

This interview with PCI Board Member, Dr. Siegfried Hecker, appeared in the SPIEGEL International on Friday, May 5, 2023.



A nuclear mushroom cloud following the explosion of a French nuclear bomb over Mururoa Atoll in 1971

Foto: picture alliance/dpa

"Everything Is at Stake"

Has Vladimir Putin Destroyed the Delicate Nuclear Order?

In an interview, former Los Alamos Director Siegfried Hecker explains how Russian President Vladimir Putin's war against Ukraine has already destroyed certainties that have for decades prevented the use of these weapons of mass destruction.

Interview Conducted By **Bernhard Zand** in Santa Fe, New Mexico

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Nuclear scientist Siegfried S. Hecker, 79, is one of defining figures of the United States nuclear program. For 34 years, he conducted research at the Los Alamos National Laboratory, where the first nuclear weapon was developed in the early 1940s as part of the "Manhattan Project." From 1986 to 1997, Hecker served as director of the institute and was thus the fourth successor of Robert Oppenheimer, the "father of the atomic bomb." After his time at Los Alamos, Hecker taught at Stanford University. He is currently working as a part-time professor of practice, nuclear engineering, at Texas A&M University and the Middlebury Institute of International Studies at Monterey.

DER SPIEGEL: Mr. Hecker, since the attack on Ukraine, Russian President Vladimir Putin has been threatening the use of nuclear weapons and has suspended the last remaining disarmament treaty with the U.S. North Korea and Iran are expanding their nuclear weapons programs, and China plans to more than triple the number of its strategic nuclear weapons. Which of these developments do you consider to be the most dangerous?

Hecker: The immediate greatest concern, of course, is Russia's potential use of nuclear weapons in Ukraine. Putin's threats appear to be primarily to dissuade the West. However, because they are nuclear, they must be taken seriously. But the much greater danger is the combination of all these developments. And this really began with Putin's unprovoked invasion of Ukraine. First of all, of course, we all look at the incredible human toll and suffering of the Ukrainian people. I certainly share that view, particularly because I was born near the Polish-Ukrainian border. But what concerned me most after the invasion of Ukraine is its impact on the nuclear world order. My fear is that Putin has destroyed this order.

DER SPIEGEL: Why?

Hecker: The nuclear order of the past decades rested on four pillars. The first is what some people call the nuclear taboo. Since 1945, when these totally new weapons were first developed and then used, no nuclear weapon has been used in warfare. That's amazing. And it didn't just happen by accident. It's the result of an order which has evolved over decades. Many countries, including the U.S. and Soviet Union, wanted to make sure that nuclear weapons were never used, and they were not used.



Foto: Steven St. John / DER SPIEGEL

DER SPIEGEL: But tens of thousands were built, of which 12,500 remained after the end of the Cold War. And now their number is increasing again.

Hecker: Which brings us to the second pillar, nuclear proliferation. One expected, and Robert Oppenheimer said so right after the Manhattan Project, that lots of countries would acquire nuclear weapons in the future, since their power had been demonstrated. But in fact, fewer than 10 countries have nuclear weapons today. That, too, is remarkable. And it is not just the result of a single treaty, but of an entire non-proliferation regime, a set of agreements, security guarantees and institutions such as the International Atomic Energy Agency (IAEA).

DER SPIEGEL: What's the third pillar?

Hecker: The third is nuclear terrorism. To date, we have not seen a mushroom cloud or a radioactive cloud from a dirty bomb set off by a terrorist organization. When you consider how much nuclear and radiological material there is in the world, that too is remarkable. How could that have happened? Well, the Soviet Union and the United States worked together against the potential of nuclear terrorism. I was involved with at least six workshops with Russian nuclear experts. We put our heads together and said: What do we need to do to prevent terrorist groups or countries that might go rogue and use radiological weapons?

Siegfried Hecker's family is originally from Sarajevo and was resettled to Tomaszew in Poland during World War II, where Hecker was born. His father never returned from the Eastern Front. He later went to Austria with his mother and emigrated to the U.S. in 1956. There, he studied metallurgy, came to Los Alamos in 1965 and rose to become one of the world's leading plutonium experts.

During and especially after his time at Los Alamos, Hecker established personal connections with nuclear weapons experts in other nuclear states. He took a total of 57 trips to Russia and 39 to China. Hecker attracted international attention with his visits to North Korea, where he gained access to the Yongbyon nuclear research center for the first time in 2004 and reported in 2010 on a uranium enrichment facility that was previously unknown to Western intelligence services. Hecker reported on his experiences in North Korea in a book published earlier this year titled "Hinge Points: An Inside Look at North Korea's Nuclear Program." (Stanford University Press, 2023).

Hecker: The fourth pillar of the global nuclear order is at the other end of the spectrum, the good that comes from nuclear energy. Nuclear reactions, unlike chemical reactions, give you a factor of millions of energy production – immense energy which can be used for both good and bad. More than 10 percent of the world's energy is produced by nuclear power. Some 40 million people benefit from nuclear medicine, be it in diagnostics or treatment. Ever since my Los Alamos directorship, I've been concerned with how we get the best out of nuclear power and avoid the worst.

DER SPIEGEL: In what way does Russia's invasion of Ukraine endanger these four pillars of the nuclear order?

Hecker: Well, it unravels the foundation of trust that allowed us to live with nuclear dangers. It threatens the peaceful expansion of nuclear energy, and it jeopardizes the consensus that prevented the use of nuclear weapons, their proliferation and nuclear terrorism.

DER SPIEGEL: You were born in 1943, six months after the founding of the Manhattan Project. So, your life almost literally spans the entire atomic age. Would you say that we are at the most dangerous juncture of this age today?

Hecker: I believe that the Cuban Missile Crisis of 1962, as well as some other incidents when the U.S. and Soviet Union came close to the possible use of nuclear weapons, may have been more dangerous in themselves. But the danger that exists today is not a single event. It is the end of the nuclear order itself. So, everything is at stake.

At the end of February, Vladimir Putin announced that Russia would suspend the New START treaty. Under the agreement, Russia and the U.S. had agreed to limit their strategic nuclear weapons to 1,550 operational warheads and 800 delivery systems each. New START is the last disarmament treaty still in existence between the two major nuclear powers. In 2002, the U.S. terminated the ABM treaty on the limitation of ballistic missile defense systems, and in 2019, it withdrew from the INF treaty on the limitation of intermediate-range weapons.

DER SPIEGEL: Did Putin's suspension of the New START Treaty surprise you?

Hecker: No. The New START Treaty was signed in 2010 when Dmitry Medvedev was president. Once Putin came back into office, the Russians walked backwards on almost every one of the nuclear agreements. I was involved in one of them, the Cooperative Threat Reduction Program. Then the INF treaty expired. While it was the U.S. that withdrew, there is no question in my mind that Russia had been violating that treaty for years. So, it has long been Putin's plan to roll back those treaties and do whatever it takes to deny American access to Russia's nuclear facilities. So far, however, Putin has only suspended New START. This does not mean an exit from the contract. If he withdraws, then the concern is that they would not live by the limits of 1,550 strategic weapons.



Russian intercontinental ballistic missiles at a parade in Moscow's Red Square in June 2020 Foto: AP

DER SPIEGEL: If that happens, will we be faced with an unchecked nuclear race like in the 1950s?

Hecker: That's possible. It's certainly not the desire of the American government, although there are some in Republican circles who would like to greatly strengthen America's nuclear arsenal. In fact, we haven't built nuclear weapons with new capabilities since President George H.W. Bush made that decision in 1992. Economic reasons tend to speak against a relapse into the fifties and sixties. Neither the U.S. nor Russia want to burden their economies with a large arms race. Unlike the U.S. and Russia, China has never been bound by a disarmament treaty, and Beijing has no intention of changing that. On the contrary: In October, head of state Xi Jinping declared that his country would build "a strong system of strategic deterrence" in the future.

Unlike the U.S. and Russia, China has never been bound by a disarmament treaty, and Beijing has no intention of changing that. On the contrary: In October, head of state Xi Jinping declared that his country would in future build "a strong system of strategic deterrence." China currently has over 400 nuclear weapons. The Pentagon estimates that number could increase to 1,000 by 2030 and 1,500 by 2035. China's arsenal of ballistic missiles – also unconstrained by any treaty – is already the largest in the world.

DER SPIEGEL: How do you explain the change in China's nuclear policy?

Hecker: China had a very sensible nuclear doctrine for a couple of decades. It said that a few hundred warheads and the so-called second-strike capability are enough to provide

the necessary deterrent. Instead, China focused on building its economy and in doing so became the economic powerhouse it is today. That was a smart decision. There's an enormous responsibility associated with nuclear weapons and there's a huge financial outlay. So, the Chinese were well advised not to go in that direction in the first place. In the meantime, their economy has grown – but at the same time their insecurity grew. And that uncertainty has convinced them that they now need a larger nuclear arsenal.

DER SPIEGEL: There would then no longer be two, but three major nuclear powers. How will this change the dynamics of deterrence?

Hecker: The dynamics of deterrence was developed for two adversaries, and we don't know what it's going to be like in a threesome. In the U.S., many expect that China and Russia will collaborate to form one single node against the Americans. I think that's unlikely to happen. What I hear from my Chinese and Russian interlocutors suggests that China will continue to pursue its national goals and Russia will pursue its own. So, I think we are going to have three separate nuclear centers. How they relate to each other – that is going to be very complicated.

DER SPIEGEL: In your opinion, how should Europe position itself in this new constellation?

Hecker: The Europeans and the Americans have come together on this issue. Russia's invasion of Ukraine created a unity between them that had seemed threatened, particularly under President Trump. Yes, European countries are different, and each has specific relationships with China and Russia, especially on the economic front. But ultimately, I see the European and American visions aligned as where they need to be vis-à-vis the rest of the world.



A satellite image of a suspected missile silo in China's Xinjiang autonomous region

Foto: Planet Labs Inc. / AP / picture alliance

"The Chinese want to appear stronger in the eyes of the US government."

DER SPIEGEL: Communications between China and the U.S. are severely disrupted – at the government level, but even between experts who deal with nuclear and disarmament policy like you.

Hecker: Yes, this unofficial "Track 2" diplomacy is extremely important when it comes to national security issues. I have had this experience with both Russia and China. I have worked with the Chinese nuclear complex, both the military and the nuclear energy side of it, since 1994 directly. I have visited the city of Mianyang in Sichuan province, where the Chinese Los Alamos is located ...

DER SPIEGEL: ... the place where the Chinese atomic bomb was developed in the 1960s.

Hecker: And I have discussed issues of national, regional and international security, North Korea's and Iran's nuclear programs – and the U.S.-China deterrence situation. That was very useful. We, the Americans, came away with a better appreciation of the Chinese views and concerns. And I think they came away with a better understanding of how we think about non-proliferation and nuclear terrorism.

DER SPIEGEL: How should one imagine talks between Chinese and U.S. nuclear scientists? What is the level of trust?

Hecker: We have a totally different type of relationship than many government people or diplomats have. We have this communality that we both believe in the importance of the global nuclear order, which means the expansion of all good things nuclear – and the avoidance of the worst. For example, before the 2008 Beijing Olympics, we had a workshop on nuclear terrorism prevention. Frankly, the Chinese didn't show much concern at first. They had the view that nuclear terrorism can't happen in China. But then I told them about my work at the former Soviet nuclear weapons test site in Semipalatinsk, close to their border – and all the nuclear materials that were left behind from the Soviet testing days. Later on, President Obama followed up after one of the the Nuclear Security Summits with a joint program with the Chinese, setting up a center of excellence just outside of Beijing. Great step.



Foto: Steven St. John / DER SPIEGEL

DER SPIEGEL: Meanwhile, however, hundreds of new missile silos have been dug in western China. How do you assess the expansion of the Chinese nuclear program?

Hecker: The Chinese are building up their nuclear capabilities because they feel insecure. They want to appear stronger in the eyes of the U.S. government in order to protect themselves from the Americans. One of my Chinese scholar colleagues claims their nuclear build-up is not to conquer the rest of the world. They are, however, forging ahead for global economic dominance. I happen to believe that based on discussions with my Chinese nuclear colleagues. And if you believe there might be some truth to this, then more "Track 2" diplomacy should be pursued – not less.

DER SPIEGEL: Beijing has cut off virtually all contact with the outside world during the COVID pandemic and developed veritable paranoia toward the U.S.

Hecker: Both governments seem to be too stuck in their own views. There is also great paranoia about China in the United States. As a result, politicians are driven by domestic political dynamics rather than doing the right things for the benefit of improved international security. I'm neither a Republican nor a Democrat, I'm a scientist. And my view is: reduce – particularly reduce the nuclear threats. With China, we still have a big chance to do that.

In terms of North Korea, this opportunity seems to have been missed. In September 2017, the country undertook its last and largest nuclear test to date. The explosion was so

massive that the slopes of Mount Mantap, inside of which the bomb was detonated, shifted meters. After a brief phase of détente between Pyongyang, Seoul and Washington, the IAEA and U.S. intelligence services are now anticipating that North Korea will conduct another nuclear test in the near future.

DER SPIEGEL: Would North Korea benefit from another nuclear test?

Hecker: The answer is: absolutely, yes. The North Koreans have conducted six nuclear tests and shown us a wide range of delivery systems, from short-range missiles to cruise missiles and intercontinental ballistic missiles (ICBMs). North Korea wants South Korea and the U.S. to recognize these systems as a threat. To do that, they must be able to mount their nuclear weapons on these delivery systems, and for that they need further tests. I can't say exactly when there will be a seventh test. But I am almost certain that they will do another test because they need it to accomplish their ambitious program.

DER SPIEGEL: Do you think North Korea could enter a nuclear alliance with Russia and China?

Hecker: Before the events of last year, I would have said that North Korea does not belong in that company at all. China is not happy with nuclear development in North Korea. To the Russians it has so far been insignificant. Yes, if North Korea's tests provoke the U.S., that's good from the Russian point of view. But I don't see the North Koreans getting together with either China or Russia in some sort of a big triad. That doesn't mean that we should dismiss North Korea as much as we have done in the past. One of the arguments that I make in my new book, "Hinge Points", is that we've not paid sufficient attention to the North Korean situation – not just the nuclear threat but the entire North Korean situation. We've allowed that to fester so that today North Korea is one of only three countries that can threaten the U.S. with nuclear weapons.

DER SPIEGEL: How far, exactly, has North Korea's nuclear program progressed?

Hecker: We don't know for sure. What we do know is that they detonated six bombs, and five of the explosions were massive enough to concern us. Based on what I hear from my North Korean and Chinese interlocutors, I conclude that North Korea can reach all South Korea and most of Japan with a nuclear-tipped missile. That alone is big news. In my opinion, they don't need to be able to reach the U.S. to deter us. There are some 200,000 Americans in South Korea and we have over 50,000 U.S. troops stationed in Japan. The damage that would be done by North Korea using a nuclear weapon in either of those two countries would be enormous.



North Korea's dictator Kim Jong-un inspects a Hwasong-17 intercontinental ballistic missile with his daughter in November 2022. Foto: Yonhap / Korean Central News Agency / AP



Siegfried Hecker during one of his visits to the Yongbyon nuclear research center in North Korea

Foto: UPI Photo / IMAGO

"North Korea's intercontinental ballistic missiles (ICBMs) are designed and built to reach the United States' mainland."

DER SPIEGEL: How far along are the North Koreans with their long-range missiles?

Hecker: North Korea's ICBMs are designed and built to reach the U.S. mainland. Judging by their last parade, they've built a dozen or so of these missiles. In their tests, they have lofted them – on a trajectory that lofts them high and keeps them close. That way they can monitor and assess the performance of that missile. If this trajectory were stretched accordingly, such a missile could reach the U.S. So, North Korea has demonstrated the ability to reach the U.S. – but not yet to do so reliably. The U.S. still conducts several such ICBM tests each year. However, we have the advantage of being able to fire our missiles from California to Kwajalein and track their performance ...

DER SPIEGEL: ... an atoll in the Pacific where the U.S. Armed Forces maintain a base.

Hecker: North Korea has not yet conducted such tests. And the second problem is the warhead: Once a warhead is mounted on a rocket, it first has to withstand the G-forces at launch, then the cold in outer space – and then the hot reentry into the atmosphere. My assessment, therefore, is that North Korea cannot yet have confidence of reaching the continental U.S. with a nuclear-tipped missile.

DER SPIEGEL: South Korean President Yoon Suk-yeol hinted in January that his country, too, would be capable of developing its own nuclear weapons. How do you evaluate this statement?

Hecker: This question also came up with the Russian attack on Ukraine. After all, it appears that countries that do not have nuclear weapons, or have given them up as Ukraine did in 1994, are in danger of being threatened by a nuclear state. President Yoon's public statement on this is a very serious matter. Polls at the time showed that more than 70 percent of South Korea's population supports the development of its own nuclear weapons. I think that would be a very bad idea.

DER SPIEGEL: Why?

Hecker: Because it would make South Korea less safe. The American government, I think, sees it that way too. Because then you would have two reasonably inexperienced leaders on the Korean Peninsula with their fingers on the nuclear trigger.



The testing of an intercontinental ballistic missile at the Vandenberg Air Force Base in California in 2017. Foto: 2lt. William Collette / ZUMA Press / picture alliance

DER SPIEGEL: Last week, President Biden and President Yoon reiterated that the U.S. is providing South Korea with its "enhanced deterrence." How do you interpret this "Washington Declaration"?

Hecker: The primary objective of the declaration was to reassure Seoul that the U.S. will protect South Korea's security. There are many economic cooperative provisions as well. For the time being, it worked. President Yoon reassured the world that they will not develop nuclear weapons and will remain in the Nuclear Nonproliferation Treaty.

DER SPIEGEL: Isn't it understandable that countries like South Korea, Japan and even Australia are discussing the development of their own nuclear weapons after Russia's attack on Ukraine?

Hecker: It is important to note here that the U.S. does not just provide these countries with an enhanced nuclear deterrent. The important thing is that we have alliances with them. We need these countries. We're still suffering here from the aftermath of Donald Trump's presidency. He put this as sort of a protection racket: Unless you pay us, we're not going to protect you. The exact opposite is true. We are a maritime power, and as in other parts of the world, you are our allies in Northeast Asia and help us maintain security in that region. That's why we need you, and that's why we will step in when you are threatened.

DER SPIEGEL: Iran is also expanding its nuclear program. The IAEA found traces of uranium there in February, enriched to 84 percent, just below the level needed to build an atomic bomb.

Hecker: Iran has restarted producing more low-enriched uranium following the Trump administration's withdrawal from the International Nuclear Deal. For nuclear power plants, you need about 3 to 5 percent enrichment. Enrichment up to 20 percent is considered peaceful. Iran reached this stage years ago. Now they have gone a significant step further. Uranium enriched to 84 percent is effectively weapons-grade. So, the Iranians have not only demonstrated that they know how to step up uranium enrichment, they have done so. And if they continue to do so, it is realistic to assume that they can produce enough material for some nuclear weapons within six months.



Siegfried Hecker (right) and DER SPIEGEL correspondent Bernhard Zand during their interview at Hecker's home in Santa Fe, New Mexico [Foto: Steven St. John / DER SPIEGEL](#)

DER SPIEGEL: How should the international community deal with a regime that has been suppressing a large pro-democracy movement for months – while at the same time enriching significant amounts of uranium?

Hecker: This is where I'd like to use the phrase where I say "I'm just a scientist." Trading off the nuclear issue versus something as important as Iran's pro-democracy movement is very difficult. When the nuclear deal with Iran was signed in 2015, I thought it was a good

decision in terms of risk management. We couldn't get everything. The missile testing wasn't going to be stopped. But we got the plutonium production essentially turned off and uranium enrichment greatly limited.

DER SPIEGEL: Israel had major reservations about the agreement. The government doubted that Iran would give up its nuclear ambitions.

Hecker: We didn't know then what later became known through the findings of Israel's Mossad – namely, that Iran already had a serious nuclear program in the 1990s, long before the nuclear deal. They were not just going to build a bomb, as we thought. They were going to build a nuclear arsenal. So, when it comes to the question of how to balance the nuclear deal against other factors, I believe Iran has to do much more – first, to fess up to the fact that they had such a program, and second, to demonstrate it has ended. Unfortunately, our options for working toward this are very limited today. And the suppression of the pro-democracy movement complicates this problem.

DER SPIEGEL: In an interview with DER SPIEGEL, Henry Kissinger warned that nuclear weapons are now more dangerous than ever in the age of cyberwarfare and artificial intelligence. And he expressed doubts as to whether politicians can control this technology. Do you share this concern?

Hecker: When someone of Kissinger's age and experience says something like that, one should pay attention. I was surprised at the emphasis he attached to artificial intelligence and the possibility of entrusting strategic nuclear decisions to machines. I share this concern. But perhaps I'm not as pessimistic, because this is where the humans need to step back up on the stage and say: We are running this show. We are not going to give that to an algorithm. This is why history, books, research and teaching at universities help us so much. If you go back and read, for instance, the story of the Cuban Missile Crisis you understand the importance of the human decisions. And when it comes to nuclear weapons, it is the political leadership that matters – and ultimately the president. So, my concern is more about which people we elect to lead. We should be concerned about who has their fingers on the nuclear button.