



## Global Dialogue

### *"Oppenheimer": What Does the Story Tell Us About Existential Threats Then and Now*

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President and CEO, The Bulletin of The Atomic Scientists

With  
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## Transcript

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**Patrick Ryan** [00:00:26] Welcome to the Tennessee World Affairs Council's Global Dialogue Webinar series. I'm your host, Patrick Ryan.

Today we'll talk with Dr. Rachel Bronson, President and CEO of the Bulletin of the Atomic Scientists at the University of Chicago about the movie "Oppenheimer" and what we can take away in understanding the implications of technologies that, despite some positive applications, could have catastrophic consequences, even posing existential threats to humanity.

But on a drier note, first, let me tell you about the World Affairs Council of Tennessee. We're a nonpartisan, nonprofit educational association based in Nashville, Tennessee, at Belmont University. And we bring programs and resources to the community and work with high school students and college students to inspire and inform them on the challenges they face in an increasingly complex global landscape.

And now, to do a deep dive into the meaning of the "Oppenheimer story," there is no better expert on the topic than Rachel Bronson, the keeper of the "Doomsday Clock" at the Bulletin of the Atomic Scientists. Dr. Bronson oversees the publishing programs, management of the "Doomsday Clock" and a growing set of activities around nuclear risk, climate change and disruptive technologies. Before joining The Bulletin, she served as the Vice President of Studies at the Chicago Council on Global Affairs. She also taught Global Energy as an adjunct professor at the Kellogg School of Management. Prior to moving to Chicago, Dr. Bronson served as Senior Fellow and Director of Middle East Studies at the Council on Foreign Relations in New York. She is author of "Thicker Than Oil: America's Uneasy Partnership with Saudi Arabia." I encourage you to take a look at her biography on the website, "TheBulletin.org," to see more of her impressive professional achievements.

Thank you, Dr. Bronson, for taking time from your busy schedule to talk to us today about "Oppenheimer."

**Dr. Rachel Bronson** [00:02:19] Thank you so much, Pat. It's really a pleasure to be here with you in particular, and with all those who are listening.

**Patrick Ryan** [00:02:28] Let's start with the movie itself. We're going to talk about the current environment, but we really want to drill down to begin with here on the movie, because it has turned out to be quite the moment in Hollywood's engagement with important topics like nuclear proliferation and the technologies that could pose threats. It's adapted from the book "American Prometheus," a Pulitzer Prize winning book. It's the story of J. Robert Oppenheimer, the theoretical physicist, Director of the Los Alamos Laboratory during the development of the atomic bomb and subject of the Christopher Nolan blockbuster movie.

I had a chance to see it in IMAX 70 millimeter. I had to wait until 11:30 p.m. for the local Nashville IMAX showing that the first weekend.

Terrific movie. Really came away impressed with the storytelling. I've read some comments that there were a couple of Hollywood-izations of the story, but I think it's captured the imagination of a lot of Americans about the story and the consequences.

So, I'll hand off to you for your opening remarks about the movie and about what it means to our current conversations about nuclear proliferation and other technologies that pose threats.

**Dr. Rachel Bronson** [00:04:00] Well, thank you, Pat. There's really a lot to talk about. And I look forward to this discussion about it.

It was a terrific film. It is a terrific film. I highly recommend everyone go out to see it. My experience, I've seen it twice now, and my experience, like so many is a three-hour film is pretty daunting. But this film, you sit down and three hours later it's over. You kind of walk out and it's really immersive. You're really involved in kind of thinking through with Oppenheimer, the challenges and at the moment that he was working in World War II and the need for a bomb and who is participating. It's really, truly fascinating.

There's so many different directions we could go in this discussion. I think that first of all, I think one question that I ask well, let me just actually step back and say I am getting a lot of questions about the movie because Oppenheimer was one of the founders of the Bulletin of the Atomic

Scientists. He was the first chair of our board of sponsors, which were illustrious scientists around the United States and world. And many of the figures you see in the movie were part of our founders and our founders list.

So, Edward Teller and I.I. Rabi and Hans Betha and all the great scientists of the day, along with Albert Einstein, who was, you know, as we saw in the movie, kind of really at the end of his career and life, but still was an advocate for the Bulletin and actually wrote some of our first fund raising materials.

So, we've been thinking about this for quite some time for the past year or so, knowing this movie was coming out. And I really do recommend that if folks are interested, they take a look at The Bulletin's Web site ([TheBulletin.org](http://TheBulletin.org)).

We publish every other month a magazine, and we have one devoted to Oppenheimer, and our publisher made it free. So, it's free to the public and just phenomenal content. So, if you want to go down the rabbit hole after seeing the film, that's one rabbit hole that you can go down.

There's a lot of material there. So, a number of different directions we could go in. But I think the first reason that this movie is having such resonance is because of how fraught the nuclear landscape is today. And it gives us a way to talk about these really complicated issues over the dinner table and in elevators with our friends in ways that, quite frankly, could feel kind of weird without the movie, right? It's hard to say. How are we doing on nuclear security or are you worried about nuclear weapons?

You know, raising that in this in any context can seem a little intense. And it is. But this movie is allowing us to have these conversations and start thinking about nuclear weapons again in a way that I think in our ether we have the sense that it's more present than maybe we're aware or more present than we're making it known. And so, you know, we see, huge, huge audiences among young people. People ask, are young people concerned? We see a huge young audience who've grown up with threats from North Korea and fights over the Iran nuclear deal. During President Trump's administration, a kind of a casualness around whose button is bigger than the others and trips to North Korea.

And of course, we're now living through and within the Russian invasion of Ukraine, that for the first time a leader of a major nuclear state is threatening nuclear use. And all of this kind of, it's put up on our screens and in front of us regularly in a way that seemed impossible a decade or two ago, that we need to be talking about not only conventional land war in Europe, but a Russian invasion and the threat of nuclear weapons, and whether it's the threat of nuclear weapons or using Zaporizhzhia and nuclear power plants as landmines, if you will.

So, it's hitting at this moment when I think many people are feeling that things are not going in the right direction around nuclear weapons. And we see Oppenheimer struggling with how do we manage the situation?

The scientists understood back in the mid-forties that there was likely to be an arms race and there weren't guardrails and having to figure out what a governance system should look like. And I think very much we are in that moment now. So that's one area. And I don't know if you want to dive deeper into that or we can talk about some other areas. So, let me just stop and ask

you, should we stop there or do you want to go into some other areas that are I think this movie surfaces for us?

**Patrick Ryan** [00:09:25] We'll get into the conversation about technology and global governance of technologies and so forth. But you're an expert in the field and you saw the movie. What jumped out at you as key lessons in the conversation?

You know, there was the, I think there was only one scientist. You know, they were pursuing the bomb because we thought Germany was going to get the bomb. One scientist left the project after Germany threw in the towel in World War II and the others continued to work to complete the project. And there's the conversation that Oppenheimer was enthusiastic about getting the bomb, and he cooperated and worked with the military planners on how to employ the bomb.

Then there's the quote he's become the destroyer worlds. So, he was clearly conflicted. And then, as it turns out, he was against the development of the hydrogen bomb. He was pushing for international controls. So, as we screen the movie in our minds here walk us through a little bit of your reaction to how it played out.

**Dr. Rachel Bronson** [00:10:54] Yeah. Thank you for that. You know, I think as I was sitting there watching the movie, the history of who these people were is really important to what we're understanding. Many of these scientists in this Manhattan Project were refugees from Europe. They had fled. They were either Jewish or they were married to someone who was Jewish, in the case of Enrico Fermi, which is why he leaves Italy to find his way eventually to Chicago to split the atom. They were being pursued for their science, for their expertise, as well as their identity. This was very personal for many of them. And so and of course, the others who weren't directly connected had siblings overseas fighting. Right.

So, the existential nature of the war that they were embedded in was very, very present, and especially in the European theater of operations. But as they moved to Japan as well, a very, very deadly, catastrophic war with casualties, the numbers of which we can barely comprehend. And I think that actually becomes important, because we know now what nuclear weapons can do and how big they are, and they can end life on Earth as we know it.

These were being built at a time where you have the bombing of Dresden with tens of thousands of people dying at the hands of repeated bombings and the battle of Tokyo, the firebombing of Tokyo, which had happened before the [atomic] bombs were dropped just a few months before, but a few months before, had casualties that exceeded the casualties of these nuclear weapons. So, the scale of the destruction and the casualty of what World War II was like, I think that context becomes very, very important to to what's going on.

I think that needs to absolutely shape how we understand the physicists and the scientists so when they're, what you're hearing is just a line that goes very quickly. But they're sitting in Washington, and I think it was the Secretary of State at the time, but it may have been an assistant secretary as they're beginning to chart out the targeting. He says, you know, I worry for an America where tens of thousands of deaths cause no protests in the streets. And then those sitting listening say to him, well, Pearl Harbor, and we'll do that. And so, it's just important, that was just one line. But I thought that the destruction and the death that's around them, that doesn't, we don't fully feel that from watching the movie. And that was driving the scientists.

That was one thing that very much kind of was on my mind as we kind of rethink about what we should or shouldn't have done back in the day. I think the other thing that was on my mind was, and this happens very, very quickly in the movie, and it's really hard that one little thing I would have love for him to put dates, for Christopher Nolan to put dates and places as he's going back. And, you know, there's a moment when we're in Chicago and then we're back in Los Alamos, and then I think we're in California, probably at Berkeley at some point, and then we're back.

The importance of that is the Manhattan Project, we tend to kind of think about it as Los Alamos. Right. But Los Alamos is just the tip of the spear of what the Manhattan Project really was. In fact, the heads of the Manhattan Project aren't Oppenheimer. Oppenheimer is the director of Los Alamos, but the heads of it were Arthur Compton in Chicago and Ernst Lawrence in Berkeley. And they were overseeing a national effort to build these bombs and create the science behind it. And so really important work is still going on in Chicago under Fermi, Oak Ridge Laboratories, right in your home state of Tennessee, you have Hanford in Washington. And in each place, there's a different focus on how to build this. In every innovation that they're coming up with are mind boggling advancements. All of them could have won scientific awards. And in in the movie, right.

It's just like they're dropping marbles into a fishbowl and measuring fissionable material. But really, this is a national effort around these scientists to create the next innovation.

**Patrick Ryan** [00:16:18] Well, when you talk about marbles and fissionable material, you mentioned Iran earlier, there's, you know, current world questions about how easy it is to build a bomb. And if it was if it was feasible so many decades ago we can only imagine the feasibility among countries that have some level of technological expertise and the ability to produce fissile material.

Let's talk a little bit about, as we continue to dive into the movie, and you're right, Nolan is a non-linear director. He jumps around and we're not sure if you're in 1938 or 1953. But I think it was a well-crafted film. And the intersection of the storylines, I think worked out very well.

We're going to talk about global governance after we talk about some of the other technologies that pose a threat to us. But why do you think that the movie, apart from the simultaneous release with the Barbie weekend, why does Oppenheimer strike such a chord with the American public in this time and age? And why is it that we've come so long before this story was told and received so well?

**Dr. Rachel Bronson** [00:17:48] Yeah. So, we talked a little bit about kind of the current nuclear environment in which we're operating. So, you know, I had I characterize it as the new nuclear landscape, or this isn't your father's nuclear landscape. Right? This is, we are in an era right now where every nuclear power is investing in their nuclear weapons. So, the US is embarking on a \$1.8 trillion, probably about that much if there are no overruns. But about a \$1.8 trillion investment in modernizing their nuclear arsenal, well beyond what we need, I would argue, to keep what we have safe.

These are really kind of investing in new technologies. The Russians have just gone through a major refresh of their nuclear arsenal. The Chinese are investing in ways that we haven't seen in the past and so on and so on. The Pakistanis continue to have a very fast building nuclear arsenal, all of that. We talked about North Korea.

So, all of the major states are investing in them and they're investing in them in ways that seem to be making them more usable. That as we talk about debates over tactical nuclear weapons or low yield nuclear weapons, you know, they can be used. There's just a new environment where we're kind of leaving a space, where for a while these weapons are viewed as, by and large, as mostly for deterrence. And now, like in our postures, if you look at our military postures and statements, certainly the Russians and even the U.S., they seem to hint on being more useful. We were also shredding our arms control architecture.

We went through a period of really from 1970 to about 2010 when we were building up our arms control architecture and really reducing, ultimately reducing the numbers that we had. Now there's very few limitations on what nuclear states can have, in part because the agreements have become dated. They weren't working. But we kind of stepped away from them without layering on new ones. And so, in many ways, it is very similar to the moment that Oppenheimer and his colleagues were operating. Right, because there was no arms control architecture. They're trying to figure out how to build one. In part, that becomes many of their life's work. They're trying to figure out how to reduce the need.

Oppenheimer believes, you hear in the movie that maybe this weapon will end war as we know it. And there's an argument that for a number of years that may have held. So, there's a lot that's resonant. The difference is we know what happened. We know that, that we haven't, we're not seeming to learn from that experience. But I think there is a sense of an underlying sense of camaraderie, like, oh, we know what this feels like when the guardrails aren't there, where investments are being made, where maybe it's going beyond the science. So, I think there's that aspect that is really resonating, but not only that aspect.

The other part of the movie that I think you can extrapolate from, is scientific advancement is always dual use. There are always huge benefits that can come from scientific endorsement, but also real risks. And if you extrapolate from that, that's what the scientists are, they're really taken by their, they're taken by their innovations.

They've come to a part where it's like, well, just because we can do it, should we. Right. And so that's the that's the debate over the hydrogen bomb, where Oppenheimer is very much against the hydrogen bomb. He doesn't think it's a good use of resources. He thinks that atomic bombs are dangerous and that you don't need something that big, even if the Soviets have it, and that our focus can be on other uses of nuclear power, which go on to help with radiation treatments for cancer and powering spaceships to Jupiter and things like that. But trying to figure out how to govern this and where are the limits?

I think today we're very much in conversations about that, about technology. Right now, things don't feel like they're going in a great direction. And we've just talked about nuclear. But we saw in, you know, with the kind of debates over pathogens in COVID and regardless of whether you think COVID was a lab leak or naturally occurring, what we've learned is that technology is advanced enough in pathogen research that you could have a very significant lab leak that could lead to pandemics like COVID or worse. And we don't have a sense that those are being governed very well.

You can look at artificial intelligence and literally we're having a battle right now about is AI an existential threat or not? We have Geoffrey Hinton stepping down, literally the father of AI, just like Oppenheimer, was the father of the atom bomb. The father of AI stepping down because he

doesn't think this is being managed very well. And we're being referred to in "The New York Times" as having an "Oppenheimer moment." So, science is moving ahead very quickly. We know it's going to bring huge benefits. There's a reason like AI in so many ways is helpful to us. But we don't have the ability right now. We can't see a vision. How do you govern these new technologies that we're creating?

The same kinds of questions the Manhattan Project scientists were asking. You see Geoffrey Hinton and Sam Altman asking about AI and sites within the community of, how dangerous is it? And you hear Hinton and others calling for regulation, just like the way the scientists were calling for them in the project.

So, I think that whether it's on the topic of nuclear issues or the advancement of technology, I think it really resonates with this complicated environment that they found themselves in then and we find ourselves in now. Now, here is, I think, also an optimistic point of this is as we turn back and look back at the Manhattan Project and we talked about how it was nationwide. When the United States puts its mind to something, it can truly do great things.

I think we're harkening back to a time where there seemed to be a greater sense of shared mission where we could undertake these national efforts and produce great things. And I think this film is providing a vehicle for some of us to kind of begin again and continue to think about how could we make that possible again? What would that look like?

I really do think it's tapping into a zeitgeist that, you know, and in a way that Christopher Nolan, when he started this project, couldn't have even imagined. But it's why I kind of argue in my op-ed, the right movie at the right time on the right topic.

**Patrick Ryan** [00:25:10] You mentioned the question of, just because you can do something, should you do something and the question about building a hydrogen bomb. But there's also the incentive for people developing technology that if we don't do it, someone else is going to do it. Which gets back to the global governance piece. And I have a question on that in just a second.

First, I want to remind everyone that we're talking with Dr. Rachel Bronson. She's the President and CEO of the Bulletin of the Atomic Scientists. You can find out more about the bulletin at "TheBulletin.org."

I encourage you to take a look there and check out the Doomsday Clock. And, Rachel, we're going to talk a little bit about the Doomsday Clock. And I understand we're 90 seconds to midnight and I take it you own the title the "Keeper of the Doomsday Clock." Is that right?

**Dr. Rachel Bronson** [00:26:03] Oh. [Laughs]

**Patrick Ryan** [00:26:05] How is that received?

**Dr. Rachel Bronson** [00:26:05] My Science and Security Board.

**Patrick Ryan** [00:26:10] We moved away from nuclear a little bit to talk about AI and pandemics, but let's see if we can dot a couple of I's and T's on the nuclear question. When it comes to global governance, there really have been some successes in governing nuclear weapons. The Nuclear Nonproliferation Treaty, which has been effective in deterring some countries because of the

downsides. We've had bilateral treaties with the Soviet Union and the Russian Federation, although the New START treaty is now no longer being observed by either party.

Let's just look at the Cold War and the atomic age. And how would you, you're a professor, you've taught classes. What's your grade for global governance in controlling nuclear weapons proliferation and the threat that we face?

**Dr. Rachel Bronson** [00:27:07] Right now we're at a pretty dismal time in terms of global governance of nuclear weapons and I think it's important. It's also like just leaning on the movie a little bit. I'll come back because I think it speaks directly to your question, which is towards the end of the movie, we see a number of cases where basically Oppenheimer is first telling his colleagues that just because we created it doesn't mean we get to control it. We have to leave that to the political actors.

Then right then, once that happens, he asks, Groves, can I come to D.C. with you? And Groves said, for what? And then he does try to get in to see Truman, to talk with him about negotiating, you know, trying to figure out how to manage this escalation, which he and his fellow scientists, they were prescient.

They anticipated a very expensive global arms race. And I think what's important on this is some people I know who I spoke to came out very deflated about that, like no one listens to the scientists. But what was really interesting is that Oppenheimer and his colleagues don't just take no and go away. They actually stay at this effort to try to think about how to create governance structures of this technology that seem so impossible to govern. And their ideas at the time are about internationalizing the science, which continues to be part of a conversation, certainly around the Iran deal that we can get back to.

They have those, they are trying to build track two what we call track two conversations or meetings between scientists in Russia and the U.S. We have Pugwash evolving. But they stay very active in this and ultimately create institutions like "The Bulletin" and others where for the next 15, 20 years, I mean up to the present. But at the time, the next 15, 20 years, there is very raucous debates about what's the best way to keep us safe. Is it arms control or is it abolition? Do we have to get rid of all nuclear weapons? Or if they're if we have about as much as they do that keeps us in sort of a posture of mutually assured destruction?

And what would arms control, what would be the most stable ways to maintain a kind of strategic purity. So these kinds of issues are debated, and many of the conversations around technology and strategy emerge in the seventies, as you're talking about, in arms control agreements that really do control, as you mentioned, the proliferation around the NPT, uses around nuclear power, important agreements around testing above ground, below ground testing, no testing, important agreements about reducing numbers, important, important developments around removing certain weapons that were particularly provocative. All of that comes out of this thinking.

One of the things that I take away from it is like these things take time, when we look, and the problem is these weapons are so dangerous, we have to have some urgency around it because we can't we don't want to wait another 20, 25 years until we're able to start responding. But to me, it's inspiring that they faced such daunting challenges and they stayed at it and they created institutions that bring others in.



Bringing that up to the present. You are asking the question, "What's my grade?" We have. I mean, is it a failing grade? We're all here to talk about it. But the "Doomsday Clock" has steadily moved closer to midnight. I know there's at least one question on that so we can kind of tackle that head on. But the "Doomsday Clock" has been moving pretty steadily towards midnight, mostly because of the lack of government structure, that there is nothing that is really bounding the US and the Russians, the two countries that control 90% of the world's nuclear weapons, there is very little in terms of exchanges and conversations and efforts to reduce the threat.

I think for many of us looking at it the time does not feel right for it, which is we cannot find ways to actually engage with each other productively on these issues. And now we also have the Chinese who are investing very heavily. They seem very uninterested in any sort of negotiation.

So, this is not to say it's easy, but it's too dangerous for us to throw our hands up and say we'll never be able to figure this out. Precedent shows we will be able to figure out if we stay with it. And the dangers of these technologies insist that we stay focused on it because it's too dangerous for us to throw our hands up and say, well, the time isn't right.

I think we have to continue working on it. So, when the time is right, there are suggestions for how do we move forward and it has to move in that direction. It's too dangerous for it not to.

**Patrick Ryan** [00:32:36] As you mentioned, we are starting to get questions in the queue and I'll remind everybody to please put your questions in the Q&A tab at the bottom of your Zoom screen, and we will get to as many of those as we can.

Rachel, you mentioned that we had a question about the "Doomsday Clock" and Robert Altschuler asks about the data and facts that go into adjusting the time, but give us just a snapshot of what it is. I know every January, is it, that you get your CNN moment to tell us how close we are? And it's a widely disseminated conversation. But what is it? How did it start? And how is it instructive to us?

**Dr. Rachel Bronson** [00:33:21] Sure. Okay. So very quickly, the first "Doomsday Clock" was created by an artist, Martyl Langsdorf, who is the wife of Alexander Langstaff, a Manhattan Project scientist and a founder of "The Bulletin." And they were, it was 1947. So, the bulletin was created in 1945. We had a black and white bulletin that we put out. But the communication channels of the day were a magazine, right? Time magazine, Life magazine. That's how people were communicating most effectively. And so, The Bulletin of the Atomic Scientist becomes a magazine. They need a first cover of the first magazine.

So, they go to Martyl to design the first cover. And it's a magnificent story of art and science coming together. She was an artist, but she understood the urgency that her husband and his colleagues were feeling and how dangerous the times were and how much they needed the American public to engage. And that was really the mission of "The Bulletin" and trying to generate interest and support and education around these issues. And so, she creates a clock and it's set at seven minutes to midnight and it's set in that quarter, the last quarter of the clock that is so famous right now, at seven minutes to midnight, she says that was pleasing to her eye.

It's a design that conveyed the message that the scientists were trying to share. It was urgent. It was in our hands to pull it backwards, but we had to be engaged. And so, it's 1947, right? By 1949, the Soviets explode their atomic bomb. And the editor of the bulletin moves the clock closer to

midnight. And then in 1953, both the Soviets and the Americans have tested the hydrogen bomb. So, this very static design becomes dynamic in a way that was unique, before you had GIFs and things like that by the early fifties.

Over the years, at first the editor and then the Science and Security Board set the time on the clock. So how was the clock set now? If you look at it, and it's all detailed on our website, but it's the Science and Security Board of "The Bulletin of the Atomic Scientists" that sets the clock. And if you look, you'll see we have nuclear experts, scientists and security experts setting it and they are across the issues that we focus on.

Every year when we sit down to start our in-person discussions, we're talking throughout the year. But in November of every year, we sit down with the in-person discussions, I ask the Science and Security Board are we safer or at greater risk. Is humanity safer at greater risk this year compared to the last year and this year compared to the last 75 plus years we've been asking the question.

Those are big questions, and they are answered in different ways. Right? Until 2009, I believe it was, it's either seven or nine, you could answer that question by focusing on the nuclear threat. But by 2007 it was you couldn't answer that question anymore without including climate change. Right.

So, you couldn't answer is humanity safer or at greater risk. And that's when we defined climate as a second existential threat. Although we had been publishing through the late sixties and early seventies on climate change, that we were very early to the climate discussion because we care about existential issues and manmade threats to humanity.

I asked that question, and the setting of the clock reflects the answer of the Science and Security Board. Are we safer or at greater risk? Is humanity safer or greater risk this year compared to last year and this year compared to the last 75 plus years? And why do we ask the question that way? Because we look at what's happened in the last year. But we also know after we have the history of setting it, that we're trying to say something by how the clock is set. And we use our past settings to calibrate what we're trying to say.

We indeed say by "90 seconds to midnight," which is where we're at now, it's the closest it's ever been. And so when the Science and Security Board means that. Now what is it? That's the Doomsday Clock is a judgment. It's a judgment among those scientists and security experts. And they delineate their explanation every year in the clock statement that we released. And I always urge people to read that statement because it gives you a better picture of why they moved the clock where they have.

The purpose is to convey our concerns, but also to provide an opportunity for people to question whether we've gotten it right or wrong. Right. And so, to say, okay, do you agree that it should be 90 seconds, that we should have moved it forward or back that year? Why? When would you have set it? Would you have included those issues that we include? What else would you include and why? And the importance of that gets us right actually back to this movie, which is these are really hard issues to talk about, whether it's nuclear risk, climate change, new disruptive technologies, myths and disinformation, all of that. They're very hard to talk about. And many of them, like nuclear issues and climate issues, are almost designed to keep the public out. They're hard to talk about.

What the clock does, is provides an entry ramp into these discussions, if you will. It gives people an easy heuristic. It's 90 seconds to midnight, do you agree or not. And I think that's why it is used so widely throughout the year by people at the decision makers at the highest levels to school kids writing book reports. Right. Because it very quickly can give you a way to jump into a very complicated conversation. And that's what this movie is doing as well. It's giving us all an entrance ramp into a very complicated set of issues that affect our daily lives and feel like they shouldn't be that difficult for us.

We might not understand the nuclear technology, but we do have a vested interest in how they're used. And so I think, that's what the clock, the clock is really this metaphor, but I see it as an accessible way to enter really difficult conversations. We can all participate in it, but it is a judgment. We are not feeding data into a computer and it's spitting us back a number.

What we're doing is we're talking. We're using the assessment and judgment of experts who do that for a living in their different parts of their expertise. And they come together and it's like, how does this roll up? How do we understand this moment we're in over the last year and over, you know, nearly three quarters of a century?

**Patrick Ryan** [00:41:03] You know, in the past, even just the past four or five months, we've had some really revolutionary moments in the "Doomsday Clock" criteria. Moscow has said, it has started brandishing the nuclear weapons threat. You talked about the scientists, the AI technology people having "Oppenheimer moments."

Now we see climate change causing dramatic and drastic consequences. The heatwaves we're seeing and firestorms, etc., etc. So, it seems that at some point the "Doomsday Clock" won't be able to keep up with the downward spiral of some of these events. And I'm sure you all will figure out the best way to display these things. But we're inching closer and closer. I don't think anyone could say we're the same or better than we were a year ago. And a year from now, we'll probably be in the same predicament.

I don't I don't want to be the pessimistic one here, but the "Doomsday Clock" analogy may run out of steam.

**Dr. Rachel Bronson** [00:42:18] Well, we hope not. [Laughs] Every year, you know, we kind of come out and talk about it. It's created to help provide a way that we hope to move it away from midnight. And we do spend a lot of time also thinking about the magnitude of the change, you know, compared to where we're at. And like 90 seconds is a very, very dangerous. And so, we really take it seriously when we move it, especially given where we're at.

We really do think about it, about in terms of like orders of magnitude and what is the message we're trying to convey and what time would say that.

**Patrick Ryan** [00:43:00] Now let's jump into a couple of these topics. Nuclear weapons has been the bread and butter of the "Doomsday Clock" for so long and continues to be an element. And we saw that Moscow has backed away from the New START agreement. We see that they're threatening nuclear weapon use over the war in Ukraine.

When you talk with your board, what do they say about the developments and the likelihood and threat from a tactical nuclear exchange? We see increased hostility between India and China, and India and Pakistan. So, all these are festering opportunities for disasters.

What kind of anecdotal response do you get from the board as you're talking about making changes of "Doomsday Clock," specifically relative to the threat of nuclear exchange?

**Dr. Rachel Bronson** [00:44:02] There's a lot of conversations about, you know how fast things are changing. There's growing concern about space as a future battlefield. What that means in general for nuclear weapons, but also in general, you know, what is civilian and what's not and what's a target and what isn't? And real concerns about space as the kind of forefront of that new kind of battle area, a battlefield. So that's one issue that we spend time talking about.

There's a lot of interest in like mis- and disinformation. We talk about mis- and disinformation as a compounding threat. You know, what does it mean for our ability as a society to tackle these big questions about science are in front of us and have such promise, but such peril as well. And our inability to like trust sources of information and how to make sense of that. And so those are some of the window dressing around as we think and talk about, you know, the environment in which we are.

I would imagine this year, just from what I've been seeing, we'll be talking a lot about artificial intelligence and what does it mean in terms of itself as an existential threat. And I think there's some questions about whether it is. But what does it mean in terms of weaponry and that future battlefields? And they'll be talking about that. And where are governance structures and differences between nuclear weapons, which are largely state owned? Right.

And artificial intelligence, which is really the province of the private sector. And what would that mean? Those are some questions that I can imagine they'll be talking about in the coming months as we go into thinking about these issues.

**Patrick Ryan** [00:46:15] Rachel, we have another question from Robert Altschuler He asked about the organization's mission, The Bulletin's mission evolving over time, and what strategies you consider most effective in engaging the public.

**Dr. Rachel Bronson** [00:46:28] Oh, that's a great question and we are looking at that every day. So in some ways, the..

Well, let me just start with, on the 10th anniversary, our editor Eugene Rabinowitz, was asked what were the goals of the Bulletin, of forming the Bulletin of the Atomic Scientists? And I like to repeat those because they really drive us today.

The first was to educate the public about nuclear technologies and that notion of, we would say today, engaging the public. We were founded on this belief that the public is important to democratic discourse and pressuring our political leaders to do to do the right thing. And that continues to be our mission to engage the public on these issues. And he talked about that, to engage the public, educate them on nuclear technologies. I think he used that term nuclear power specifically. But in it, what he meant was that these advancements are dual use, right. And we

need to be educated to kind of understand where there's good and harm and how to and really debate how to govern them. And that still holds true today for nuclear technologies and other technologies.

The second reason was to provide a place where scientists could come out of their labs and engage the policymakers. We still have this debate whether experts should be relegated to their universities in their labs and just work on getting tenure, or whether we should support their engagement for those who want to on public policy issues, when and where and how. And so we were created as a space for those who wanted to engage on the policies of their innovations to engage. And that remains something we're doing.

But it's the third goal, and this goes to your question, and I think that the questioner, which was to manage the dangerous presence of Pandora's Box of modern science, and it's a beautiful mouthful, but it's a beautiful quote, right, to manage the dangerous presence that we need it to govern the dangerous presence, dual use technology of Pandora's box of modern science, which the science is moving quickly at such large scale. And so, what you see is that The Bulletin is largely focused on nuclear weapons for all of its history, but never exclusively.

And increasingly, as science is innovating and growing and expanding, the topics we cover do so as well. And so that's why the issue of climate change often comes up. And what I said before is, I'm not surprised now, knowing our history, that in 1978 we had a cover story that said is mankind changing the environment or changing the climate. And you open it and basically, as we say, yes, right.

They were grappling with these innovations in climate and climate science as they're grappling with not just physics, but they move into biology and questions of population, all these big heady issues that they see in terms of science. And that's why we were so active around COVID. We had longstanding connections to bioweapons experts and pathology and and pathogen researchers because of BWC. But we very quickly were able to say that we don't think COVID is a weapon. We don't think it's a bio weapon. But we do think that it could have come out of a lab. And we have kind of our scientists who are looking at that.

We've always looked at these big consequential issues of the advancement of science. But the biggest one, and the poster child that remains and will always be key at The Bulletin are nuclear weapons, because those have the greatest consequences and are the most difficult in many ways to govern.

**Patrick Ryan** [00:50:29] We're coming down to the last couple of minutes here. So if you have questions please get them in the Q&A tab. Victor Hugo Noguera asks you to comment on the crossover between AI and nuclear decision making. What are the consequences of using AI in the process of a nuclear power, deciding when and where and how to employ nuclear weapons, especially if they feel that they're at peril.

**Dr. Rachel Bronson** [00:51:02] Yeah. So, there's a lot of conversation about that among the planners, as you can imagine. And the kind of reigning view is that humans should always be making any decisions in terms of any sort of use. And we wouldn't want to turn that over to artificial intelligence.

Let me kind of step back and share with you a conversation that I was having with a member of our Board of Sponsors, which is yet another layer of leading scientists that support The Bulletin's work. But as a leader in AI, this particular board member was saying, what worries him so much is that I just speeds up all decision making, even if you leave it to humans to make final decisions,

AI is processing the information. It's built to process the information so quickly that it's narrowing the time frame available to make decisions. And what we know about diplomacy is that the whole point of diplomacy is to broaden the time you have to make a decision, widen the amount of time that you have for leaders to be able to think about what they need to have happen and ask the right people. And so even if you were able to institute individuals in these positions, you know, and AI is still operating around us. Right. And the information that we're getting is coming so quickly and faster and faster. And I think if you think about the strategies of deterrence or whatever strategies we're working, they need time and we need time to be able to see how the other side is reacting and everything.

So, like every other part of our life, right, that the need to create space for engagement and thought is under pressure. And this is not an area that we want it under pressure because as it is, it's already a very tight time, amount of time that you can make decisions. So, I think that to me is the most interesting.

Well, there's a lot of introspection, but is a truly interesting one of like, how do you continue to create space for decision makers to think through a problem where information is just coming at them so quickly?

**Patrick Ryan** [00:53:33] Rachel, Robert Kapanjie asks if there has been a more destructive atomic weapon developed since the first hydrogen bomb. I know that they've increased the the power of hydrogen bombs. What's your answer to that question?

**Dr. Rachel Bronson** [00:53:50] Yeah. So, we definitely saw over time as larger and larger tests of of nuclear weapons at the scale of which were just, you know, multiples of what we saw in Hiroshima and Nagasaki. I think one of the areas now is actually the opposite of where we're so focused in terms of nuclear strategy doctrine policy, is this return to, quote unquote, low yield nuclear weapons.

What was happening during a lot of the Cold War was could you make a bigger and bigger bomb? Could you have a greater and greater yield? And we saw that demonstrating. But where are the investments are now being made are in, quote unquote, tactical nuclear weapons or smaller yield nuclear weapons. And the idea was, was the weapons were becoming so destructive that it was becoming inconceivable that you would ever use one. Right. And so, then the different the led largely by the Russians in this way, but matched by the US, an effort to now make them smaller and smaller. And many of these small tactical nukes are bigger than what we saw in Hiroshima and Nagasaki.

What we hear on the Russian side now, like literally few weeks ago, is leading Russians think we're going to have to we have to use one of these weapons so that the West knows we're serious and we can use one of those. And that will convey our seriousness about Ukraine and where our red lines are. And so, these weapons in some ways are becoming, it seems, if you look out, more usable. And now the United States, the Biden Administration, but also the West, are trying to find ways to how would they respond.

We saw it right after the original invasion. We saw, okay, even if they used one, there are other things that the U.S. and West could do to make it to make it very painful for the Russians without responding with tactical nuclear weapons. But this is really untested. And what if they use a second one, what if a third one. What then?

What if the U.S. response and then you get back into that good old term of an escalation ladder where no one knows where that ends and when you wargame these out. Just about every war game ends with both sides then using low yield weapons, increasing their yield and getting back to the catastrophic global consequences that we know are possible. So, the question is a good one. But in terms of things to watch, for sure, it's actually the minimization of them, quote unquote. That seems so unstable right now.

**Patrick Ryan** [00:56:47] When a weapon becomes more usable, it's more likely to be used.

We've covered a lot of ground with Dr. Rachel Bronson, President and CEO of the Bulletin of the Atomic Scientists. And, Rachel, I'm going to ask you for a closing comment here, but I just wanted to thank everyone for their questions and participation today. You'll be able to find this program in our [YouTube.com/TNWAC](https://www.youtube.com/TNWAC) archive podcast. And a transcript will be on our website. Rachel, a lot to digest here.

People can go to your [TheBulletin.org](https://www.thebulletin.org) website and get more information about the Doomsday Clock and about 90 seconds to midnight. You have a rich collection of videos in YouTube and op-eds and you're out there, so people can find out more about the topic. But the floor is yours for any closing comments that you'd like to make.

**Dr. Rachel Bronson** [00:57:45] Well, thank you, Pat. It's always a pleasure to be with you. And thanks to the audience. Yeah, I think, first of all, do go to our website. There's a ton of good material on Oppenheimer and the movie and how to understand it, the good work being done on many of the issues we talked about.

The one thing that maybe I could leave our listeners with and one thing that the film didn't touch on is the consequences on impacted communities. And we have a great video out right now with an interview with Tina Cordova, who talks about the effects and impacts on what are called downwinders, those who are downwind of the Trinity test.

There's also a really important "New York Times" piece out that focuses on a study at Princeton, which shows the consequences of the Trinity test, that it touched 47 states and blew so much further than scientists at the time believed.

There are communities across the world who continue to suffer the effects of the testing and the incredible number that we tested in the Nevada desert, right in our own country and the consequences of that. And so that wasn't very visible in the movie nor very little on the Japanese.

It's really important just to remember that there are impacted communities and they're living with the consequences of these tests today. They are heroes in the story in many ways in that they weren't asked to be.

Right now, compensation efforts are going through our own Congress to widen the scope of compensation to include those who were at Trinity. And it's called Rica. And it's going through now, this compensation act. And I'd urge folks to look at it because if we can encourage our political leaders to widen the scope of who gets compensated for it, it will serve justice, quite frankly. That's the lesson and we can leave it there.

**Patrick Ryan** [00:59:44] Well, thanks for that. And I apologize for not getting that topic in earlier. There's certainly a lot to discuss there. It's been in the news lately, especially with the observance of the anniversary of the dropping of the bomb in Japan in August of 1945. But the consequences for those in and around the Trinity site and the other nuclear testing sites have been profound. And when you put a human face on the incidences of cancers and other consequences, it's really a story that more people need to know about. Thank you. Thank you for sharing that. And we'll include some references to that in the transcript and website posting.

Dr. Rachel Bronson, thank you so much for being with us today. We really enjoyed this conversation on a very important topic, but probably nothing more important that we could be considering.

As you as you pointed out, what we seek at the World Affairs Council, as you do there, is an informed citizenry who is impacted by developments in the world and steps up to talk about them with their elected leaders and in their community.

That's it for me. Patrick Ryan, President Emeritus, Tennessee Workers Council. Please visit our website [TNWAC.org](http://TNWAC.org) where you can become a member and you can also make a gift to the World Affairs Council to help our programs in global affairs awareness in the community and in schools.

Dr. Bronson, thanks so much. Have a great day up there in Chicago.

**Dr. Rachel Bronson** [01:01:14] Thank you so much.