

Future of US nuclear weapons a tangle of visions, science, and money

As National Nuclear Security Administration officials push for a new nuclear bomb, some scientists and arms control experts are asking what's wrong with the old ones.

In January the US Nuclear Weapons Council was expecting to announce the winner in the new nuclear bomb design competition between Los Alamos National Laboratory in New Mexico and Lawrence Livermore National Laboratory in California. Instead of selecting the design from either one of the weapons labs, the council—a joint organization of the Department of Defense and the National Nuclear Security Administration (NNSA)—was leaning toward combining the designs into a hybrid warhead that, if built, could eventually replace many of the 5000 deployed warheads now in the US arsenal.

The prospect of blending designs from weapons labs that have a history

of intense rivalry caught many nuclear weapons experts by surprise, but it would solve a key problem the weapons council has struggled with in trying to select a winner: What happens to the valuable and experienced bomb designers and other weapons workers at the losing lab?

The decision on whether to go forward with the new bomb, known as the Reliable Replacement Warhead, rests with the Bush administration and Congress, but weapons and arms control experts note that the decision is not straightforward. The RRW program, mandated by Congress in 2004 “to improve the reliability, longevity, and certifiability of existing weapons,” faces a

host of questions based on need and on cost. While the long-term costs of the RRW are uncertain, Congress appropriated about \$34 million for the project over the last two fiscal years, and another \$27 million was requested in the administration’s FY 2007 budget. Weapons experts expect the total cost of the RRW could reach tens of billions of dollars over the next 25 years if the bomb is developed.

And the RRW program is just a piece of NNSA’s “Complex 2030” planning scenario, which calls for reorganizing and modernizing the massive national nuclear weapons infrastructure. That infrastructure currently involves eight major facilities spread across the coun-

US-India nuclear pact gets mixed reaction

In the midst of the US government’s attempts to refocus its nuclear weapons program and stop the spread of nuclear weapons in hostile countries, President Bush signed legislation in December allowing the sale of civilian nuclear fuel and technology to India and thus reversed 30 years of nonproliferation policy. The legislation allows US companies to sell nuclear fuel to India and invest in and construct new civilian nuclear power plants in that country. In exchange, India will open up 14 of its civilian nuclear reactors to international inspections but keep 8 military reactors off-limits.

“After 30 years outside the system, India will now operate its civilian nuclear program under internationally accepted guidelines, and the whole world is going to be safer as a result,” Bush said during the 18 December signing ceremony. The legislation allows the trade in nuclear material despite India’s development of nuclear weapons and ongoing refusal to sign the Treaty on the Nonproliferation of Nuclear Weapons (NPT). The law makes India an exception to the US Atomic Energy Act, which prohibits trade of nuclear material with countries that haven’t signed the NPT.

Both the US House and Senate voted overwhelmingly in early December to pass the legislation, with Representative Tom Lantos (D-CA) saying it “ushers in a new era of cooperation between our two great democracies.” But Rep. Edward Markey (D-MA) termed the deal a “historic mistake” that has “shredded the nuclear nonproliferation treaty.”

Markey is one of many critics inside and outside of government who fear the agreement will lead to greater proliferation of nuclear material by weakening the NPT. “The whole system of international nonproliferation was constructed on the basis of norms that apply to everybody,” said nonproliferation expert Michael Krepon, president emeritus of the Henry L. Stimson Center, a Washington, DC, think tank that focuses on international security and peace issues.

By making an exception for India despite that country’s

refusal for decades to sign the treaty and open its nuclear program to inspection, the US has essentially switched to a “good guy, bad guy” system, Krepon said. “When you do that, it explodes the whole nonproliferation system because we can’t agree on who the good guys and the bad guys are.”

When asked what benefits the US gets out of the treaty, Matthew Bunn, of the Belfer Center for Science and International Affairs at Harvard University, said, “On the proliferation front, the answer is somewhere between not very much and nothing. It is basically an effort by the Bush administration to build a stronger strategic partnership with India.”

But Bunn said that despite the weaknesses of the agreement, he doesn’t see it as “being as big a disaster as some of my colleagues in the nonproliferation field believe it is.” India has long had the capability to produce more weapons-grade plutonium than it is making now, he said, so he doesn’t see why it would suddenly increase production.

Bunn, Krepon, and critics on Capitol Hill are concerned, however, about the message the agreement sends to countries such as Iran, North Korea, and even Pakistan. “I have colleagues in Tehran who use the Indian example when talking about Iran’s program,” Bunn said. “They point to the 1998 sanctions against India [after India tested a series of nuclear bombs]. There were sanctions, then everyone came crawling back.”

The India agreement, Bunn continued, has increased the plausibility of the view that “there will be modest and temporary penalties for bad nuclear behavior.”

India must now reach an agreement with the International Atomic Energy Agency on the inspections process; the Nuclear Suppliers Group, a coalition of 45 nations that regulates nuclear trade, must unanimously approve the agreement; and the US must still negotiate the technical details for the trade pact. State Department officials expect the process to be completed in six months.

Jim Dawson



Workers install a cover over multiple independently targetable reentry vehicles (MIRVs), each containing a W87 nuclear bomb. This configuration of warheads is for a Minuteman missile.

concerns that, over the long term, minor changes to current warheads through repeated LEPs and maintenance will decrease confidence in the warheads, possibly requiring a return to nuclear testing." In congressional testimony in April 2006, D'Agostino said the existing cold war stockpile "consists of highly optimized warheads designed to tight specifications (maximum explosive yield with minimum size and weight)." That means any degradation of a warhead could make it unreliable, he said. The RRWs, on the other hand, would trade size and weight for "increased performance margins, enhanced safety and security, system longevity, and ease of manufacture and certification."

A nuclear vision

D'Agostino went on to describe the NNSA vision for the nuclear complex. "Let me take you forward 25 years," he said. "The deployed stockpile ... has largely been transformed. RRWs ... are more easily manufactured [than old warheads] at fewer facilities with safer and more environmentally benign materials. These replacement warheads have the same military characteristics, are carried on the same types of delivery systems, and hold at risk the same targets as the warheads they replaced, but they have been redesigned for reliability, security, and ease of maintenance."

Physicist Bruce Tarter, who served eight years as the director of the Lawrence Livermore weapons laboratory, said he was troubled by NNSA's vision because it is only that, a vision. "The year 2030 is a very long way away," Tarter said. "If you define a program more than five years out, you'd better have a detailed plan, and the prospects for strong bipartisan support. The NNSA won't have a plan that can be evaluated for at least one or two years," he said.

Tarter is chairing the Nuclear Weapons Complex Assessment Committee, a panel of nuclear weapons experts put together by the American Association for the Advancement of Science (AAAS) to try to determine the prospects for NNSA's 2030 vision. "The vision is often quoted," Tarter said, "but every time we try to get hold of this and do a 'pros and cons' look at it, we run headlong into the problem that there isn't yet a plan. There isn't even a rudimentary plan for a major facility."

try. Thomas D'Agostino, appointed in early January as the acting director of NNSA just days after Linton Brooks was fired for failing to stop ongoing security breaches at Los Alamos and other weapons laboratories, described the RRW as the "enabler" that will allow the Complex 2030 program to proceed.

But while D'Agostino pins the future of the Complex 2030 program on the bomb, other nuclear weapons and arms control experts are asking why the US needs a new bomb at all. The roughly 10 000 existing nuclear weapons in the US stockpile, although old, have been certified as safe and reliable by the national weapons labs in each of the past 11 years. The certification is possible even though the US stopped nuclear-explosion testing in 1992. Subcritical underground testing and other non-explosive means of assessing the weapons stockpile are now used.

In 1993 Congress established the Stockpile Stewardship Program to "ensure the preservation of the core intellectual and technical competencies" of US nuclear weapons. Part of the stewardship program is the Life Extension Program (LEP), in which warheads are maintained by replacing various components with new ones that are as close to the original design as possible.

So if the current bombs are well maintained and certified as reliable, critics ask, why spend billions of dollars designing and building the RRW?

A recent Congressional Research Service report by national defense specialist Jonathan Medalia noted that "NNSA and its labs have expressed

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In addition to the creation of the RRW program, NNSA's vision as outlined in its 2030 document calls for "significantly increasing dismantlement of retired warheads; consolidating special nuclear materials used in nuclear weapons to fewer sites in the complex and fewer locations within the sites; construction of a consolidated plutonium center . . . in lieu of construction of a modern pit facility," and introducing better management practices to be more efficient.

Several years ago NNSA proposed the construction of a new facility to manufacture the plutonium pits that are the primary fission trigger in a nuclear bomb. The old pit facility at Rocky Flats in Colorado was shut down in 1989 after an FBI raid for environmental crimes in the handling of radioactive material (see *PHYSICS TODAY*, September 2006, page 34). Congress wouldn't fund a new facility until NNSA officials showed that they needed new pits. NNSA officials have long argued that the pits in "legacy" nuclear bombs in the current cold war stockpile would degrade after about 40 years and that a new pit manufacturing facility was needed. Aging of the existing pits was also a key justification for producing RRWs.

Pits long lived

But many scientists, including those on an American Physical Society panel that looked into the issue in 2004, said there was not a scientific basis for claiming a 40-year lifetime for pits and called for a study into pit lifetimes before a new facility was considered (see *PHYSICS TODAY*, June 2004, page 34). A November 2006 JASON report using data from the weapons labs concluded that the existing pits have "credible minimum lifetimes in excess of 100 years."

That conclusion undercut much of NNSA's argument for the RRW program and the new weapons complex, said Robert Nelson, senior scientist with the Union of Concerned Scientists. "Now they are talking about the safety and security of RRWs and about terrorist attacks," he said. "They've changed their language."

Indeed, when the JASON report was released, then-NNSA director Brooks conceded that "degradation of plutonium in our nuclear weapons will not affect warhead reliability for decades." But, he added, "other factors control the overall life expectancy" of the weapons.

Raymond Jeanloz, a geophysicist at the University of California, Berkeley, and a member of the JASON group that wrote the pit report, noticed the shift in emphasis. "Plutonium aging was one of [NNSA's] driving concerns for a lot

of things, including the modern pit facility, the RRW, and the 2030 Complex infrastructure modernization," Jeanloz said in an interview in early January.

Concerns about plutonium aging "weren't unreasonable 5 or 10 years ago," Jeanloz said, "but there has been a huge amount of work on aging and it shows the problem isn't as urgent as was feared. So the next question is, Are the other arguments for transforming the nuclear complex realistic?"

Those arguments have to do with both the age of the existing facilities and the need to maintain expertise by giving the bomb designers and others at the weapons labs something to work on, Tarter, Jeanloz, and other weapons experts say. The weapons complex dates back to the early days of the cold war, with some facilities dating back to World War II.

"I think all who look at it agree that a large part of the nuclear complex hasn't been upgraded in years," said Jeanloz, who is also a member of the AAAS panel.

High costs

Underlying the entire discussion about the future of US nuclear weapons is the enormous expense. The US currently spends about \$6.7 billion a year to maintain the existing stockpile and the weapons complex. D'Agostino said in his testimony that as the RRW program is put in place, the weapons stockpile can be reduced to "meet the president's vision for the lowest number of warheads consistent with the nation's security." In 2002 President Bush signed a treaty with Russia agreeing to reduce

the number of deployed US warheads to 2200 by 2012.

Daryl Kimball, the executive director of the Washington, DC-based Arms Control Association, said that despite NNSA claims that RRWs will be easier to manufacture and fewer in number, "it won't be cheaper. The RRW would be phased in over 20 or 30 years, and during that time the Department of Energy will have to continue with LEP. So for a period of time, it would not be RRW instead of the existing warheads, it would be RRW also. It is not going to be less costly."

Kimball also said that "Congress needs to ask 'do we need all of these things and at what cost.' You might get a marginally safer warhead but at a cost of hundreds of millions or billions of dollars."

One weapons expert said that in all of the studies he's looked at, "I haven't seen a 10-year budget scenario involving RRWs. It's troubling that RRW, as a program, hasn't been able to put together a plausible budget scenario. Many in Congress pushed RRW with the idea of capping expenditures. If that continues to be the view in Congress, then money is a serious issue."

Tarter said the AAAS panel is trying to assess the risks in various approaches to the weapons program. The difficulty is "trying to articulate a path that is a little of both [old weapons and RRWs] that takes us through the next 25 years, or 12 Congresses and three or four administrations. And we're trying to do this when our national consensus on the role of nuclear weapons in the future isn't completely clear."

Jim Dawson

Bell Labs parent merges into communications giant

With fundamental research in industrial settings long on the decline, researchers inside and outside of Bell Labs wonder how it will fare as part of a new, bigger company.

Bell Labs is a mere shadow of its former fabled glory. But it is still home to excellent research, so what does the 1 December acquisition of Lucent Technologies, its parent company, by Alcatel augur for Bell? Will there be layoffs? An increased emphasis on directed research? A boost for basic research? "People have been through a lot in the last few years," says Art Ramirez, a materials physicist and director of device physics research at Bell. "I think there's a wait-and-see attitude."

Today the remnants of the physical sciences team that built Bell Labs's Nobel Prize-studded reputation num-

ber around 100 researchers, down from perhaps 400—and some estimates put the earlier high at twice that. The full Bell Labs, which includes research, technology development, and commercialization, has 650–700 employees. Alcatel's research and innovation counterpart is of comparable size, with a more applied emphasis. Although they are in close contact, the two research arms will remain separate, at least to begin with, says Bell Labs president Jeong Kim.

The combined Alcatel-Lucent communications giant has some 88 000 employees. The company has said that