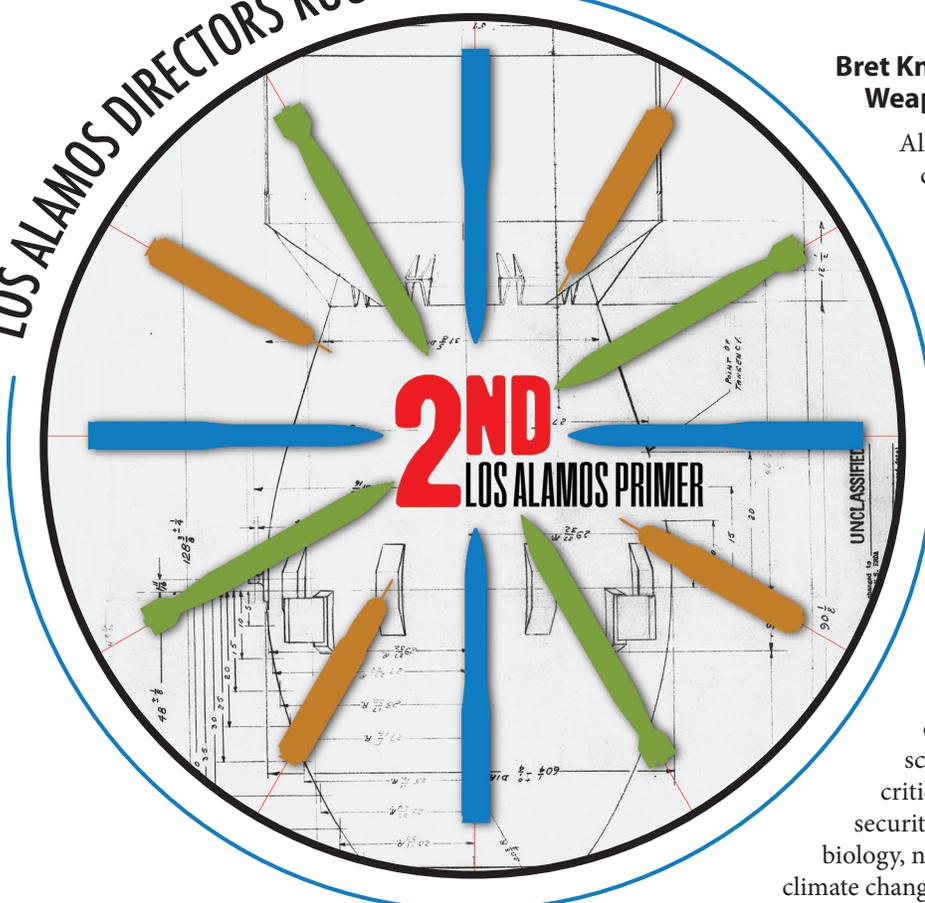


LOS ALAMOS DIRECTORS ROUNDTABLE



Bret Knapp, Principal Associate Director for Weapons Programs

Almost 70 years ago [July 16, 1945] Los Alamos conducted the world's first nuclear weapons test and started the Nuclear Age, putting us on a path of no return and helping us end WWII. Since that time, Los Alamos has become known as the world's center for nuclear weapons. Los Alamos designed the bulk of the stockpile, and we continue to keep the certification responsibility for those weapons.

Out of the Weapons Program have grown lots of different areas of LANL technical expertise and science that are critical to national security. Those areas include

biology, national intelligence, global warming and climate change, seismology, and computational science. Today, Los Alamos is known for the quality of its science in general.

Each of the directors speaking today was a director during the era of stockpile stewardship. Each went through his own periods of turmoil and stress at the Lab and found ways to lead the Lab through traumatic change—political and technical. I want to personally thank each of them.

Director Pete Nanos (2003–2005)

Every American has to worry about this institution and the importance of the science done here. People are the most important part of that, and Los Alamos and Johns Hopkins [Nanos is currently at JH] are competing for the same talent: postdocs in the hard sciences in their late 20s who are in the top 10 to 20 percent in their field. It's important for Los Alamos to win that competition, but right now Johns Hopkins is winning. What the Lab has to do is show young talent a future with work that is relevant and exciting. It has to provide the opportunity for new people to do high-risk, high-payoff work with recognition and rewards. The best and the brightest want to be at the forefront, taking on the toughest problems.



Laboratory Directors Pete Nanos, Bob Kuckuck, Michael Anastasio, and Charles McMillan have all signed Annual Assessment Letters regarding the health of the nuclear stockpile weapons that were designed by Los Alamos. This roundtable, moderated by Bret Knapp, principal associate director of the Weapons Program at the time of the 2nd Los Alamos Primer, explored the directors' views, opinions, and concerns regarding the aging stockpile; the challenges created by the moratorium on underground testing; and the challenges confronting the Laboratory in its efforts to maintain its scientific and engineering capabilities for addressing issues in national security.

(Note: Directors Sig Hecker and John Browne, who also signed Annual Assessment Letters, were unable to attend. Bret Knapp is now acting director of Lawrence Livermore National Laboratory.)



The Director's Roundtable included (left to right) Pete Nanos, Bob Kuckuck, Mike Anastasio, and Charles McMillan. Bret Knapp is standing at the lectern. (Photo: Los Alamos)

There has to be a future beyond stockpile stewardship, and the young designers have told us the kinds of things they want to do. The RRW (Reliable Replacement Warhead) was a very exciting and important project, but that was stopped about seven years ago. Today, it's research to understand weapon failures that occurred during testing, solving other legacy questions from that era, and doing more experiments now—experiments where designers can strut their stuff, make more predictions, and have a chance to win or fail. There must be a competitive element. Designers need tough grades to know they're good.

When the designers with nuclear test experience don't answer the phone anymore, we'll need to have confidence in the new generation in the same way we had confidence in the old generation, with its test-born judgment.

Working to understand proliferant weapon designs is another way to attract new people and develop their judgment. What worries me is that our thinking about proliferation may be "path dependent." Proliferators don't have to follow the same path we did. They have computing power that we didn't have when we started. They have materials we didn't have. They don't have to design weapons the way we did. Weapons science is going to internationalize, and we have to stay in the mix and know what's going on. We must make sure we don't ignore paths because they're different from what we did.

Doing science and simulation without experiments is what I call theology, and we don't need faith-based weapons. Experiments validate intuition and tell us who knows this

game and who doesn't. Scientists will not come to Los Alamos without experiments.

The competition between Los Alamos and Livermore is a good thing. Without competition between the two labs, I don't know how we can have confidence in the stockpile. And we also need new science and new experimentation to undergird that confidence.

Director Bob Kuckuck (2005–2006)

The Stockpile Stewardship Program (SSP) has been incredibly successful. We've encountered serious materials and manufacturing process problems and "code blues" in the LEPs [life-extension programs for aging weapons], and we've been able to resolve those. But stockpile stewardship has an end. I doubt our grandchildren will be doing it in the 22nd century. Stockpile stewardship has been stockpile research. We've advanced our understanding of nuclear weapons beyond simple sustainability.

The way we implement stockpile stewardship is focused on a set of materials that are in the stockpile. Because materials and manufacturing have changed, there's going to be a time when we can't fix things [that were manufactured decades ago]. The 3+2 strategy [reducing the different types of warheads from seven to five] might extend that time by giving us more things to think about, but eventually we'll be there [at the end of the SSP]. But I believe that when that time comes, it will not be an end [to the Lab's national security science mission]. It will open new doors; it will be the onset of bigger and more challenging things to do.



My concern with stockpile stewardship is its narrow approach: it's all about LEPs and weapons in the stockpile. I think sustaining the stockpile may not be sustaining deterrence. The world's evolving fast and so are threats; we need to think about the deterrence of tomorrow. What will future deterrence look like? What science will we need to underpin that deterrence? Who will do that science?

A few thoughts I want to share with you:

We will still need a vital national defense 70 years from now. Human behavior convinces me of that.

Defending freedom has attracted the best and the brightest over the past 70 years. And good science attracts them. Defending freedom with good science attracts absolutely!

The University of California model of laboratory oversight was extraordinarily successful, producing first-rate science. Under that model, the labs thrived in capability, mission, and size. Freedom to speak out and to follow where the science leads is part of that model. In my generation, it was something we took for granted.

This model followed the lead of E. O. Lawrence, with interdisciplinary teams and the flexibility and responsiveness to enable people to move around among teams and projects. Loose organizational structure, minimal hierarchical constraints, and minimal formality allowed ideas to be confidently presented and challenged.

A meritocracy, with merit-based rewards and merit-based assignment of responsibilities and authorities, scientific leaders who are scientifically credible—these have been very important and have made Los Alamos the model it is. But much of that model is under attack or at least under stress.

Communication needs to be better. There is an impedance mismatch in communication between the labs and the people we work for: the public, Congress, our federal overseers, the military, and so on. We're communicating on different wavelengths, so the signals aren't getting through. The history of the labs has been fraught with tension: the public has a fear of all things nuclear and even a concern about the morality of the work.

Our federal overseers have the perception that we're often not efficient, safe, or secure. They often see us as arrogant and narcissistic—believing we're always right. That perception has manifested itself in many ways—environmental laws, Tiger Teams [outside experts assigned to come onsite and vigorously investigate and solve systemic problems], excessive regulation, and micromanagement. Both sides have valid points and faults, but it's the labs that suffer.

It's imperative that we develop better ways to communicate our scientific capabilities in answer to the other side of the argument and do it with integrity and respect.

Director Mike Anastasio (2006–2011)

Where are we? Where are we going? Stockpile stewardship will survive in the sense that we will continue to advance our scientific understanding of the stockpile without nuclear testing—BUT:

Its character will change as the context of the central question changes. That question is, What does it take to have the confidence to underwrite the stockpile, to sign that letter [the Annual Assessment Letter] that assures the nation that the weapons will work? What does it take for the new designers, who have a different set of experiences than we had in the past, to provide the assurance our weapons-lab directors need to sign that letter?

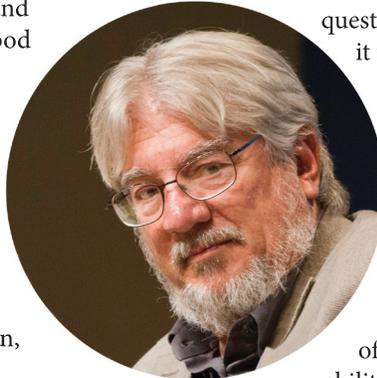
Advancing the scientific and engineering depth of understanding of the stockpile underwrites our ability to make judgments, have confidence, and give assurances about the stockpile, but what it takes to get that done is something the next generation has to figure out. For example, how would designers of weapon secondaries use a hydrotest? How would designers of weapon primaries use NIF [National Ignition Facility at Livermore]? What's going on in climate change modeling or in global security and/or in nuclear power that would help? Where are the opportunities to do things that will expand new designers' skill sets and allow them to develop judgment, given that they don't know what questions will be asked in the future? The new generation will have to figure that out.

How do we keep our focus on science and engineering in an environment of declining budgets, indecision in Congress, and an emphasis on a 40-year program of LEPs for the current stockpile?

I helped develop the 3+2 strategy, but who in their right mind thinks we're going to take weapon concepts from the 1970s and extend them for another 40 years? My answer is, that's crazy. But that's what we're embarking on.

The thing that makes me have a little hope is that we'll probably not fully execute the LEP program. Something will happen to break us out of it. Nevertheless, while we have the LEP program, we need to do a very good job on it to maintain our credibility.

The coming of the "second nuclear era" [see "The Second Nuclear Age," p. 2] will also change stockpile stewardship. If a country feels its principles, its sovereignty, and its fundamental way of life are at risk, it will do what it takes to survive. That's what the Cold War was about.



We won that struggle with communism and the Soviet Union, so now we're relaxing and reducing our stockpile. But that's not the way the rest of the world is thinking, and you see that in Iran, North Korea, and Pakistan, countries with smaller economies than ours. The Pakistanis say to us, "We have to have nuclear weapons to protect our sovereignty. You're helping to build up India's conventional weapons as a bulwark against China, and we can't keep pace with that." That will be the way of the real world, with each country facing its own survival issues.

What does our nuclear force need to look like in a world like that? I would argue that it's not the Cold War kind of stockpile. It's something different. The weapons we'll need in the future won't be the ones from 1970 designs. The Lab needs to think about that right now—because nobody else will. There isn't the political climate for talking about new kinds of nuclear weapons, but that doesn't mean the Lab shouldn't be thinking about them.

LANL's designers should explore new ideas, then develop new designs and test them because the country will need them in the future, and when it does, there won't be a lot of time to think about it. Don't wait. Find a way to do it.

The technical barriers to nuclear proliferation have been coming down for years, and in the next 70 years, it will be easy to proliferate. I urge you to think about how countries will proliferate 10 or 20 years from now. They probably won't do it the way we did it in 1943, so how will we know what they're doing? What should we look for? How do we work with the intelligence community to make sure they're looking for the right things? And if we can figure out what other countries will do, why don't we do it? Why continue to make pits the way we do? Why does Y-12 [in Oak Ridge] do what it does, the way it does? Is additive manufacturing [making 3D objects from digital models] in our future? If it is, how would we certify something made that way?

On such nuclear matters, we need to be out front, so the country needs you working on new ideas. Don't wait. The country can't have us wait.



Whatever you do, do more experiments. There's nothing more important in science than data.

The one thing the Laboratory has to have is integrity, and integrity is about people and their judgment. How does anybody have confidence in what the Lab says? It's about the Lab's people, and it's about the Lab's integrity. The Lab needs to nurture and sustain its integrity because without that, the Lab is nothing. Without that, the Lab will go away.

Director Charlie McMillan (2011–present)

How is the Laboratory going to maintain its scientific edge into the future? I see our science flowing from the mission, and the Laboratory's mission space [doing national security science] is very broad, broader than the stockpile and deterrence. We are a national security science laboratory.

We've talked a lot today about deterrence, but what about assurance? We have to convince not just the Navy but also Japan and South Korea that the stockpile is safe, secure, and effective.

The central point about our people is creativity. I've seen that rise to the fore time and time again in projects like Gemini [experiments recently conducted at the Nevada National Security Site]. Creativity is important because we will not solve the problems of the future by looking in the back of the textbook. We will execute the program of record, but I believe we'll be surprised.

Things will happen that we don't expect, so we need creative people who can address the unexpected problems that are sure to come. And they have to be working in an environment where people see things others don't see and where they ask unfettered questions.

Our budgets won't look good until the economy is good. But today is the time to get ready, to do the research for projects we'll need to do when larger investments become possible again. When that time comes, we'll need ideas that are well thought out and mature. ✦



(Photo: Los Alamos)

Directors

Q&A

Q: *What gives a Lab director the confidence to sign those annual letters assuring confidence in the reliability, safety, and performance of the stockpile when the people in charge of assessing the stockpile don't have testing experience?*

Anastasio: That's the issue. How does the country have confidence? It's a risk-management issue, and it depends on the people. I was a designer with test experience. But still, as a director, you look to the people you trust in the organization and ask them. On the other side, who are the people who take ownership and take on responsibility?

As director, you have to make a judgment even though you don't know all the answers. There are so many dimensions to it, but in the end, it's about trusting the people.

Q: *This is a national security science lab with multiple national security challenges to help solve. Global security is a major challenge, but we don't have a vision for that beyond taking the capabilities from the Lab's Weapons Program and applying them elsewhere. How might we start to get to a vision for global security?*

Nanos: The Lab's disadvantage is a lack of contact with the customer. We don't have contact with the warfighters. The world is flat technologically. Everybody's going to fight with the same software. Science is ubiquitous. Our edge could come from employing technology and integrating the technology into operations in an almost seamless way, but to do that, the Lab needs to see what the problems are—get out in the field and talk to the warfighters—and apply the Lab's creativity in a profound way.

Anastasio: The second nuclear era is with us today. How will it play out? We have an advantage in this new nuclear world because we can anticipate how it will evolve. That's a niche we can be in and should be in, now. The Pakistanis say their technical people can build something that has an 80 percent chance of working, without doing a nuclear test. That may not be good enough for the U.S. Navy, but it may be for the Pakistanis. What might other countries do, and how will they go about it? How do we look for it? How do we help the intelligence community know what to look for?

McMillan: Los Alamos needs to be involved in everything nuclear. We have a long history of doing it well, and we're the logical place for it.

Q: *What is the calculus that would have to go through your minds to make the recommendation to return to testing?*

Anastasio: The decision to return to testing is a political decision. It does not depend on what I say in my letter.

McMillan: Were we to return to testing, it would be because there was a change in the global security situation. Suppose we had a technical problem in the stockpile and couldn't solve it. We could field a nuclear test, and we might solve the problem, or we could retire the system.

Nanos: Returning to testing is a presidential decision. The Annual Assessment Letter is specific to the systems in the stockpile. You might report the news that a particular system has a flaw, and then people higher up make the decision.

Anastasio: I'm concerned that we stopped doing weapons design and development. It's a bigger risk than to stop nuclear testing. There are a lot of other things we do to have confidence in what we put in the stockpile. When we stopped doing weapons design and development—that's a different kind of risk, a bigger risk than not testing. That's not doing anything at all.

That's like we're in the car business and we stop making cars, which means you don't do it at all and you lose the skills. How do you keep people's skills so that when we have to do something again—or something different to meet a different need than we had in the Cold War—we're prepared to do that?

That's what was discussed in the Designers Roundtable, and it's key. How do we make sure the weapons designers keep their skills? ✦

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~ Mike Anastasio ~
