

# News & Views

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## The Border is a Wicked Problem

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We treat the border between the United States and

Mexico as a barrier, a political entity, a geographic place. But more than any of these, the border is a problem—a “wicked problem,” to be exact—for which there are no easy solutions.

In the early 1970s, civic planners H.J. Rittel and M. Webber proposed this “wicked” concept to refer to rapidly evolving situations with multiple stakeholders, contradictory requirements, and incomplete specifications. Engaging with a wicked problem changes the nature of the problem itself, making it impossible to fully resolve the issue at hand. Think transportation networks, global warming, poverty eradication: not only is there no single solution to any of these problems, but every solution we propose introduces a new set of stakeholders with a new set of problems.

Tackling a wicked problem is like being in a sea monster movie. The hero kills the monster by cutting it into

pieces, then rows off into the sunset, only to have a slimy tentacle spring to life and wrap itself around his throat. The moral of the story? Applying the “obvious” solution to a wicked problem just creates more problems.

Borders are wicked because they’re more about people than they are about a line in the sand. In the case of the United States and Mexico, the people on one side of the border are unemployed, poorly educated, are often deprived of basic material resources, and lack the social, political, and economic capital to make changes in their lives. They see people on the other side of the border enjoying a lifestyle that seems impossible to achieve in Mexico. To use a physics metaphor, the perceived difference in opportunity creates an extremely strong gradient, a pull for people to move from one location to another. What dominates this gradient is a ten-to-one ratio in per capita income in favor of the United States. That is the “wicked problem” we need to address.

Unfortunately, all we hear are obvious solutions that will

supposedly tame the problem: criminalize immigrants, create a guest worker program, set out provisions for general amnesty, put up walls, fences, and

*“Tackling a wicked problem is like being in a sea monster movie.”*



networks of sensors; deploy the National Guard, get private citizens to patrol the desert frontier. But when we perceive movement across the border as a

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“For better or worse, both countries own this gradient, and both will have to engage it.”

symptom of a very wicked socioeconomic gradient, we realize that none of these solutions does anything to tame the problem.

For better or worse, both countries own this gradient, and both will have to engage it. However, as NAFTA has taught us, there is no easy way to tackle the wicked problem of wealth disparity. What we need are a range of creative initiatives that both the United States and Mexico can own equally, that can begin to lay the groundwork for permanently increasing Mexico's GDP.

Among other things, these initiatives would have to reverse Mexico's brain drain and intellectual under-utilization problems. There are many dedicated, well-educated, and creative people from Mexico who would have stayed and contributed to their society if they had the opportunity. There are certainly many more in Mexico who aren't living up to their full potential because of many institutional problems.

I believe that under the right technical/entrepreneurial environment they can accelerate the growth of their technology research and development sector to provide higher wage skilled jobs that will support the healthy, educated Mexican middle class that both our countries need.

My brief experience in technology transfer at Sandia in the early 1990s gave me some sense of one way in which the United States and Mexico might begin to address this gradient. At Sandia, the ACG proposed the idea of a Bi-National Sustainability Laboratory (BNSL) that would provide a jointly-owned site where both the United States and Mexico could harness the creative energy of citizens from Mexico and the United States in joint R&D, technology exploitation, and business development projects. Technical, legal and financial experts would work together to bring innovations into economic reality with an emphasis on growing an S&T exploitation infrastructure for

both the Mexican and American economies. Mexicans and Americans would be recruited to contribute to the BNSL, with an emphasis on drawing intellectual capital into the border region and creating conditions for it to thrive. These benefits would diffuse throughout both countries, spreading from the border.

I realize that something like a BNSL is not going to fix manifold problems including lack of educational opportunities, inadequate life-supporting infrastructure, corruption and chaos that characterize this region. But a sustained commitment to this kind of enterprise could be the seed for a new border: a vibrant, exciting, prosperous, multicultural experiment in joint research, technology, and economic development, rather than an unenforceable boundary demarcating where wealth ends and poverty begins. ■

*“Some analysts are predicting an imminent physical resource constraint. The oil and gas reserve data published in this Review provides a reassuring picture about oil and gas reserves. The aggregate levels are high (1,200 billion barrels) and year by year a combination of exploration, investment and the application of technology is ensuring that every unit of oil and gas that is produced is replaced by new proved reserves (global consumption 82 million barrels/day). There is no resource constraint.”*



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# Preparing Sandia for a Pandemic Flu

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The possibility of avian influenza becoming easily communicable between humans has raised concerns about the potential for a worldwide outbreak of a virulent flu strain that might cause millions of deaths in the United States. Pandemics occur in varying severities averaging four episodes per century. The most recent Hong Kong flu of 1968-1969 killed approximately 28,000 Americans. The Spanish influenza of 1918-1919 was the most deadly 20th-century pandemic, killing some 500,000 Americans and 21 million people worldwide. The emerging avian flu virus, technically the H5N1 variant, comes with many unknowns. It could remain primarily in the bird population, or it could combine with a common flu virus and begin to transmit among people. Mutations might render it more or less efficient (virulent) or more or less deadly (pathogenic). World-wide precautions might blunt its spread. Global air travel might enhance its spread. We cannot accurately determine the likelihood of a pandemic, but the possible consequences of this danger are too severe to ignore. If a pandemic is like the Spanish

flu, we could have 180-360 million dead worldwide.

As a national security lab, Sandia must be equipped to support its customers and partners in a national crisis. The lab should be technologically ready to complement local and regional responses to an avian flu outbreak in New Mexico, California, and other host communities.

The Advanced Concepts Group sponsored a lab-wide brainstorm on Sandia preparations and plans for pandemic flu. Sandia Medical Director Dr. Larry Clevenger started the brainstorm with an overview of pandemic influenza, its potential impacts, and Sandia's planning efforts (which are in the initial stages). The brainstorm dialogue covered many topics: communications for the workforce, isolation and quarantine on-site, dealing with large absenteeism (at Sandia and for community/national infrastructure systems), determining who is critical for mission and support, providing for extensive work from home, and thinking about general business continuity.

**THE FLU THREAT REMAINS UNDER DEBATE.** Some say it's a looming disaster; others that it's overblown hype. That it remains a contagious virus with a remarkable ability to propagate among and across fowl, posing difficulties for a large number of countries, is certain. The real concern is

whether human-to-human transmission will begin to occur routinely. We currently do not know if we will have time to fully prepare for a pandemic flu outbreak. We could have

as little time as days or weeks. The CDC is projecting that 2-3 waves will propagate globally and the virus will evolve. Historically, the pathogenicity of viruses tends to go down as they move into human populations, but that is another element of uncertainty.

## IS THE U.S. PREPARED?

Worldwide there is a lot of monitoring, and that's good news. The U.S. has a preparedness plan. State and city plans are being developed. Antiviral drugs such as *Tamiflu* are available in limited quantities, but it is not known if the drugs will work. There are many technological issues regarding the creation of a vaccine, but even if we can develop one, will it be possible to manufacture and deliver the vaccine in time? The tone of discourse around planning is changing: in a post-Katrina world, we should be prepared to respond "on our own" – we cannot necessarily count on much (if any) government assistance.

**WHAT IS SANDIA DOING?** Our pandemic influenza response plan has two goals: (1) to protect our people, and (2) to manage our mission. We do not want to close the labs.

**ACG Weekly Brainstorm sessions!!**

Please join us for our weekly brainstorm sessions every Friday, 9:00-11:00 a.m! Please check our web page under "Events" for a list of scheduled topics. If you'd like to suggest a topic, please contact Nichole Herschler at [nahersc@sandia.gov](mailto:nahersc@sandia.gov) or 284-5013.



“We are working with others at national, state and local levels to coordinate and integrate plans.”

What tools can be put in place to ensure this? We must address conduct of operations, health services and other community resources, protection of the workforce, as well as command and control during a crisis. Lab risk management also involves monitoring international travel for guests hosted by Sandia as well as Sandians visiting other locations.

**WE MAY NEED NEW CONDUCT OF OPERATIONS PLANS,** expanded infrastructure, expanded emergency operations models, coordination, and linkages with community resources, etc. To the degree that Sandia is impacted, we can assume that Albuquerque, NM and Livermore, CA will also be impacted. Sandia needs to prepare because we have a national security mission. The local community will expect Sandia to help. Mutual aid agreements with surrounding communities are important.

**TELECOMMUTING?** Are we prepared for lots of Sandians to work from home? We can't telecommute the entire laboratory, but with current capabilities, we can partition telecommuting. We might isolate people who don't have the flu (e.g. If you're well and not mission critical, stay home.) Many people in the U.S. will be telecommuting, so lots of our communication and internet infrastructure could be overloaded and service degraded. Each

Sandian should come up with a personal/family plan – including the possibility of working from home. Supplies that are needed at home should be obtained in advance of a flu outbreak.

#### PREPARING THE NM COMMUNITY.

Kirtland AFB would likely make a lot of the decisions for us. What happens if they close the base? The Sandia team will be meeting with Kirtland to discuss

how we would access the base in case of a closure, but we need to make sure that system is operating properly well before the flu begins to spread among humans.

#### WHAT ABOUT THE CA SITE?

California is different because people commute from 5 different counties, each with its own public health officers, so there's a different solution set and a different puzzle to solve. The county where the lab is located has the same population as the entire state of NM.

#### PUBLIC RESPONSIBILITY AS SANDIANS.

We are learning about the “facts” of what could happen, but that may be countermanded by talking heads on TV news, movies on bird flu, and friends and neighbors who go into bunker mentality. We've got to keep people reminded that it's just FLU – there are practical steps to take. We need to be a fountain of accurate information. Can we leverage our position as “experts” to counter “bad” information that will inevitably be circulating? How

can we best use our systems engineering and analysis perspectives? Can we use our modeling and simulation capabilities to understand how the disease might spread and what mitigation measures might be effective at slowing or stopping it? Can we develop countermeasures to help detect the disease, decontaminate surfaces, or rapidly manufacture effective drugs and vaccines?

#### WE ARE DEVELOPING A PLAN.

Sandia is preparing for this potential healthcare crisis. We are working with others at national, state, and local levels to coordinate and integrate plans. We have some supplies of antiviral drugs. We are considering upgrades to our telecommuting capabilities. We have activated a number of employee communication channels. If a worldwide outbreak of a virulent form of flu occurs we will be prepared to respond and recover. ■

## Getting Wiser about Getting Smarter

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The confluence of nanoscience, biology, computing, and neuroscience is leading to the emergence of technologies that may allow us to enhance some of the ways human brains process information. (Some technologies may also be used



to degrade human cognitive abilities—a dark side not addressed in this article). Of course, computers and sensor systems are already being used to change the ways we gather, store, retrieve, and manipulate information about our world. Tools from Google to VR simulation training to PDA's to advanced “augmented cognition” and “augmented reality” systems are changing the ways we perceive, recall, think, and decide. But on the horizon (and, to some extent, already with us), are more intrusive interventions to enhance cognition.

These technologies include pharmaceuticals that may improve attention, concentration, short (“working”) or long-term memory. Research is underway on devices to be implanted in peripheral nerves or directly into brains that might intensify or broaden sensory perceptions, improve memory, provide direct brain-to-computer interfaces, or even permit brain-to-brain communication. The bulk of this research is directed at countering the effects of disease, such as Alzheimer's, brain damage, blindness, or deafness. But most people who have thought much about this subject will tell you that the line between making people “well” and making them “better than well” is a fuzzy one. Such ambiguity means that we are facing a tangle of ethical dilemmas centering on whether cognitive enhancement technologies are “good” or “bad” for us as individuals

and as a society.

Many thinkers in the fields of bioethics and (more recently) “neuroethics” have been analyzing and debating the ethical questions relating to human capability enhancements in general and cognitive enhancements in particular. Fewer have examined in detail how these ethical issues may play out in the arena of public policy, where decisions will be made on whether or how to support and regulate relevant research, support and regulate uses of the technologies, study and inform the public about the risks and benefits, and manage international commerce in enhancement goods and services.

Therefore, early in May 2006, the ACG, collaborating with the Arizona State University (ASU) Consortium for Science, Policy, and Outcomes (CSPO), held a workshop at ASU on “The Policy Implications of Cognitive Enhancement Technologies.” The workshop included a range of scholars and other experts from such fields as bioethics, philosophy, neuroscience, science policymaking, and public policy studies, as well as a handful of Sandians. Some were highly enthusiastic about the prospects for cognitive enhancement, some highly skeptical of the alleged benefits, and some undecided about the balance of risks and benefits.

Not surprisingly for such a complex subject, the workshop raised more questions than it answered. But the questions were well

posed and the discussions rich and nuanced. Early in the fall, CSPO and the ACG will publish a report on the ideas emerging from the workshop. In the meantime, I thought I would share three general conclusions that I drew from the workshop proceedings—one about how we structured the workshop and two about its substance.

First, a note on how we structured the event. In a series of both full-group meetings and sub-group breakout sessions, we asked the participants to look at the issues from one of four perspectives or schools of thought on enhancement technologies:

**1. LAISSEZ-FAIRE ON COGNITIVE ENHANCEMENTS.** In this view, the emphasis is on the freedom of the individual to seek and employ technologies that he or she judges would benefit his or her self or family. By and large, market mechanisms can manage the risks, and government should play little or no role.

**2. TECHNO-OPTIMISM.** Technologies for human capability enhancements promise great benefits to individuals and to society, but a supportive government role is needed to foster research and development to increase the fairness of distribution, to assure the effectiveness of the technologies, and to manage the risks.

**3. TECHNO-PESSIMISM.** The risks both to individual well-being and to a fair and just society outweigh the promised benefits of these



“...whether government turns out to play either a very active role in our society’s management of cognitive enhancement technologies or a very passive role, the policies chosen will have significant consequences. It is just not easy to predict exactly what those consequences will be...”

technologies. Commercial values and interests in profit are likely to override broader social interests. Negative unintended consequences are likely, and enhancement technologies should not be made available until net benefits can be demonstrated. The government emphasis should be on regulation and fairness, not promotion.

**4. CULTURAL CONSERVATISM.** Technologies that may restore disabled people to normal function may be acceptable, but attempts at “transhuman” enhancement of undiseased people threatens to violate God-given or evolved human nature and to undermine the values that make us human. Government should carefully restrict when and how these technologies are used.

In some cases the participants may have partly or mostly agreed with the perspective they were asked to explore, and in others they may not. (We did not have enough true believers in each

school of thought to go around anyway.) What we found was, that, by and large, people were willing and able to bracket their personal views and try to take an honest look through the eyes of others. I think many enjoyed the chance to think out of their own boxes, and the result for the workshop was perhaps a much richer discussion than if we had set up a debate of opposing positions. Instead, we got to explore what was reasonable and valuable in each position, as well as to understand better how and why they differed. I hope we will make more use of this technique in future ACG “fests” here at Sandia.

My second observation is more substantive: one thing that seems clear is that whether government turns out to play either a very active role in our society’s management of cognitive enhancement technologies or a very passive role, the

policies chosen will have significant consequences. It is just not easy to predict exactly what those consequences will be. The following table outlines just some of the possibilities, positive and negative. Perhaps because of the complexities of the issues involved, those in the workshop presenting the various policy perspectives (described above) did seem to agree on one thing: the great desirability of better understanding of the nature, potential, and limitations of the various cognitive enhancement technologies. Some argued that, at least, consumers of the new products should be given full information upon which to base their buying choices. Others hold that sounder government regulation and support for the technologies will emerge from open and enlightened public deliberation about them. And some believe that full examination of the

Potential Consequences of Weak and Strong Government Intervention

	Positive	Negative
Weak	<ul style="list-style-type: none"><li>•Marketplace produces wonderful new opportunities for personal development and health</li><li>•Competition sorts out the best products</li><li>•Economy and society are enhanced by increases in member’s capabilities</li><li>•Enhanced capabilities improve job performance and satisfaction</li></ul>	<ul style="list-style-type: none"><li>•Research priorities determined by short-term sales prospects, not long-term societal benefits</li><li>•Technologies are oversold, risks to users understated</li><li>•The advantages of the wealthy are further enhanced, while the rest fall farther behind</li><li>•Being “unenanced” stigmatized as subnormal; pressures to conform and compete.</li></ul>
Strong	<ul style="list-style-type: none"><li>•New technologies developed with open, public deliberation</li><li>•Consumers are protected against false product claims and concealed risks</li><li>•Research resources devoted to disease amelioration</li><li>•Benefits of technologies are more fairly distributed in society</li></ul>	<ul style="list-style-type: none"><li>•Artificial constraints on technology place U.S. at competitive disadvantage in global markets</li><li>•Individual freedom of choice is stifled, while desired products are forced underground and go entirely unregulated</li><li>•Opportunities for enhancing individual performance beyond “normal” are missed</li><li>•Government rule overrides individual preferences and choices</li></ul>

technologies will reveal the risks they pose to society and lead to greater restraint in their development and use. In any case, these technologies loom on the horizon, and both as consumers and as citizens, you and I are going to have decisions to make. ■

## U.S. Nuclear Weapons Strategy – Red, Green, or Christmas

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### Introduction

Restaurant servers in New Mexico often ask, “Would you like red or green chile with your meal?” Some chile connoisseurs respond by asking for “Christmas,” which (as every New Mexican knows) is a blend of both green and red chile peppers. What does this spicy New Mexico topping and the US nuclear weapons strategy have in common? A lack of clarity. Today, the purpose of U.S. nuclear weapons within global

security is confusing because of a mixed up “Christmas” strategy when a clear “red” or “green” strategy is needed.

The 2001 U.S. Nuclear Posture Review (NPR) calls for a new triad that combines offensive

conventional and nuclear weapons, active and passive defense, and a revitalized nuclear and non-nuclear defense infrastructure: truly a “Christmas” strategy. The 2006 Quadrennial Defense Review (QDR) supports the NPR and furthermore states that the US will maintain a “robust nuclear deterrent, which remains the keystone of U.S. national power.” Also, the NPR calls for “greater flexibility ...with respect to nuclear forces and planning than was the case during the Cold War;” yet, the U.S. continues to rely only on Cold War nuclear weapons systems, or a “red strategy.” Left behind is any consideration of whether new nuclear weapons with “other” characteristics would better enable the “greater flexibility” requested by the QDR and the NPR, or a “green strategy.”



Whenever NNSA attempts to evolve the current warhead stockpile into a non-Cold War structure, its ability to deliver modern, advanced, more

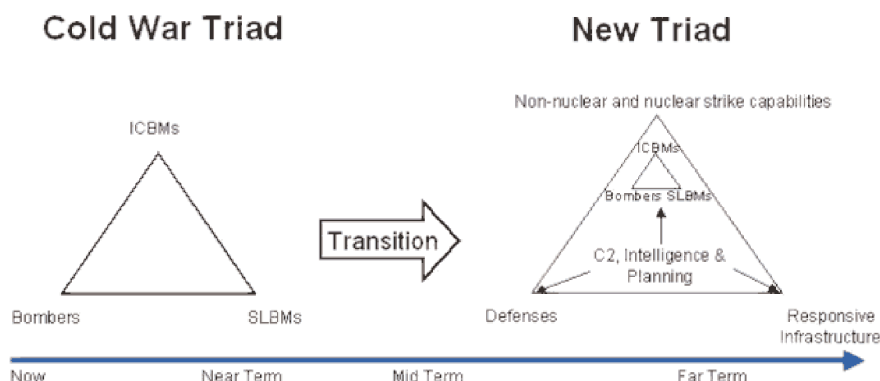
appropriate warheads faces a conundrum because of those who believe any different warhead designs would violate the intent of article VI of the Non-Proliferation Treaty.

Even though some countries are violating the NPT and there are no serious global discussions on nuclear disarmament, some policy makers argue that the U.S. should unilaterally comply with article VI to grab the moral high ground, thus influencing other countries to follow. Meanwhile, France and Russia have both publicly announced that they are developing new nuclear weapons. Others, such as Ahmadinejad of Iran, declare that owning a nuclear power cycle (that can readily lead to nuclear weapons production) is a fundamental “right.”

### Christmas Confusion

Congressman David Hobson of Ohio asked the National Academy of Sciences to define the deterrent value of the U.S. nuclear stockpile for the

“I do not believe that our nuclear stockpile is useful against our new foes.”



“The actions of our potential foes indicate that they are undeterred from aggression by current U.S. nuclear weapons, but these new foes believe nuclear weapons are valuable and openly state their willingness to use them against U.S. forces.”

threats of the 21st century. He added, “Other than a Cold War ‘Russia gone bad’ scenario, I do not believe that our nuclear stockpile is useful against our new foes.” Yet the Congressman sees no need for advanced nuclear warheads; perhaps because he is not being offered the appropriate “green strategy” that includes advanced weapons?

The current stockpile was designed to be used for total destruction of targets. The Cold-War Mutually Assured Destruction (MAD) mentality remains in most peoples’ thinking instead of Mutually Assured Deterrence. The actions of our potential foes indicate that they are undeterred from aggression by current U.S. nuclear weapons, but these new foes believe nuclear weapons are valuable and openly state their willingness to use them against U.S. forces. U.S. policy, captured within the February 2004 Defense Science Board task force on Future Strategic Strike Forces, suggests that the United States should try first to transform relations through “dissuasion and assurance.” But if that fails, the objectives should be:

*“...to prevail, while minimizing the prospects of unwanted escalation and damage to allies; and to terminate the conflict as quickly as possible on terms consistent with U.S. values and objectives.”*

U.S. conventional forces can invade and destroy other conventional militaries

(although not necessarily to successfully occupy and pacify the resultant territory); and any use of current nuclear weapons is unthinkable because the collateral damage is inconsistent with U.S. values and objectives. Thus the paradox: *This great conventional capability increases the nuclear danger by driving potential foes to develop their own nuclear weapons to use against U.S. forces as an alternative to certain defeat, but the U.S. has no acceptable level of nuclear response.* Such a “Christmas strategy” of relying on conventional forces and Cold War nuclear weapons is destabilizing in that it motivates potential foes to escalate to nuclear weapons while inhibiting the U.S. ability to deploy a measured nuclear response. The unintended consequence is an increase in nuclear proliferation and a greater risk of nuclear detonations in future wars.

### Can Advanced Nuclear Weapons Reduce the Nuclear Danger?

Some believe that all nuclear weapons have high yield and lots of residual radioactivity, thus producing tremendous collateral damage. This is not necessarily the case. The U.S. probably has the ability to develop lower-yield, lower-residual radiation weapons and possibly weapons with special effects (tailor output, EMP, etc). Both Russia and France are on record as working on a 21st-century

stockpile, possibly with special effects. Vladimir Putin’s Nov. 18, 2004 message stated the following:

*“Russia intended to remain a major nuclear power by deploying a new weapon in the coming years that other states lack and are unlikely to develop in the near future.”*

France’s President, Jacques Chirac in a speech on 19 January 2006 stated:

*“It would be irresponsible to imagine that maintaining our arsenal in its current state might, after all, be sufficient. What would be the credibility of our deterrent if it did not allow us to address the new situations? What credibility would it have vis-à-vis regional powers had we kept strictly to threatening total destruction?”*

Developing a proportionate, nuclear-based response would not require the U.S. to openly reject the non-proliferation treaty any more than Russia, France,

and China have done so. *In reality, announcing the elimination of thousands of older, high-yield, environmentally devastating,*

*nominally secure Cold War devices would demonstrate a commitment to the goals of the NPT while reducing the potential nuclear danger. Would it not be better to have a few hundred low-yield, low-residual radiation warheads with advanced safety and security features than thousands of high-yield, environmentally devastating warheads? Some would argue that such a move by the U.S. would invite other nations to build up and deploy their*





own advanced nuclear weapons and lower the nuclear threshold; both prospects are unlikely because:

- Technical knowledge regarding advanced nuclear warheads is not readily available to proliferant groups, and therefore they could not produce such devices for many decades, if ever. This would buy time to further the cause of the NPT.
- The so called “nuclear threshold” has already been reduced because of perceived U.S. conventional superiority. Iran and North Korea are not developing nuclear weapons to counter U.S. Cold War nuclear weapons. They know that would be impossible. They are seeking a limited nuclear capability to counter overwhelming conventional superiority. *Therefore, even without detonations, the nuclear threshold of “no first use” has already been reduced to first use against superior conventional forces.* Even Russia has stated that it will maintain its nuclear forces because of its lack of conventional capabilities.

Advanced nuclear weapons, especially those with tailored effects made for escalation prevention and war termination, would be credible against most conventional and nuclear threats. Should conflict

escalate above a certain level, advanced nuclear weapons may be able to stop further devastation. Therefore, militaries would be used for peacekeeping. The U.S. and other nations would have to renounce war because anything beyond peacekeeping could involve nuclear weapons. Another benefit is that the U.S. could downsize its conventional military, freeing billions of dollars for innovation in energy, environment, health, and economic competition. Advanced nuclear weapons could lower the cost of U.S. national defense and help clarify a U.S. “green” nuclear strategy.

#### Conclusion

The massive U.S. commitment to a conventional military and the lack of investment in a modernized nuclear stockpile leaves the U.S. relying on a “Christmas” strategy. This destabilizes the world by motivating any country fearing military invasion to develop nuclear weapons. As long as the U.S. attempts to walk the line between NPT goals and maintenance of nuclear deterrence, we send a confusing message to the global community. The U.S. must maintain a nuclear stockpile until we can cooperatively and forcefully move towards total global elimination of nuclear weapons along with Russia and China. Present U.S. public policy requires a flexible nuclear response, yet Congress limits the military to the “red” strategy of the Cold War. The MAD theory

wasn’t designed to stop nuclear weapons development, but the Non-Proliferation Treaty was. Subsequent events indicate that the Non-Proliferation Treaty is currently not succeeding for those nations whose calculus of self-interest leads them to value nuclear weapons more than they fear global disapprobation.

By self-limiting advanced weapons development, the U.S. leaves these opportunities to other nations in a similar manner, as the U.S. has left advanced development of nuclear power to others. This could leave allies feeling the need to develop their own stockpiles, or, if other nuclear powers appear to have a superior nuclear strategy based on agile response characteristics, allies may tend to cozy up to them. The inherent truth is that only weapons that can lead to victory can prevent the emergence of war in the first place. Perhaps the U.S. should move to a clear “green” strategy that lessens the need for advanced conventional forces and enables development of advanced nuclear weapons that can effectively de-escalate any future confrontations. ■

“Perhaps the U.S. should move to a clear “green” strategy that lessens the need for advanced conventional forces and enables development of advanced nuclear weapons that can effectively de-escalate any future confrontations.”

## About the ACG News & Views

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## Breaking the Sound Barrier

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When the U.S. stood on the verge of breaking the sound barrier for the first time with piloted flight, many believed that it couldn't be done—many thought that there was an impenetrable "wall" in the atmosphere at that special speed, which would obliterate any piloted machine that encountered it. Chuck Yeager chose to believe otherwise. He loudly proclaimed that the wall did not exist—and then on October 14, 1947, this USAF Captain went out in his rocket-powered Bell X-1 aircraft and proved that he was right.

Yeager courageously challenged himself and others to venture into new territory—even to improvise and take risks to achieve an objective and a vision. And he had a bevy of like-minded followers. One example was Jack Ridley, a friend who provided the famous sawed-off broom handle that enabled the injured Yeager to "whang down" his airplane hatch so that he could make his historic flight. (Yeager had suffered two broken ribs in a horse riding accident just two days earlier).

And what actually happened? Sure enough, as Yeager approached the supposed "wall," his plane

became extremely difficult to control. It experienced violent buffeting. But his insight and skill enabled him to maneuver his controls in a special, innovative way—no further technical improvements required, only a leveraging of what was



already present—such that he suddenly passed through to the other side. The impenetrable wall proved fiction. The ride suddenly became eerily quiet and smooth. The sonic boom on the ground announced to onlookers a significant advance toward U.S. national security objectives. New technologies were subsequently introduced: technologies well suited to the supersonic regime that enabled breathtaking advances in performance and led to new and unanticipated benefits to the nation in a multitude of areas. Whereas it took the U.S. 43 years and ten months to progress from Kitty Hawk to Mach 1, it took only another 6 years and one month to reach Mach 2. On October 3, 1967 a rocket-powered X-15A-2 reached Mach 6.72—the world's official airplane speed record.

What wall?

Corporations have their own walls that they are extremely reluctant to approach or challenge, based on cultural or historical "Goldilocks" metrics that somehow feel "just about right." History proves that both tactical and strategic

corporate decisions have a real relationship to these self-imposed constraints. One such Sandia metric, for example, is maintaining a total staffing level of around 8000-8500 FTEs. Anything much less feels too small, anything much more feels too large, and anything within that range feels just about right. Another Sandia metric is the size of the nuclear weapons program within the Labs. A nuclear weapons program that is below 50 percent of the total laboratory budget has been a seeming impenetrable wall. But pressure on NNSA Defense Programs budgets and our corporate desire to contribute solutions to other pressing national security challenges combine to bring this metric up for possible re-examination.

Our culture has made us fear the consequences of passing beyond the 50 percent wall, and the trip could indeed create some violent buffeting. But perhaps the flight beyond could become eerily quiet and smooth. Let us prove our own impenetrable wall fiction by passing through it with vision, by leveraging what we already have as leaders and like-minded followers. Let us position ourselves to realize the breathtaking advances and unanticipated benefits to the nation's national security that may lie beyond.

What wall? ■