

Transcript, "Women of NSA: Codemakers and Codebreakers"  
Episode 4 of No Such Podcast from the National Security Agency

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[Jen]: Cryptology has gone back through millennia. If you had a reason to write it down, you had a reason to keep it secret.

[Amy]: We make code to protect U.S. government communication from those that would want to listen in. We also break codes used by our adversaries and we do that to intercept their communications.

[Jen]: Women have been involved in cryptology since the beginnings of the United States, back into the Revolutionary War. Primarily there's Elizebeth Smith Friedman. In paper and pencil cryptanalysis, she was able to solve the wiring for the German cipher machine Enigma twice.

[MUSIC – INTRO]

[Christy]: Welcome to No Such Podcast from the National Security Agency. I am one of your hosts, Christy, and I'm joined by my co-host,

[John]: John.

[Christy]: And today we're talking about cryptography and the NSA's history of making and breaking codes with the focus of women who have kept our nation safe for years. We're joined today by Jen. She is the Director of Education at the National Cryptologic Museum. And Amy, she is the Chief of NSA's Cryptanalysis Organization. Welcome guys, thank you for being here.

[Amy]: Thank you for having us.

[Jen]: Thank you.

[Christy]: A little background, Jen, did you want to start?

[Jen]: Well I have been with the National Security Agency since 1986. And 25 of those years I've spent at the National Cryptologic Museum with a heavy focus on the women that have been involved in cryptology.

[Christy]: Awesome, Amy.

[Amy]: Hi, I've been at the National Security Agency for over 20 years. I started as a mathematician and I've been part of the mathematics community here ever since.

[Christy]: Okay, well Amy, let's start with you. What is cryptography?

[Amy]: So cryptography is the practice of securing communications so that other people can't read them. And this is done by making codes and keys. So a code is sort of the method of changing original information into another format that can't be decoded unless you have the right information to do so.

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And we sort of talk about that information as the key. And that's sort of the process of encryption. And on the flip side, being able to use that key to read that code would be called decryption.

[Christy]: So it's almost like reading zeros and ones?

[Amy]: It is a lot of zeros and ones.

[John]: I bet. I guess in layman's terms you could say it's a process for securing information or communications that we don't want other people to know about.

[Amy]: That's right.

[John]: And then on the other side it's a way for us to then decrypt that information so the right people see it.

[Amy]: That's right.

[Christy]: So Jen, what is an example of a cipher?

[Jen]: Cryptology has gone back through millennia. If you had a reason to write it down, you had a reason to keep it secret. And in the early days of the ancient Greeks, they had devices that they would use, a scytale and an aeneas disk. But the Caesar cipher is probably the most famous of all the cipher systems. And in today's world, it was a very simple system. All he did was he took the alphabet and he shifted it three places. So instead of the letter A, he would write down D. B became E, and so on. It was a very simple system. It's what we call a shift cipher, a mono-alphabetic shift cipher. And it worked great for him because nobody had ever done it before. But today it's extremely simple and nobody uses it except for entertainment purposes.

[Christy]: So Jen, something as simple and basic as that really started NSA, the National Security Agency.

[Jen]: Cryptology can take its history all the way back to ancient Greece and Rome. We actually date ourselves to the Civil War and then predominantly into World War II.

[John]: Nice. Thanks. That's a really helpful example. I bet we've come a long way since then. It's been what, 2,000 years or so?

[Jen]: Yes. Although for centuries, much did not change. And we didn't even get into machine encryption and cryptanalysis until the 20th century.

[Christy]: Can you provide an example of women in history of cryptography at NSA?

[Jen]: Women have been involved in cryptology since the beginnings of the United States, back into the Revolutionary War. But if you want to look at their involvement in more recent years, we would go to the middle of the 20th century and World War II.

Primarily there's Elizebeth Smith Friedman. And she actually had a degree in English, not mathematics. And she was originally hired to work at a place called Riverbank Laboratories on the Shakespearean ciphers. There's a thought that Shakespeare was written by Francis Bacon and there was a cipher in

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there. But anyway, that's how she got introduced into codes and ciphers. And she met and married William Friedman, and that's how she came to be working for the US government. And in the Prohibition era, she was working against rumrunner codes. But when World War II rolled around, she was asked to look into Nazi codes in South America.

And they were using similar codes to the rumrunners, so she was able to break into those. And she learned that the Nazis were giving away the location of Allied shipping there in South America. And so through her efforts, they were able to warn those ships and protect them against being attacked. She was also able to reveal Nazi spy rings down in South America. And she, through paper and pencil cryptanalysis, she was able to solve the wiring for the German cipher machine Enigma, twice.

[Christy & John]: Wow.

[Jen]: Yeah. Initially, the FBI took her information and captured some of the spies, but not the leaders. And so they just started over and started with a new cipher system. And so she had to figure out the Enigma again. And through her work, the Americans were able to push some of those South American countries to openly side with the Allies and protect US supplies and natural resources that we were getting from that area of the world.

[Christy]: Wow. This is all with an English degree.

[Jen]: Yes.

[Christy]: Wow. That's very interesting.

[John]: Yeah. That's a huge impact. You know, I got to say, I'm a history nerd myself. And it's kind of a shame. We don't really do a good job sort of telling these stories, you know? I mean, even here at the agency, like we've got buildings named after them, and I really haven't heard any of this.

[Jen]: Well, Elizebeth was best known for her work with the rumrunners. It wasn't until very recently that we've uncovered, through doing a FOIA request, the work that she did with the Nazi spy rings in South America. So that's fairly recent. So we'll give you a pass on not knowing that information. Yeah.

[Christy]: So Amy, Jen brought us to the end of World War II. Amy, how was and why was NSA founded?

[Amy]: So NSA was founded after World War II in 1952 to make and break codes. We make code to protect U.S. government communications from those that would want to listen in. And then we also break codes used by our adversaries, and we do that to intercept their communications of groups like terrorists and nation-state actors like Russia or the People's Republic of China.

[Christy]: And that keeps us safe and our troops safe. So it continues to make an impact on our mission.

[Amy]: It does. And thinking about what Jen just said about how things hadn't changed for thousands of years, I think maybe that's a little bit different today. You see the evolution of technology. There's rapid evolution here. And how, thinking back, when I started at the agency, I didn't have a smartphone. And now everybody's got a smartphone, right? And so if you think about that sort of change in communication methods, you can sort of see that, along with that, we have to evolve to make sure that

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we're still successful in making and breaking codes to address the technology challenges of today and tomorrow.

[John]: Now just to tie it back into one of the themes of the podcast, Women in the NSA. Now we were founded in 1952, and I got to be honest, the world looked a lot different back then. With that in mind, we mentioned Elizebeth Friedman, but is there anybody else that you'd like to talk about from that time?

[Amy]: We should definitely be talking about Dottie Blum, one of the sort of pioneering cryptanalysts and computer scientists that has made tremendous impact for the agency.

[Jen]: So Dottie Blum probably got her start in machine cryptanalysis when she joined the Army Security Agency in World War II and was introduced to it with a machine that the Army was using to break into German Enigma messages. After that, in the 1950s, she was the representative that would go out to the conferences and conventions on this new field of computing and then bring that information back to NSA and say how this could be applied to what NSA needed it to do. And she was encouraging other employees to become computer programmers at a time when computer programming was not taught in colleges. And in 1972, she was named the Chief of the Computer Operations Organization, and she was the only woman in that chain of command at that time. She continued on and became the Chief of the procedures and policies for computing. And she's best well known at the agency for her mentoring. She was always encouraging young people to study computers and particularly computer programming.

[John]: Jen, thank you so much for telling us that story. It really sounds like Dottie laid the foundation of where we are today as an agency. You mentioned that she was a cryptanalyst. Amy, I'm actually going to kick it over to you since you're the Chief of the NSA's Cryptanalysis Organization. What exactly does that mean to you, to the agency, to the world at large?

[Amy]: This is really the discipline that we call code breaking. So we have adversaries ranging from countries like Russia to the PRC to these terrorist groups and they're all using some form of cryptography to secure their communications and to secure their computer networks. So my team is charged with finding ways to get around those protections and acquire information that the United States needs for our own national security purposes.

We talked about how technology has changed a lot, but you're absolutely right that the sort of principles that Dottie Blum established about leveraging computing and programming to be effective in the cryptanalysis code breaking space are exactly the kinds of things we do today.

[Christy]: So it's really the cryptanalyst, the skills and expertise, they help mitigate these threats.

[Amy]: That's right.

[Christy]: And I guess we can't go too deep into it, but they are really the core of NSA's mission and they help keep us going and again, keep DOD safe, keep the nation safe.

[Amy]: That's right. And it's really not very straightforward to break codes. I sort of wish it was like some of those earlier days, to be honest. But we have to be very creative. We have to take a variety of approaches. The problems that we face are complex. They're unique.

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But I really like to think of cryptanalysis as both an art and a science. And it's really a discipline well suited to people that just like to tackle hard problems.

[Christy]: And that's the agency we are. We tackle hard problems and we have a lot of women who do that. That's so exciting. Can you talk more about the day to day of a cryptanalyst?

[Amy]: So every day is a little bit different. We're making progress on various types of mathematical problems. We're making engineering decisions, architectural decisions. We're doing things like data science, computer science. And we're combining sort of all of these fields of knowledge to be effective in reading the communications of our adversaries. So I love it, honestly. I love that everything is different and I love that the idea that we can use math and computer science and engineering to keep people safe. If you had told me that when I was growing up and I really liked math, I never would have believed that this would be an opportunity that I could have.

[John]: I'm assuming there's not really too much specifics that you can talk about given the nature of your work.

[Amy]: That's right. You know, we don't want our adversaries to know sort of the tradecraft, our sources and methods because that can really lead to some security risks, right? We might end up not being able to access the information that we need to protect ourselves or we might create risk for our own systems, so but we're still working it, right? So we are still behind the scenes. We are underpinning some of the stories that you might hear.

[Jen]: Amy, you had mentioned that we need to protect our sources and methods. And I wanted to go back to Elizebeth Friedman on that. When she was breaking into the Enigma messages down in South America and the FBI took it over and captured some folks, she did not want that, nor did the Coast Guard, because they knew that if these spies were captured, they might look back and say, "How could they know we were here? Oh, they must be reading the Enigma." And sure enough, that's exactly what happened. We lost that source. And so the Germans just picked up and went on and we had to basically start over again, forcing Elizebeth to break into the system again.

[Christy]: Wow. How do we recover from that?

[Jen]: The next time around when they wanted to capture those particular spies, they found a cover story and they captured one person and interrogated him. And so it made it look like the information came from this interrogation. And so they had a cover and deception story already lined up.

[Christy]: Wow. That's interesting.

[Amy]: Thanks for providing that real world example of how fragile the tradecraft that we have here is and how important it is then to be thoughtful about how we use it.

[Christy]: Absolutely. And it's all about mitigating the threat. They were a step ahead at mitigating that and making sure that they covered their tracks, so to speak, to make sure our sources and methods weren't uncovered.

[Jen]: Exactly. Another story would go back to the shoot down of Yamamoto. It doesn't pertain to women, so I didn't mention it here. But again, we had broken into the Japanese naval messages. We

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knew exactly when and where Yamamoto would be flying. And we had to come up with a cover story to make it look like, "Oh, we just stumbled across his flight and not say, hey, they must have known he was here and they must be reading our messages." So yeah, we always have to take that into consideration, the risk assessment of acting on the information that we have. What damage can it do to our sources and methods?

[Christy]: And that's why we're so close-hold with our sources and methods. And it seems like a lot of the women who came in had liberal arts degrees. It's so interesting to hear that. And they've become mathematicians and code makers and code breakers.

[Jen]: Not all of them. Elizabeth was one, but I could name a dozen others that were either science or math or physics majors.

[Christy]: Okay.

[Amy]: I think what they have in common though is that they really like problems, solving problems that help keep people safe. And I think it's fantastic that people with liberal arts degrees can be successful in this space because there's rarely a problem that we work that is sort of only done by an individual. It takes this team and it takes a lot of people with these different disciplines. So I welcome the idea of having that diversity of thought and experience on that team to be making it more possible to break the codes that maybe otherwise we wouldn't have a shot at.

[Christy]: Absolutely. That's what makes NSA so unique.

[John]: And that's the thing I don't think a lot of people realize. When they think of NSA, they think of math, they think of STEM. I was a history major in college. I had that same sort of viewpoint when I applied. I was like, "Eh, I probably won't get in." Lo and behold, here I am. And I think that's just a testament to the quality of mentorship here at the agency and the education opportunities available to us.

[Amy]: I think so. And I think what we've done a really great job of as an agency is really cultivating community of inclusion and diversified thought and experience. As a woman, I've really seen that evolve over the last couple of decades. And we have communities and societies now aimed at sharing knowledge, building tradecraft for women, not just in STEM, but across the agency's communities. And I see a lot more women now in senior leadership positions, leading the technical efforts here in ways that maybe hadn't always occurred in the past. And I think that's fantastic.

[John]: We've heard about some of the skills and expertise that go into the role. We've heard about Elizebeth Friedman and Dottie Blum. Could you give us an example of maybe somebody who worked here a little bit more recently?

[Jen]: Well there is Debora Pullen-Plunkett, and she is from Towson University in natural sciences. And she joined the agency in the 80s and came in through the internship program. And on her very first rotation, she was in a target area and realized that the call signs of this country were using the French spellings of animal names. And no one had realized that before. So she was off to a brilliant start. At the end of her rotations, she decided to move into the Soviet area. That was of course the big country at the time. And then 1999, and she's decided to move on into the leadership field.

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And there was a problem known as Y2K, which some of us old folks remember. And it was a very valid concern that when we rolled into the new millennium and the year 2000, you couldn't just use two zeros to indicate the year, the computers would freak out and collapse. And so she was sent to President Clinton's committee to mitigate this Y2K issue. And that brought her to the attention of the White House. She served under two administrations at the National Security Council, becoming the Director there. So when Debora came back to the National Security Agency, she was eventually named as the Director of what was then Information Assurance Directorate. And that is today's cybersecurity. In that position, she was able to create or guide the policies that would be used until today for how we are protecting US communications and computer systems and networks.

[Amy]: Jen, I love that you're sharing the story about Deb because at the time, she was one of the few women to have a top leadership position at the agency and really sort of setting that bar of achievement for women and leading the field for us so that we can have more people coming and rising up into these leadership positions.

[Jen]: She was not only the first woman at that position, she was also the first African American in that position. So she was really blazing the trail. And her final job at NSA was involved in the diversity and inclusion. And she said that it wasn't a matter of just checking the box. We need to allow people to do the things that they have the skills to do.

[Christy]: Absolutely. So we talked about cryptography and its history, how NSA uses it today. Jen, can you talk to us about where it's going? Where are we headed with that?

[Jen]: Well, just looking back at history, it's clear that innovative out of the box thinking. I mean, it's one of the reasons why Elizebeth Friedman might have been so good because she was not coming at it from the mathematical point of view. She was looking at it from a different point of view and might be able to see things that others didn't see. And innovation plays a large role. One of the things that I try to teach the young people that come through the museum is that cryptanalysis is a team effort. And they don't have to struggle alone because somebody might have an insight that you don't have or be able to supply that missing piece to the puzzle. So it's definitely a team effort and we all work together.

If I could bring up yet another woman, Hilda Faust Matthews, in the 1970s she was looking at computer networking. And she realized that, yes, we need to protect the computers, but we need to protect the network as well. And then she proposed to the Director, you know, maybe other target countries are not realizing this and maybe we can exploit their networks. So that innovative thinking is something that we really need and need to continue on into the future. You know, again, finding ways to protect our communications and exploit enemy communications.

[Christy]: Thank you so much for that, Jen. Amy, did you want to chime in?

[Amy]: Yeah, I can think of several things that will impact our future and the way we go about making and breaking codes. And I think the first thing I want to mention is partnerships. We are successful as NSA as leading the intelligence community for code breaking, but we don't do it alone. We work with a variety of other government agencies and partners to be successful here. And I believe that will only continue and be more and more important in the digital age that we have here. There's so much data now. And when we think about what do we do with all of that data, this is where things like machine learning and artificial intelligence are going to be even more and more valuable and important to us as we move forward.

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We have a lot of opportunity there to take advantage of that sort of tradecraft, that sort of computing to be effective at figuring out what types of information do we need to look at to be able to protect the security of our country. And then there's the disciplines that are evolving and going along with that evolution of technology. And so data science and data analytics, these weren't really terms and skill sets that were well-defined when I started at the agency, but now they are very much high in demand for us because we believe that's the sort of science that combined with mathematics, computer science, and engineering can really help us shape and move through this vast amount of information that we have today.

[Christy]: And Amy, you mentioned those partnerships. I know General Haugh is really encouraging NSA to move into the realm of partnerships with academia, the private sector. Can you talk a little bit about how we're kind of navigating those waters?

[Amy]: We are. We are continuing to build and mature relationships with universities across the country and support curriculum for highly technical careers and make sure that the next generation of cryptanalysts and cryptologists that we're bringing into the agency are best positioned for success here.

[Jen]: I think that also is a way to point out that cryptology and technology have always pushed each other in their development, whether it's the need for secure communications, pushing the development of secure phones and easy processing, we've pushed the development of supercomputers, or the other way around. When technology has improved, and cryptography has had to keep up, for example, with the invention of the radio. And now we're having to secure radio communications. And so the two really are pushing each other to better themselves into, and we're looking into that, into the future, into other realms of where technology and cryptography can work hand in hand.

[Christy]: I was going to say it works hand in hand. You mentioned AI, Amy. How is AI playing a role in cryptanalysis?

[Amy]: I think what AI offers us is the opportunity to identify the key problems that we really need to be focusing on in a wide set of information. So it allows us to sort of hone in on the areas that really need the deepest technical attention upfront and sort of helps us eliminate the things that are going to be less useful or less relevant to the national security and foreign intelligence information that we're seeking.

[Christy]: So is there a push to train more cryptanalysts on AI?

[Amy]: Absolutely. We do a lot of work again with the academic institutions, but we also do a substantial amount of training within the agency. So Jen mentioned that coming in as an intern, we hire a lot of individuals into what we call development programs. And these are three year rotational programs where you really get sort of your master's degree in an NSA discipline. During these programs, you receive a lot of training about our internal tradecraft and approaches. And we use that training to then help folks be successful on problems that we have. These are real world problems of national security importance. And it is the sort of training that augments the academic institutions, but you can't really get it anywhere else. And so it's a really rewarding experience. I myself started the agency in one of these development programs, and it was a very important experience for me to gain knowledge and then apply it in the sort of real spaces.



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[Christy]: That's awesome.

[John]: Yeah, I love hearing that because it's a rapidly changing environment. Technology is advancing in ways that we couldn't even imagine. You always hear leadership talking about attracting top talent and partnering with universities. But what you don't really hear about, not really here, or even in the private sector, you don't really hear about places investing in their employees once they're there. So to see these educational opportunities, these internships, these development programs, it's kind of a breath of fresh air.

Now over the course of the podcast, we've spent some time now talking about the real pioneers here at the NSA. But I wanted to pivot, I wanted to give you both some time to talk about some of the challenges that you might have faced here at the agency and some of the rewards that you've had.

[Jen]: Well, rewards come to mind easier. I've been here for a long time now, and I've had the opportunity to try several different things within the agency. I wasn't just put in one spot and told, "This is it for the rest of your career." There's so much to do here at the agency, and many of the women that I've talked about actually started on one side of the house and flipped over to do the other side. They've gone from protecting systems to breaking into enemy systems or vice versa, or moved on into leadership. I have found in my experience here that that has been an opportunity for me to always progress and move on into fields that looked intriguing or something that I've grown to love, which is why I've been at the museum for so long. I found my place.

[John]: If you don't mind me asking, how did you get your start at the museum? I feel like that's kind of a big jump to go from this sort of closed world of classified information to going to that public facing role.

[Jen]: I have a degree in broadcasting from Michigan State University, and I actually started here in the TV Center. And then I moved over into what was then the NSA Library System back when we actually had books on shelves. That is where I learned to do real research. I'm a very outgoing person. And when the agency started a museum, I had the opportunity to do one of the diversification tours there, loved it. When a position opened up, I was able to go over and basically created the position of Education Coordinator Director at the museum. As I say, I've been there for 25 years because it is something I have loved deep in my heart.

[Christy]: I can tell you love it. So inspiring.

[Jen]: I am so amazed at the people that have gone on to careers in the mission, doing what I consider to be very difficult work. And here you are the chief of cryptanalysis. That blows my mind.

[Christy]: And you started in the development program.

[Amy]: I did. I started as a mathematician, had no idea what to expect. When we talk about challenges, I was a little intimidated by the level of complexity of the work, the amount of work, the amount of diversity of problems. I really felt like I didn't know what my voice would be necessarily in that space. So I really cannot thank the mentors in my life enough for helping me find that voice and being able to articulate how I can contribute and take on new leadership positions over time. That guidance has been so important to me just as a sounding board, as advice and encouragement to step a little bit out of my comfort zone from time to time, stretch myself and see how I can succeed in that role.

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So I came here actually because of 9/11. There was a career fair early on and I had applied and I was in graduate school. And after 9/11, when I was offered a position here, I thought I got to come here, right? Because it was terrifying and something that we obviously don't want to ever happen again. And so you can use math to help keep people safe. Yes, like sign me up, right? And so that was really sort of what landed me here. And it's been so rewarding. You asked about rewards and I think Jen is spot on the fact that we can move around within the agency and build our skills, work in different positions, work in both the cybersecurity and the foreign intelligence aspects of our mission.

That's amazing that you can, you know, over time, you can have all sorts of different experiences and work with different people. And that's the second biggest reward is the talent that we have here and the, you know, working with people that are just amazing. Like I'm so grateful for that, learning from them and in awe, honestly of the community that we have here. And that's just been truly beneficial. And I've made some of the like the best friends here, honestly. And so it's really that community spirit that I think helps the agency thrive in our mission.

[Christy]: Absolutely. Jen, Amy, any parting thoughts?

[Jen]: I just want to say that the history of cryptography is important to the work that is being done today. It's, you know, we don't want to make the mistakes that may have been made. We want to build on what we've done in the past and continue to move forward. And I think that the women and the other folks that have been involved in past cryptography allow us to stand on their shoulders and move forward.

[Christy]: Absolutely.

[Amy]: Yeah. I just want to say thanks. I am so grateful that we are able to highlight those, these wonderful and supremely talented women in our history and highlight how their work has really affected the way we do our work today and is really aspirational for those of us now working in the discipline to achieve even the future and next levels based on their accomplishments of these wonderful predecessors. And as Jen said, we didn't hear a lot about them maybe in the past. I think you said that, John, but I'm really excited now that we're, you know, taking these steps to really show that women have had just as important a role as men here in protecting us and, you know, securing our national security interests.

[Christy]: So refreshing to hear this. And I know the women who've paved the way, the code makers and code breakers will be so proud of where NSA is going, where we're headed.

[Jen]: If I can put a plug in for the museum?

[Christy] Sure! Absolutely.

[Jen]: We are open to the public and it's all free of charge, Monday through Saturday, 10 to 4. But what I want to say is one of the tours that we offer is a women focused tour. And we will talk about the women that I've mentioned today, but there are so many others that we can point out in that tour that I'm sure many of you have never heard of. And it's a joy for me to give that tour and show what women have done in the past.

[Christy]: Well, for the listeners who are interested, how can they set that tour up?

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[Jen]: They can go to the website, NSA.gov slash museum and click on tours. And there's a form to fill out. You can also give us a call 301-688-5849 and we'll be happy to set that up for you.

[Christy]: Awesome. Jen, Amy, thank you so much for joining us. Again, this is another episode of No Such Podcast. If anybody out there who is listening is interested in joining the NSA, go to NSA.gov forward slash careers and look up job opportunities. Again, I am Christy and I'm joined by my co-host again,

[John]: I'm John.

[Christy]: And thank you guys so much for joining us.

[Narrator]: Thanks for watching this episode of No Such Podcast from the National Security Agency. If you enjoyed the show, please leave us a review and make sure you're subscribed so you don't miss our next episode. For show transcripts and other information, please visit NSA.gov/podcast.

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