This earthquake expert dodged Russian surveillance to try to halt nuclear testing

At 5AM on a June morning in 1974, seismologist Lynn Sykes awoke to a phone call from the Department of Defense. The voice on the other end of the line asked Sykes to be ready to leave for Moscow that evening. The DoD needed his help to negotiate a treaty that would cap the size of the US and Russia's underground nuclear explosions.

Sykes, now a professor emeritus at Columbia University's Lamont-Doherty Earth Observatory, was invited because of his unusual expertise. Sure, he was an expert on earthquakes. But he was also an expert on underground nuclear explosions, which – like earthquakes – can send vibrations ringing through the Earth. So the same devices that monitor and measure quakes can do double duty as secret nuclear test sensors.

In his new book, *Silencing the Bomb: One Scientist's Quest to Halt Nuclear Testing,* Sykes chronicles his efforts to end explosive nuclear testing. When Sykes visited Russia in 1974, nuclear testing in the atmosphere, underwater, and space had already been banned by the Limited Test Ban Treaty signed in 1963 – the result of public pushback against the perils of radioactive fallout.

The cover of Lynn Sykes' book, Silencing the Bomb: One Scientist's Quest to Halt Nuclear Testing.

Credit: Columbia University Press

But there was an ongoing debate about whether it was possible to tell the size of an underground nuclear explosion from the seismic wiggles picked up by monitoring stations. If there were no sure way to check if someone was cheating on the deal, then neither the US nor Russia wanted to stop underground tests altogether. That's why Sykes was in Russia: to confirm that detecting underground tests was scientifically possible, and to help negotiate a treaty that would limit underground nuclear tests to 150 kilotons or less.

The negotiations were a success, and President Richard Nixon and Soviet premier Leonid Brezhnev signed the treaty about a month later. But the quest for a complete ban on nuclear testing continues. The Comprehensive Test Ban Treaty, which would ban all nuclear tests of all sizes, was finalized in 1996. But the US, China, Iran, and North Korea still need to ratify it in order for the treaty to enter into force.

In his new book, Sykes reflects on his 50-year career working toward a test ban that is still out of reach. But, he says, he sees the glass as nearly full, since no one except North Korea has exploded a nuke since 1998: "I consider that a big accomplishment," Sykes tells *The Verge.* "I'm very sad that we didn't have a full test ban way back then. But I did as much I could, I believe, to try and open up this problem."

The Verge spoke with Sykes about detecting underground nuclear tests, fights over the size of explosions, and the perils of nuclear war.

This interview has been edited for clarity and brevity.

Why work for 50 years on preventing nuclear testing?

I came of age during the Cuban Missile Crisis in 1962 as a graduate student. It was work that I thought I could do — as few others could — to develop better methods of identifying

underground atomic testing, so that we could eventually have a full ban on nuclear testing. Preventing nuclear war is most the important thing that faces humanity and the United States.

You start the book off with talking about how in 1974, you were whisked off to Moscow to help negotiate the Threshold Test Ban with Russia that eventually capped underground nuclear tests at 150 kilotons. What do you still remember about that experience?

There was one general who represented the Joint Chiefs of Staff. He was going to go to the opera and he asked one of our handlers 'Will I get lost?' and in a very thick Russian accent they said, "Do not worry."

Does that mean that you were being followed?

Sure. Some of us, to get exercise, walked about a mile and a half from where we normally met at the US embassy to our Russian hotel. A couple of our handlers said, "You guys walk fast."

It must have been eerie knowing how closely you were being watched at what was, for you, almost a scientific meeting.

It was. I had been involved in some classified work beforehand, so I knew what to be careful about and which things were classified. We were warned ahead of time not to leave classified information in our hotels, or out on a desk at a place we were having our negotiations, because they could be seen by overhead cameras, and not to talk in the cars about any classified information.

You say in the book that the technology has been around since 1969 to monitor, detect, and verify underground nuclear tests. So, why did it take until 1996 to negotiate a comprehensive test ban?



Lynn Sykes
Credit: Columbia University

There were several holdups, and one was that the agency responsible for the research on this subject was the DoD and there were many people there who thought that the US needed to continue testing for a variety of reasons, and they were against having a full test ban.

Then another was that I rather quickly discovered just after the negotiations in Moscow in 1974 that the US was overestimating the size – the yields – of Soviet explosions by about a factor of three, and that turned out to be of big political importance. So it took a long time to get that cleared up. And two of the people that had put together the US calibration of Soviet explosions got it wrong, and they were at high places – one within the Department of Defense and one with a senior advisor, and they were adamant about keeping their old method of determining yields.

Why was it so challenging to figure out the size of the explosion – the yields – of Russia's tests?

What we had was the size of the wiggles produced on seismic instruments by Russian explosions. And we wanted to figure out from them what were the yields. We had information on both the size of the wiggles and the yields from the Nevada test site, where we had done virtually all of our underground atomic testing. And Nevada is a region of young geology and seismic waves are absorbed, or dampened down, as they pass beneath the Nevada test site – whereas Soviet explosions were overwhelmingly in old, strong rocks. And so those seismic waves were not as absorbed, and they were larger for a given yield than what you saw for a US test. So it took a long time to get that worked out, and into the policy arena, and accepted.

There were claims that the Soviets were testing 350 kilotons

or 450 kilotons – well above the 150 kiloton limit. Many believed that they were cheating on this treaty. And that turned out to be solely an artifact of not determining the yields from the seismic waves correctly.

So if the DoD and experts like you had agreed that the Russians *weren't* cheating back then, how do you imagine the world would be different today?

There were many new weapons that were developed after 1968 including most of the Russian warheads for missiles that carried nuclear warheads that could be independently targeted – a very dangerous development, and many other weapons that both countries developed. Also, many other countries like China went on to develop larger weapons after the Threshold Test Ban was negotiated. So back in 1969, if we'd had a full test ban then, China, India, Pakistan, North Korea could not have developed weapons as easily. Whether they would have tested, maybe only North Korea would have.

As you went back and refreshed your memory and did your research for the book, was there anything that surprised you?

It surprised me how consistently I'd worked on this problem. I had not given myself the credit that I finally did, in writing the book, of 'Yes, I really worked on this' and I worked on it hard and consistently and resisted a lot of these people. So I pat myself on the back for that.

https://www.theverge.com/2018/3/20/17143702/nuclear-testing-underground-explosions-lynn-sykes-book-silencing-the-bomb