I was wondering if you could tell our listeners a little bit more about the evolution of satellite. So, it may not be something that they all know a lot about. So, Sputnik because up in '57. When was the first US satellite in space? And was there like a satellite race where they were trying to get the most and the best and the most technologically advanced satellites up there? Help us understand the evolution of artificial satellites.

[00:09:13] JO: Glad to talk a little bit about that. The development of Sputnik and the first US satellites actually grew out of the decision in 1954. For the world to come together with what was known as the International Geophysical Year. Its purpose was to understand more about the earth, its oceans, its atmosphere, and gain more scientific understanding. Both the United States and the Soviet Union both proposed to put up satellites that would allow us to observe the earth from above, so to speak.

So, if you look at it within that context, in a way, Sputnik shouldn't have been a surprise when it was launched in 1957, which was the International Geophysical Year but it still was, because they got to space before we did. We were preparing satellites. as well for launch in 1957, and the initial efforts were not successful. So really, it was not until January of 1958, that Explore 1 was launched, and it was launched through the Redstone Arsenal, the army program. It was a successful launch and it did something that Sputnik didn't. It actually collected scientific information. It allowed for the identification of Van Allen radiation belts. But that was the USS first successful launch.

I share that because, this question of a race is an interesting one. Symbolically, there certainly was a race at Sputnik 1. If you speak to people that were alive in 1957, invariably, they will talk

about experiences, such as going out in their backyard and scanning the horizon and looking for the glint of the Sputnik satellite. On the radio, you heard the beep, beep, beep sound, the signal coming off the satellite. But if you step back and sort of look at it, as a whole, Sputnik only, I'll say, provided sort of propaganda on the United States and consistently launching satellites. We have a purpose for those satellites, and in comparison, to Explore 1, we were able to gain scientific information. And I think that the United States has continued to leverage its advantage and space in that regard when we launch with a specific scientific purpose or reconnaissance collection purpose.

So, in short, yes, the Soviets were able to get to space first by a matter of few months, but we were able to get into space and continue to use space as a platform, working either scientific information or intelligence information. With respect to the NRO, our first satellite development efforts began in 1954, as well, growing out of recommendations from a long effort at the RAND Corporation to propose that the United States invest heavily in reconnaissance satellites. In 1956, the Air Force invested some initial funding to begin the development of reconnaissance satellites. That program originally was known, just kind of as trivial as Weapon System 117L, it became known as the SAMOS satellite program. Out of that came a satellite program, the Corona program, which eventually became part of the National Reconnaissance Office.

Corona was the first successfully launched imagery collection satellite. It was successfully launched in August of 1956. The first launch though started, I'm sorry, in August of 1960, I apologize. But the first efforts to launch began in in January of 1959. So, we had some 12 launch failures in that period of time, and it just goes to show the complexity of developing a satellite. You have to put them up, you have to see where the problems are, and work through those problems in those early years. There's no other way than that kind of experience. So, that's how we got into the reconnaissance business.

[00:13:09] AH: I find that absolutely fascinating that as human beings, we're here on this planet that out there in the darkness of space, and a lot of us aren't really sure why we're here and we've never developed the technological capability to turn the lights off and destroy ourselves, and up above us, there's all of these satellites that are all around the earth. I think it would be really interesting to kind of just populate that landscape and give listeners that don't know much

about just an understanding of what's going on. So, what as a satellite and are all satellites and the sky space satellites? Or is it 50/50? Or is that classified? Or how has it been historically?

[00:13:56] JO: In the beginning, we were launching satellites on a very regular basis, and it really had to do with technology limitations. Again, take for example, the way that we collected imagery. Because of technology limitations, we weren't able to digitally collect an image like we do in today's world. We had to go back to the more tried and true way of getting an image or taking a picture which was on film, and the real challenge back then was if you put a camera with film in the space, how do you get the film back, and US' unique solution was to have the film ejected off of the satellite in a small return vehicle that would, once it came into the atmosphere back into the Earth's atmosphere, there would be Air Force planes that would capture it midair, sort of reel that film in so to speak, and take it back to where, I guess many Americans had their film developed, Kodak Corporation and that's what we did. Kodak would develop that film and we would then have images of denied areas as they were known, mostly the Soviet Union that we were interested in.

As a result of having that more, I guess we'll say primitive way of gaining imagery, we had to put more camera systems up more frequently. So, in those early years, we were launching multiple imagery systems every year. With the advent of our capability to collect digital imagery, first in 1976, with a system that was known as the Kennen system, we didn't have to rely upon as frequent launches since we're able to obtain a digital image. We didn't have to have those return capsules come back, as we had in the past.

So over time, that's allowed us to put up satellites that have longer lifespans. Just to give you another quick example of that, and maybe to illustrate it, the first Corona satellite that was launched in August of 1960, carried about 1,200 linear feet of film. The second generation, the more sophisticated satellite to replace Corona was known as the hexagon system. And by comparison, it carried 60 linear miles of film or some 300,000 linear feet of film. So, we go from 1,200 to 300,000 feet of film. It's the system that's longest mission life was about nine months versus being on orbit for a day or two with the original Corona systems.

So over time, we tried to build these more complicated machines that are able to stay on orbit longer, have more capability, and allow us to have more, as we say, persistence, the ability to

have a more continuous look down or listen down into areas that we have of interest. With respect to sort of the mission of National Reconnaissance, our responsibility is really to understand our adversaries, our competitors better. And as a result, we don't collect intelligence or the United States, on Americans, and so forth. Our purpose is really to look at those challenges that come from overseas and that has been the case from the beginning.

[00:17:12] AH: What's the satellite landscape like? What's the population? Is there a lot of commercial satellites up there now? Just as someone that doesn't understand how this works, where are they all? How do you make sure that don't collide with each other? Who decides where they're going to go? And what's the lifecycle of a satellite like? So, it gets launched, it's up there. Does it stay up there until it falls down naturally? Or is it brought down on purpose? Give us better understanding of that.

[00:17:45] JO: Yeah. So, I mentioned, I really can't talk a lot about current capabilities. But we can go back into the past and use historical examples to get at some of these questions that you have. Let's take an example of the Hexagon vehicle just to sort of illustrate that particular set of questions that you have. Hexagon was launched into what is known as a low Earth orbit. So, that's the orbits that allow us to fly closest to the earth, and a Hexagon system carrying that 300,000 linear feet of film would return film in four different return vehicles. After those vehicles came back to the earth, that primary satellite vehicle, which was the size of a locomotive or school bus, a large school bus, if you want to think about it in those terms, we're still left on orbit. The camera and the supporting equipment up there.

So, what do you do with that? Over time, the orbits would decay and eventually, the vehicle would come back into the Earth's atmosphere. What we would do though, is have a controlled deorbit of the satellite, and we deorbit those into an unpopulated area, into an ocean area. And that's what happened with those large vehicles so that they didn't sort of come crashing down unexpectedly and cause harm to individuals. That gives you a sense of how satellite vehicles were controlled historically, to avoid those kinds of problems.

[00:19:16] AH: Is there like a big satellite graveyard somewhere where all of these satellites that came back down are? Or are they all classified? Help us understand what happens to them.

[00:19:28] JO: Well, the best way to describe that or sort of help people understand is if you think about objects that are returned to the earth, and the National Reconnaissance Office had the very first successfully returned man made object from space with its Corona film return vehicle. When an object returns from space, it comes back through the Earth's atmosphere, and that generates a lot of heat. So, if you think of something like the Apollo capsule that came back with the Apollo astronauts. On the bottom of that, there's ablative material which disperses the heat and allows the capsule to come back through the Earth's atmosphere without being burned up.

For satellite vehicles when they're deorbited, they don't have material, ablative material that's going to cause that to occur. So, a lot of the vehicles are burned up as they come through the Earth's atmosphere. There are some large components that survive. And, of course, those are controlled and deorbited, as I said, over the oceans. So, that's where they end up. What we don't have is a satellite vehicle that we've been able to pick up and make it available to the Spy Museum to put on display as an example. As much as we'd like to, there are just a lot of burned up pieces that come back down.

[00:20:47] AH: That would be a great future exhibition.

[00:20:50] JO: Yeah, if we were able to do that, but unfortunately, it's not the nature of the vehicles.

[00:20:56] AH: So, most of them end up in the ocean. Is that correct?

[00:20:58] JO: Yes. Yeah, typically, that's the case.

[00:21:02] AH: And is that always controlled for the close to the seaboard of the continental United States? Or is there no way to control that?

[00:21:10] JO: Well, we have had an incident or two of the uncontrolled returns of space vehicles. Just to give you a kind of a couple of quick examples. In the early test launches of the Corona vehicles, we had a film return vehicle that ended up towards the North Pole and we

think the Soviets actually were able to pick that up, because they had an outpost near where that vehicle came down.

Another example is we had a film return capsule that ended up in South America and a farmer founded out in his field and called their military defense department, and fortunately, the Defense Department called our embassy and they were able to recover it that way. Probably another, even more interesting one is, when we were launching one of our early reconnaissance signals collection satellite known as the Galactic Radiation and Background Satellite, we launched that out of Cape Canaveral. And at the time, the launch was over Cuba, and there was a launch vehicle failure. So, some of the material came over, fell down into Cuba, and of course, the Cubans protested that and claimed that there was a cow killed. So, we have these photographs in Havana, these protests with this model of a cow out there being carried, but that was a result of an uncontrolled launch failure that occurred. So, sometimes we do have uncontrolled returns in those early days. But for the most part, they're controlled returns into, again, areas where people aren't going to be at risk.

[00:22:49] AH: Give us understanding of the contemporary or historical satellite landscape. Who are the main players? For example, during the Cold War, was it really just the United States and the Soviet Union that we're doing this? An exclusive club for advanced industrial nations? Or is it kind of like a mixed picture? Give us a better sense of that.

[00:23:13] JO: Yeah, back at the beginning of the NRO, certainly, it was primarily the United States and the Soviet Union that were involved in successfully launching space vehicles. The reason is, it required incredible technological capability and significant investment of national resources to get into space. And it still does, it's an expensive undertaking. And consequently, the Soviet Union in the United States were the two countries that really had those kind of capabilities to figure out how to build reliable launch vehicles and build satellite vehicles that would work in really very harsh environment, a space where you have extremes of heat and cold that you have to come up with materials that can withstand tensions there, you need to have that scientific base that can address those issues and resolve those issues.

So, in the beginning, the space race was really between the United States in the Soviet Union. I'm not sure I'm the best person to speak to today's environment. I focus a lot on the past, and

we look at the history of the space. But certainly, you can see in today's world, we have a much more diverse launch capability. We're launching out of places commercially around the world, and many nations around the world are able to launch vehicles and have vehicles developed. So, over the last 60 or so years that we've had a successful space program, that certainly has become much more of an international effort.

[00:24:49] AH: What are some of the main purposes that satellites have been used for historically? Signals intelligence, communications, photographic intelligence, are those the main ways that they're used for communications and for imager? Or are some of the James Bond movies onto something when you see a sort of laser coming from a satellite and start paying their authors that completely fantastical, or can it be used as weapons?

[00:25:18] JO: Yeah, so maybe a way to think about this. Edwin Land who was president of Polaroid Corporation had significant influence when it came to the United States' decisions to go into space and he became a real advocate for the development of reconnaissance satellites. Of course, Land was an incredible inventor at the time held US patent, second only data sent actually. So, this really phenomenal creative mind was in the background advising presidents of the United States beginning with Eisenhower, really, through most of the remainder of his life, on let's go to space, let's utilize space.

At one point, he came up with a way to phrase this to presidents and others. He said, something along these lines, "The purpose of what we're trying to do here is to see it all, see it well, and to see it now." And that illustrates in the beginning, we were really thinking about imagery in a significant way, trying to obtain images of the earth, of what we're known as denied areas where we just didn't know what was going on behind that iron curtain, that Churchill described in Missouri when he spoke to Americans. We wanted to see over that iron curtain.

It also became imperative that we not only be able to see what's going on in these denied areas, that we're able to, I guess, you would describe it as listen, intercept communications, but also pick up other kinds of signals that would tell us what was going on in those denied areas or behind that iron curtain. So, we not only want it to appear over the iron curtain, we want to listen behind it as well. As a consequence, we develop satellites that both obtain images, and allow us

to pick up signals and build what we would call a constellation that is integrated and works together to understand what our adversaries and our competitors are doing.

Our current director, Dr. Scolese has sort of fine-tuned the words of Dr. Land. His view is we need to observe it all, observe it well, or observe it now and innovate faster. That just shows the evolution of the constellation from an early focus on obtaining images to having an integrated architecture that allows us to come up with a more comprehensive set of information or intelligence. Intelligence is always about, again, putting pieces of a puzzle together, and you never quite get all of the pieces in that puzzle. You get as many as you can, and then try to ascertain what that picture is and reconnaissance satellites allow us to do that in a highly effective way.

[00:28:05] AH: I'm just thinking about like this interview, we're discussing the 60th anniversary of the NRO. As a non-American and as a historian, it's always interesting to me that when you're studying American intelligence, it's much easier than for almost any other country because there's just more of our public face to all of this. So, I guess one of the questions for you, as a fellow historian. Do you think that the NRO or other American intelligence agencies are undercut by the need to have a public face and to justify to the public, the types of things that have been done on their behalf? Do you see that as like, well, it's not ideal, but it's the price of doing business? Or do you think that democracies like the united states or countries that are more open about this type of stuff? Do you see that as an advantage that they may have, when it compared to say a country like China or North Korea or one of these other countries?

[00:29:08] JO: Well, we have an obligation here in the United States when information no longer warrant classification to declassify it. And we take that obligation very seriously at the National Reconnaissance Office. As a consequence, over the past several years, we've declassified a lot of historic systems. I've talked about Corona, Hexagon. We also have the Gambit System, which took some of the best resolution, clearest imagery from space beginning back in 1963. We declassified the fact that we had an early experimental satellite that allowed us to process radar data into imagery. We declassified our graph satellite and follow on Poppy System, which are signals collection.

Recently we declassified additional signals collection efforts, experimental satellites that allowed us to look at different signal challenges, and we'll continue to declassify and hope this year or early next year to tell a little bit more about the satellites that were developed. The reason is, by law, Americans have a right to know where their tax dollars are being spent unless there is a national security need. Once that national security need goes away, we have that obligation to Americans to to share with them what we can from a declassification perspective.

So, we do it for that purpose, but we want to advocate for the what we call the discipline of National Reconnaissance. There are people that are interested in the stories and how these things came about. There are really important reasons for that. If you look at the development of technology as a problem, and how to do it more effectively and more efficiently as an example, there are no better case studies than the development of these reconnaissance satellites. By sharing these histories of the challenges that came from getting into space, hopefully it allows people who have similar challenges and developing new technology to do it more effectively.

So, we sort of have that ethical obligation to a scientific community as well, and there are other obligations we have like with the declassification of the Corona program. The primary driver for that was so that we could share with the world this treasure trove of imagery of the earth when questions of climate change came up. The only way to make that imagery available, which had been collected over a 12-year period of time, was to declassify the system. And of course, when it was declassified, we weren't using film returned anymore. We've moved into the digital era, there was really no reason to keep it classified. And what that allows is a database to be made available for scientists to understand a problem like climate change. And the same reason that the **[inaudible 00:31:59]** imagery from the early Gambit System was declassified.

So, those are the ethical obligations that we have, from a technological perspective, a legal perspective, and also from just practitioners of history as well. I think it probably strengthens our organization in terms of being able to reach out to key partners and companies that may be interested in doing business with us, but also to the public who just have an interest in what we do and who we are. We tell what we can, in other words.

[00:32:32] AH: For those of us that maybe done some of this in high school, but have forgotten, tell us what's the definition of space. And you mentioned that some satellites are closer to Earth

than others. Help our listeners understand, are certain satellites placed in different distances away from the earth or it is happenstance, or is it planned? Give us a better understanding of that.

[00:32:57] JO: Yeah, that's a great question. Now, as I mentioned earlier, our imagery satellites would fly in a low Earth orbit. So, they're closest to the earth and the early satellites would fly somewhere from 90 miles above the Earth to about 150 miles just depending on the mission.

[00:33:12] AH: Is that considered space?

[00:33:13] JO: That's definitely considered space at that point. We also launched satellites into other orbits, into geosynchronous orbit, where the satellite actually orbits in conjunction with the earth. So, it allows the satellite to basically be placed. So, it's, I'll say, looking down at a very specific part of the earth, it doesn't move around the Earth. In other words, it just orbits at the same pace as the Earth turns. And then we have a third orbit that we fly in, which is known as a highly elliptical orbit. So, at one point, it's fine, very close to the Earth, and then the ellipse poles that much farther out. And as it's farther out, it gives it a longer time over portions of the Earth. So, there are different orbits that we play satellites into and there are different reasons for placing those satellites into those orbits, and it has a lot to do with how much of a persistence or continuous coverage that you want to have, and up until the launch of Starlink, and other kinds of communication satellites that are coming up. If you look at communications satellites, they typically were put into a geosynchronous orbit because it allowed a signal to bounce from the Earth up off the satellite and down to another portion of the earth.

So, communications typically used geosynchronous orbits in the past and of course, that's changing now as we have these new architectures that are put up with multiple low Earth orbit satellites that will pass the signal from one satellite to another. So, times are changing in that respect as well. Historically, though, we would launch into leo, geo, and heo, is the three orbits are sort of known, low Earth, geosynchronous and highly elliptical.

[00:34:57] AH: And the highly elliptical is the farthest away from Earth?

[00:35:00] JO: Well, highly elliptical, its advantages, at one point you're able to be near the Earth, but because of an ellipse, you're able to fly out much farther away from the Earth. So, it has both the capability to be near and far from the Earth. To explain it to your listeners, think of it this way, as an ellipse that goes around the Earth, the bottom of the ellipse would be close to the Earth, and the top of the ellipse would be much farther away from the Earth.

[00:35:27] AH: This is fascinating. It's so interesting. Imagine there's a satellite up above Washington DC, what would happen to that satellite at each of those levels? The second one that you mentioned that would stay above Washington, that would almost be like a pen that was stuck on an area, but some of the other ones wouldn't stay above DC, they would start going off on a different direction?

[00:35:53] JO: With respect to the three orbits. So, if you have the fixed place as Washington DC, in a low Earth orbit, the satellite is going to be going around the Earth very quickly, several times a day typically. So, the satellite is going to pass over Washington DC. At a geosynchronous orbit, the satellite is going to be in an orbit that revolves in conjunction with Washington, DC. So, as the Earth moves, the satellite is going to move at the same point, and it will always be able to look down on Washington, DC. And then if you look at a highly elliptical orbit, a satellite, when it's so much easier to describe a heel with a pitcher, because, but I'll try and do it in words.

[00:36:38] AH: That’s a good challenge.

[00:36:41] JO: Again, think of maybe marble with an ellipse, and the ellipse goes around the marble. Well, ellipse are elongated. And at the top of the ellipse, it's going to be able to be looked down on Washington, DC, the bottom of the ellipse of Washington, DC is going to be hidden because it will be – Washington, DC will be behind the orbit, so to speak. I never really thought about this. Typically, we have a picture to describe it versus words. So, it's a little bit harder. But I think the two others are much easier to visualize with words.

[00:37:18] AH: One of the other things that I was thinking about was, what is beyond them in space? Is that just somewhere that we don't go, or where's the moon and all of this is much

further away, right? It sounds like the NRO is mainly concerned with being in and around the Earth's atmosphere. Is that right?

[00:37:37] JO: Well, the satellites are not as far out as the moon. Geosynchronous orbit is going to put you, if I recall correctly, about 12,000 miles out from the Earth. So, they're much farther away from the earth. But we're not talking distances of days to get out to the moon, as would have been the case with the Apollo program. So, those orbits are all between here and the moon, so to speak, if that's the answer to the question that you're looking for.

[00:38:03] AH: Sure. Just quickly on this before we pivot to something else. Historically, has the NRO been on involved in the space program? How much does that work with NASA? Has there been thought since the earlier days that, listen, this is stuff that we want to do on Mars or farther out and the galaxy? Or is it very much a geocentric kind of organization?

[00:38:30] JO: We've had a very good relationship with NASA over the years. And to illustrate this point, let me just share the NRO's involvement in the Apollo lunar program. When President Kennedy made the decision and declaration that he wanted to see individuals on the moon before the end of the 1960s, there were huge technical challenges to getting there. One of the challenges was just how do you get images of the moon to decide where to safely land people? NASA was grappling with that. The National Reconnaissance Office, because we our space community, understood that particular problem and used some channels to get word back to NASA that we actually had imagery capability that could help them without revealing that we were at the time imaging in space, that was highly classified. We're just a small group of people that understood that we had imagery capability in space.

That technology came from that original program, I'd mentioned earlier, the SAMOS program, the first effort to develop reconnaissance satellites. That technology was repurposed, given to NASA, they modified it and they use that, the same old satellite components to help build their Lunar Orbiter. Originally, the Lunar Orbiter was supposed to be one of two imagery satellites that went to the moon to find a safe landing spot. There was going to be a second one potentially that after the Lunar Orbiter found provisional spots, the second one would come in at much higher resolution, and verify that those spots were adequate for safely landing astronauts on the moon. And that second system was also would have incorporated NRO technology.

In this case, it was the Gambit System, which was our high-resolution imagery system. It had phenomenal capability. Its best imagery allowed us to see objects that were smaller than one foot in size. I mean, we still have not declassified what its best capability is, all these many years later. So, by the mid 1960s, we have this phenomenal imagery capability and NASA needed that. They got to be able to image the moon and know where to safely land those astronauts. So, we cooperated. It turned out that the Lunar Orbiter system itself with that borrowed technology, from NRO actually provided perfectly adequate imagery. NASA did not have to go ahead and build the second system. The project, the cover name was upward at the time using the Gambit technology because they hit a home run with that early NRO technology from the SAMOS program.

So, we have collaborated historically and it really goes to show the strength of the National Reconnaissance Office. It has been a technology incubator for now 60 years. Without the NRO, we wouldn't have so many technologies that we're just taking for granted really in a way in today's world. Now, just take space imagery as an example. To get from point A to point B anymore, quite often, we'll turn on Google Maps as an example and want to look from above to figure out what the terrain looks like. A lot of that capability comes from the US and the NRO, investing in early imagery capability, which is evolved into commercial applications in today's world.

As I mentioned earlier, radar imagery as an example. There are commercial providers today that understand that sometimes weather and night get in the way of seeing what's going on, on the Earth. We understood that back in 1964. In December of ‘64, when we launched our first successful experimental radar imagery capability, and now 50 years later, after more than 50 years, it's becoming a commercial application. So, we have invested in some very, very significant technologies and there have been some real payoffs.

Another technology that we share is mammography of all things. Back in a couple decades ago, there was a working group in the federal government that was looking at how to improve the effectiveness of mammography and make sure that we were able to more quickly diagnose breast cancer. One of the key needs in mammography is to understand change and see if there has been a change from one field to the next. Well, what we do in intelligence is we're looking

for change. If we image one part of the world and we'll reimage it and want to see if there's been a change there, and the NRO was able to share algorithms that allow us to look for change. That's a key component of of mammography.

So, we've invested very heavily in technologies that are, I'll say, transferable and, more importantly, just make a real difference in the way that we live our lives on a day to day basis. It goes back to those origins, not just with NASA and the cooperation there, but cooperation in the larger scientific and technological communities.

[00:43:52] AH: Wow. And one of the other things that I was thinking about was when you were talking about the various orbits that the satellites are – I mean, there's quite literally a lot of moving parts there. It made me think of a classical music orchestra, and there's all these different sections, and there's all these different individual musicians. Who's conducting the symphony? Who's making sure that everything's coordinated. I realize that that's the NRO's function, but is this the director? Is there someone else or the DNI? Who's making sure that the symphony is in line with internal needs but also with the needs of the US government?

[00:44:38] JO: Well, I mean, I guess give me a kind of a historical example how the symphony's gotten much bigger over time. So, our very first successfully launched reconnaissance satellite, was the Galactic Radiation and Background Satellite in June of 1960. And as a signal's collection satellite, it's quite small, just about 18 inches or so in diameter. So, it's a small satellite. It was developed at the Naval Research Laboratory here in the Washington, DC area. And just to show you how early it was in the program and how small the symphony was, when it came time to launch the satellite, one of the challenges was to get it from Washington, DC down to Cape Canaveral, where it needed to be launched and the program director and a couple of employees, their way to transport it is one of the employees brought a station wagon there to work and they took the small satellite and put it in the back of the privately owned station wagon and drove down to Cape Canaveral to have it be stacked on a couple of other satellites that were going to be launched.

So, in the beginning, that symphony was really small. Over time, though, as we've launched more complicated and sophisticated systems, the National Reconnaissance Office has grown in accordance with a more complicated machines that are being put up. In today's world, if you

look at the NRO, it's organized so that there are components not only to develop new technology, but to continue to improve upon existing systems that are operating and replacing the satellites. The NRO depends heavily on its launch capabilities, and launch offices in both Vandenberg and Cape Canaveral. We have ground infrastructure in place. A few years ago, we acknowledged that the NRO has ground stations here in the Washington, DC area. And in New Mexico and Denver. We have a presence overseas. So, the symphony has gotten much bigger.

When it comes to decisions on procuring new systems, that procurement decision is in cooperation with both the Intelligence Community and Department of Defense. That's no different than it was really from the beginning. The NRO was again established to bring together DOD and Intelligence Community elements. And in the beginning, the Director of Central Intelligence and the Secretary of Defense made procurement decisions. In today's world, the Secretary of Defense and the Director of National Intelligence are involved in approving those procurements as well.

Once they're approved, the Director of National Reconnaissance has responsibility for building the systems and making sure they're launched successfully and then operating them. So, because you go from a satellite that could be carried in a personal vehicle, that's the one and only time that occurred. Today's satellites, which are much more sophisticated, you need a much bigger symphony, and there are more people involved. But what's interesting is really, the decision-making process is not really any more complicated in a way than it was in the beginning. Those decisions were always made at the highest level, including the President of the United States, and now primarily, that structure is the same as it has been in the past.

[00:48:04] AH: One of the things that I was also going to ask was just briefly, what would be like a typical size for a satellite? Are we talking like the size of a human? The size of a bus? The size of an aircraft carrier? Or does it wildly vary?

[00:48:20] JO: Yes, it varies. Again, I can talk in terms of, on the one end, our smallest declassified satellite, which is the GRAB Satellite, really a few inches in diameter, to our largest declassified satellite, which is the Hexagon Satellite. The size of a locomotive or a large school bus. The reason that the size varies is because the mission varies. A real strength of the National Reconnaissance Office over the years in my view in studying its history is we build

satellites appropriate to the mission that needs to be carried out. In some instances, to solve a hard intelligence problem, a smaller satellite vehicle going to be perfectly adequate to do that.

In other instances, if you have a hard intelligence problem, that you're going to need to build a more complicated, sophisticated satellite to gain that intelligence. We don't build just to build in other words. The National Reconnaissance Office for 60 years has built to address the hardest intelligence problems. Typically, the way that I describe this is if you look across the entire history, the National Reconnaissance Office has always been about really bright people taking the best technology and pushing the best technology to solve the hardest intelligence problems. That's how the organization was started and that's what drives it today. I don't think that we've really lost that critical mixture when we look at the NRO.

[00:49:48] AH: You were talking there about the DNI and the Secretary of Defense, how does that work if you have two different bosses to report to? What's the lane of communication or the organizational structure? Does the director of the NRO, does he report to the DNI or to the Secretary of Defense or to both? And what happens if both of them are going in different directions?

[00:50:15] JO: Well, again, the history hasn't changed much here, in a way Going all the way back to 1965, when the NRO have what was known as its fourth charter, it sort of codified that the Director of National Reconnaissance would report to both, both the head of the intelligence community which at the time, was the Director of Central Intelligence, who was also the Director of the Central Intelligence Agency, but in his capacity is the Director of Central Intelligence, and to the Secretary of Defense.

Over the past few years, those relationships have been fine tuned. But ultimately, the Director of National Reconnaissance remains the adviser to the DNI on satellite reconnaissance and to the Secretary of Defense, and that historic responsibility has not evolved from the 1960s until today. We look at systems that meet the needs of both the intelligence community and the defense community. It's not really a question of either or, and can we meet either defense needs or intelligence needs, intelligence community needs. Our systems are constructed such that they can meet needs for both communities. And historically, that has been the case. I guess the

tensions that may have happened historically came from how you go about meeting those needs.

Just a very quick example of that would have been the decision to develop the Kennen system, the digital imagery system that launched successfully in 1976. There were some competing approaches on how you get what we now call near real time imagery or crisis response imagery. The problem being that with the film return, you didn't often have film coming back quickly enough to deal with a crisis. As an example, we had imagery of Soviet troops on the Czech border in 1968. We didn't get the imagery back from space until the Soviets had invaded Czechoslovakia.

So, how do you get good crisis imagery? Digital imagery in the late ‘60s and early ‘70s nobody was doing. We invested in a charge coupled device that allowed us to get that particular imagery, but that had to be built over about a five-year period of time. So, the CIA program at NRO was advocating for that approach. The Air Force program was advocating for taking the Gambit System and, and reading the film out on orbit and then transferring the images down. So, there was that kind of debate as to what would be the better way to solve the problem.

But the problem itself was the same for both the intelligence community and the defense community, both needed near real time capability. And when there are debates, typically, it's not about who gets what, it's about what is the best way or how do you go about getting capability that meets the needs of both communities. There's not that kind of zero-sum game. If we give some to defense, that intelligence community loses out. We're trying to build systems that can meet the needs of both communities and do.

[00:53:26] AH: On the symphony, you mentioned that the symphony is growing bigger and bigger. How has the NRO evolved with the amount of information that's coming in? So, I've had some guests on SpyCast recently, and they're saying the old problem used to be getting enough information, but then your problem is making sense of the information that are worth drowning. And just thinking about some of the technology you've mentioned, so going from a satellite, the made, click limited amount of film that we get developed by Kodak, and now you've got continuous real time imagery. I mean, how do you deal with that deluge? Is that also a

technological response? You develop algorithms that help you make sense? Give us a sense of how the organization has grown with the just sheer amount of information that's coming in.

[00:54:21] JO: Well, the NRO grows to meet its needs, I guess, would be the way to describe that. Still by today's standards, we're not a large organization. The Big Five, I guess you'd say we're the smallest by far when it comes to people and so forth.

[00:54:38] AH: But you're the best funded, is that correct?

[00:54:41] JO: Well, we don't talk about funding. But we have a very nimble and responsive staffing posture. We'd be been successful in the past of dealing with this dramatic increase in intelligence. And, again, just to share a historical example of this, imagine going, as I mentioned before, from 1,200 linear feet of film to 300,000 linear feet of film, that was within a 12-year period of time and the NRO was able to handle that dramatic increase in intelligence and process it in a way that it was made available to intelligence analyst who could then use that to provide finished intelligence to US leaders. That's our history of being able to collect more information, figure out how to process that information, and then make it available to our key mission partners, either at NSA, NGA, CIA or wherever they are within the defense or within the larger communities here, that has been a mainstay of the NRO. And actually, quite a success of the organization.

[00:55:51] AH: You mentioned Google earlier, Google Earth. How has the NRO adapted to the increase in capability of private actors are non-government capabilities to capture what used to be strategic intelligence? Google Earth, how much did that change the game for the NRO or did not really do that much?

[00:56:19] JO: Well, I think the NRO has done the wise thing, and that's to embrace commercial capabilities. I don't remember exactly how many years ago, two or three years ago, the NRO became responsible for commercial imagery, and procuring commercial imagery to support the nation's intelligence needs. The reason was, if they can do it, we should embrace those commercial providers. That's, again, been critical to the success of the NRO. When you look at the development of our systems, we've done a good partnership with key industrial partners, and if they're able to do something, and we're able to benefit from it, in terms of fulfilling our

responsibilities in the intelligence and defense community, why we're going to do it. That's not a surprise, that's a historic strength at the NRO.

So, the short answer is, if it's there, and we can embrace it, we will, as we have done in the past. It's about taking, again, emerging capabilities or new capabilities and maximizing them to fulfill our mission. It allows us to do as, Dr. Scolese indicated, and that's innovate faster.

[00:57:27] AH: With the satellite business, is it still very much a nation state business? Are there private satellites or satellites that companies are putting up there? How does the NRO deal with that, if there are?

[00:57:42] JO: Well, again, there are probably better people that speak on this. But I guess from a personal perspective here, if you look at one of the nation's premier industrial gatherings each year, up until, of course, the pandemic, the National Space Symposium, which is now the International Space Symposium. I remember when I first went 10 or so years ago, there was not as much of a commercial presence there, more of a government presence in some way. Nowadays, it's much more of a commercial presence. By far, the commercial space presence is much greater and that just goes to show you that the uses of space have expanded beyond those for just intelligence purposes. We can look at various applications that are coming out, getting internet to rural areas, as an example, and using space for investment purposes, to try and look at traffic through stores, and so forth. There are a lot of different uses of space now that really just didn't exist 10 years ago, when I first started going out to a space symposium as an example.

So, it's definitely expanding. But like I said, you probably get in the space economists, can talk about it in better terms than I could.

[00:59:00] AH: Are you having any events this year to celebrate the 60th anniversary? Is there other particular things that maybe spike, us listeners, can get involved on or can do or is there a book you would recommend?

[00:59:12] JO: Yes, I mean, of course, with a pandemic, we've had to modify our approach to the 60th anniversary. So, as we get closer to the anniversary date on September 6, we'll start

releasing as an example, we've identified 60 innovations and 60 innovators over the history of the of the NRO that will be available on our website at nro.gov.

If you follow our Facebook page, we're already sharing some of those innovations and innovators over the year. That's what we're limited in a way to do a because of the pandemic is more of a virtual approach, versus the 50th anniversary where we had some very large public events. As an example, for the 50th anniversary, we declassified the Gambit Hexagon satellites. We have them on display briefly at the Smithsonian and then moved those vehicles out to the Air Force Museum. I anticipate as the pandemic, as we move away from the pandemic, we will have follow on advanced that come out of our 60th anniversary activities with respect to declassification, and so forth. And when those occur, it will be limited by how quickly we can move forward from the pandemic.

So, we're depending more on I guess, social media and our webpage than we would have in the past in terms of in person events. Let me just mention when we do a major declassification as an example, we post a public event to announce and release either artifacts or documents, or both associated with those declassifications. We will continue to do that in the future as well. We think that's an appropriate model for helping the public understand the importance and significance of these artifacts and programs that will be classified.

[01:01:09] AH: Where do those events take place?

[01:01:11] JO: It varies. Our most recent declassification event occurred at the Southern Flight Museum in Birmingham, Alabama. We declassified an early stealth reconnaissance drone program known as the D-21, and the drone is on display at that museum. When we declassified the Gambit and Hexagon vehicles, we held two events at the Air Force Museum in order to share with the public information on those declassifications. When we declassified our involvement in the early manned orbiting laboratory program that the US Air Force was developing to put their astronauts into space, we held again, another event at the US Air Force Museum. It just kind of happens, where we're able to display the artifacts and tell that story if there are artifacts or if there's a relationship to the area. And that's the approach that we'll continue to take for these other major declassifications.

[01:02:11] AH: Also, on our location on **[inaudible 01:02:12]** Plaza, we have an amazing new space. So, if you're ever looking for a future location, I'm sure the International Spy Museum would love to be involved.

[01:02:22] JO: Yeah, we have two artifacts on display there in your Museum. One from the Hexagon program and one from the Overhead Reconnaissance Program, the SR-71 program that the NRO was responsible for in the early days, and the International Spy Museum has been terrific in working with us and we're continuing to look for those opportunities for sure.

[01:02:45] AH: Just one final question, James. Just for our listeners, some of them may think satellite, nuclear weapons, arms control, that so-called war stuff, this sort of game has changed. Give them a better sense of how the NRO has changed since the Cold War ended, maybe thinking about say after 9/11, the war on terror, some of the other emerging threats or national security trends. Give us just a brief kind of overview of where we are now and where we've been.

[01:03:20] JO: Yeah, the NRO's greatest asset has always been its people because it's an innovative workforce and any set of innovative people are always looking for problems to solve. As the NRO has evolved over 60 years, the problem set has changed a lot. I mean, as you rightly point out, in the beginning, we were focused really on nuclear arms and later became arms control. And after, probably prior to 9/11, as the nation was involved in the Gulf War, there was an increasing recognition that intelligence can make differences at different levels as well. And that provided an opportunity to rethink the National Reconnaissance Office, how do you support the warfighter better and more directly. And those opportunities have evolved over time where we are able to support the warfighting efforts more directly.

Weapons issues don't go away, they just change. We move from counting nuclear weapons to trying to identify improvised explosive devices as an example. And that need for understanding weapons capability whether it's a nation state actor or a terrorist organization, that's a problem set that we're going to need to focus on. So, it's a much more diversified problem set, but it's one that the NRO, its innovative workforce has embraced and continues to embrace, and we'll continue to embrace in the next 60 years ahead, because that's what our mission is. It's about solving those hard problems and protecting the national security interests of the United States.

That hasn't changed over time, just the problems that has changed over time, and we're still well positioned to address and solve that problem set.

[01:05:11] AH: Well, thanks ever so much. This has been a fascinating conversation. I've really enjoyed it.

[01:05:17] JO: You're very welcome. I appreciate the time to meet with you today and the chat a little bit.

[01:05:21] AH: Is there anything that you think that it's important to discuss that we haven't already covered? We could probably speak for days.

[01:05:29] JO: We could. I suppose, as a historian, you're supposed to be objective, but it's a terrific privilege to work for the National Reconnaissance Office, as a CIA officer and understand really 60 years of some challenges, some things that didn't go quite as well as we hoped. But mostly, by far successes that we can celebrate for success reasons alone, but really have made a difference in the way that the United States has been able to defend basic principles of democracy and freedom. And we continue to do that as we look into the future and celebrate future successes.

[01:06:07] AH: Well, if I had a glass in my hand, I would say here's to the next 60 years.

[01:06:12] JO: Thank you. Hear, hear on that, for sure.

[01:06:15] AH: Thanks ever so much for your time.

[END]