## 1AC

#### Plan

##### The United States Federal Government should offer power purchase agreements for small modular nuclear reactors to supply power to military bases in the United States.

### Advantage One is Proliferation

#### Development of nuclear power increasing worldwide – Fukushima hasn’t deterred

Barber, Chief Analyst for Energy Central, 8-30

[Wayne Barber, Chief of Generation for Energy Central's Generation Hub, “IAEA Report Finds Fukushima Didn't Cripple Nuclear Future,” August 30th 2012, http://www.energybiz.com/article/12/08/iaea-report-finds-fukushima-didnt-cripple-nuclear-future]

Less than 18 months after the meltdown accident at Tokyo Electric Power Co.’s (TEPCO) Fukushima Dai-ichi plant, the International Atomic Energy Agency (IAEA) finds that nuclear power is still doing surprisingly well worldwide. That’s the assessment offered by IAEA’s Nuclear Safety Review for the Year 2012, a 68-page document released in July. The report notes that China, India, the Republic of Korea, Turkey, United Arab Emirates and Vietnam continue to look to nuclear energy to meet ever growing needs for clean energy. Other countries are even accelerating additions to their nuclear power fleet. “For example, France is building its first advanced reactor, with plans for a second already being drawn up; the Russian Federation seeks to double its nuclear energy output by 2020, with several reactors around the country currently under construction; and, the United Kingdom has plans to build additional reactor units,” IAEA said. “However, some countries, including Belgium, Germany, Italy and Switzerland, have decided to phase out and discontinue the use of nuclear power, partly as a consequence of lack of public support and in some cases—public opposition,” IAEA said in the report. Several other countries, such as Austria, Denmark, Greece and New Zealand, remain opposed to nuclear power, the agency said. With over 14,792 reactor-years of commercial operation in 33 countries, the operational level of nuclear power plant safety around the world remains high, the agency said. The total number of unplanned reactor shutdowns, or scrams, has shown steady improvement in recent years, “although there is room for further improvement,” IAEA said.

#### Decline of the US nuclear industry undermines non-proliferation safeguards

Loudermilk, Senior Energy Associate @ NDU, ’11

[Micah J. Loudermilk, Senior Associate for the Energy & Environmental Security Policy program with The Institute for National Strategic Studies at The National Defense University, “In Defense of Small Reactors: A Response,” February 23rd 2011, http://csis.org/blog/defense-small-reactors-response]

Smith’s final contention takes issue with the argument that DOD needs to operate as a “first mover” in the small reactor market – stating: The U.S. nonproliferation agenda, if there is one, stands in opposition to this line of thinking. Pursuing a nuclear technology out of the fear that others will get it (or have it), is what fueled the Cold War and much of the proliferation we have seen and are seeing today. Though this contention is arguably true from a weapons-related standpoint, Smith’s point does not make much sense when discussing nuclear energy. The pursuit of nuclear energy is not remotely equivalent to an arms race and it is simply not possible to draw comparisons between the two. What we do know, however, is this: the domestic nuclear industry in the U.S. has stagnated and virtually died since the Three Mile Island incident over 30 years ago. Meanwhile, foreign nuclear energy companies are surging ahead and making rapid strides in the energy industry – moving forward with advanced nuclear reactors while new countries constantly enter the market. Like it or not, the nuclear renaissance is here – the world is pressing on and the U.S. simply is not on board. More than that, DOD investment as a “first mover” in the small reactor market in fact directly supports the nonproliferation agenda. As an increasingly large number of countries seek civilian nuclear power, real discussions on proliferation begin to center not on weapons, but on the weapons risk arising from the pursuit of energy. Historically, this potential problem has been largely mitigated by the influence exerted by the U.S. in the global nuclear energy market. The U.S. is influential largely because of its historic lead in nuclear energy technology. However, with the atrophy of domestic capabilities, U.S. share of the global nuclear trade has declined precipitously as aspiring states turn elsewhere to meet their needs. Other countries, such as China, that are making rapid advances in the field, do not share the U.S. commitment to reactor safety and nonproliferation objectives. Indeed, as can be seen, DOD’s efforts as a “first mover” in the arena are imperative, not simply from a military security standpoint, but also from a mindset of preserving the nonproliferation agenda.

#### Unsecured technology will fuel a massive wave of proliferation

Macalister, Guardian Energy Editor, ’09

[Terry Macalister, Energy Editor of The Guardian, Recipient of The Energy of Word Award, International Media Award organized by The Global Energy Prize, “New generation of nuclear power stations 'risk terrorist anarchy',” March 16th 2009, <http://www.guardian.co.uk/environment/2009/mar/16/nuclearpower-nuclear-waste>]

The new generation of atomic power stations planned for Britain, China and many other parts of the world risks proliferation that could lead to "nuclear anarchy", a security expert warned in a report published today. Governments and multilateral organisations must come up with a strategy to deal the impact of the new nuclear age, which will produce enough plutonium to make 1m nuclear weapons by 2075, argues Frank Barnaby from the Oxford Research Group thinktank in a paper for the Institute for Public Policy Research (IPPR). "We are at a crossroads. Unless governments work together to safeguard nuclear energy supplies, the rise in unsecured nuclear technology will put us all in danger. Without this, we are hurtling towards a state of nuclear anarchy where terrorists or rogue states have the ways and means of making nuclear weapons or 'dirty bombs', the consequences of which are unimaginable," says Barnaby. Any country choosing to operate new-generation nuclear reactors in future would have relatively easy access to plutonium, which is used to make the most efficient atomic weapons, along with the nuclear physicists and engineers to design them. These countries would be latent nuclear-weapon powers "and it is to be expected that some will take the political decision to become actual nuclear weapons powers," argues Barnaby in his paper submitted to the IPPR's independent Commission on National Security chaired by former Nato boss, Lord George Robertson. The issue of nuclear proliferation security has been largely ignored until today as the nuclear power debate has concentrated on the economics, social issues and how to deal with radioactive waste. Ministers in the UK have made clear their desire to see a new generation of facilities to replace existing ones at a time when North Sea gas is running out and the country needs to reduce its reliance on fossil fuels to meet its Kyoto protocol carbon emission targets. Nuclear power plants across the life cycle produce one third of the CO2 of gas-fired ones. Barnaby says that a shortage of uranium for the kind of reactors that EDF and others are considering building in Britain could encourage them to reprocess fuel and produce more plutonium. But he is equally convinced that a nuclear renaissance will lead to fast breeder reactors which produce more nuclear fuel than they use and which could be useful to terrorists. The Atomic Energy Agency and the Organisation for Economic Co-operation and Development have already suggested that uranium resources would last less than 70 years if processed using the current generation of light water nuclear reactors. Barnaby wants the non-proliferation treaty strengthened at a "make or break" review conference next year and would also like to see countries as yet without nuclear capabilities discouraged from obtaining enriched uranium, a problem highlighted in the case of Iran. Ian Kearns, deputy commissioner of the IPPR's security commission, said it was crucial that the rush to address climate change did not worsen the international security environment. "A global nuclear renaissance, if badly managed, could bring enormous complications in terms of nuclear non-proliferation and terrorism. Policymakers need to be alert to the dangers and to construct policies that bring secure low-carbon energy and a stable nuclear weapons environment," he said.

**New proliferators will develop offensive postures that increase the risk of conventional and nuclear conflict**

Horowitz, professor of poli sci, 9 —Professor of Political Science at University of Pennsylvania (Michael Horowitz, “The Spread of Nuclear Weapons and International Conflict: Does Experience Matter?” Journal of Conflict Resolution, Volume 53 Number 2, April 2009 pg. 234-257)

This section focuses on how acquiring nuclear weapons influences both the new nuclear state and potential adversaries. In theory, systemwide perceptions of nuclear danger could allow new nuclear states to partially skip the early Cold War learning process concerning the risks of nuclear war and enter a proliferated world more cognizant of nuclear brinksmanship and bargaining than their predecessors. However, each new nuclear state has to resolve its own particular civil–military issues surrounding operational control and plan its national strategy in light of its new capabilities. Empirical research by Sagan (1993), Feaver (1992), and Blair (1993) suggests that viewing the behavior of other states does not create the necessary tacit knowledge; there is no substitute for experience when it comes to handling a nuclear arsenal, even if experience itself cannot totally prevent accidents. Sagan contends that civil–military instability in many likely new proliferators and pressures generated by the requirements to handle the responsibility of dealing with nuclear weapons will skew decision making toward more offensive strategies (Sagan 1995). The questions surrounding Pakistan’s nuclear command and control suggest there is no magic bullet when it comes to new nuclear powers’ making control and delegation decisions (Bowen and Wolvén 1999). Sagan and others focus on inexperience on the part of new nuclear states as a key behavioral driver. Inexperienced operators and the bureaucratic desire to “justify” the costs spent developing nuclear weapons, combined with organizational biases that may favor escalation to avoid decapitation—the “use it or lose it” mind-set— may cause new nuclear states to adopt riskier launch postures, such as launch on warning, or at least be perceived that way by other states (Blair 1993; Feaver 1992; Sagan 1995). 3 Acquiring nuclear weapons could alter state preferences and make states more likely to escalate disputes once they start, given their new capabilities. But their general lack of experience at leveraging their nuclear arsenal and effectively communicating nuclear threats could mean new nuclear states will be more likely to select adversaries poorly and to find themselves in disputes with resolved adversaries that will reciprocate militarized challenges. The “nuclear experience” logic also suggests that more experienced nuclear states should gain knowledge over time from nuclearized interactions that helps leaders effectively identify the situations in which their nuclear arsenals are likely to make a difference. Experienced nuclear states learn to select into cases in which their comparative advantage, nuclear weapons, is more likely to be effective, increasing the probability that an adversary will not reciprocate.

#### Proliferation sparks wars that escalate to great power nuclear conflict

Below 08

[Tim D.Q., Wing Commander, RAF; MA in Defence Studies, King’s College London; “Options for US nuclear disarmament: exemplary leadership or extraordinary lunacy?,” June 2008, Thesis for School of Advanced Air and Space Studies, Air University Maxwell Air Force Base, Alabama]

Proliferation. Roger Molander, of RAND Corporation, asserts that “in the near future, a large number of countries are each going to develop a small number of nuclear weapons.”50 The Union of Concerned Scientists considers this to be the greatest long term danger confronting both US and international security today. Proliferation increases risk in a number of ways. First, the more states that hold nuclear weapons, the more likely it is that one will have an insufficiently mature or robust nuclear doctrine to manage its capability responsibly. Tom Sauer suggests that developing states that do not have democratic political systems present a particularly high risk because in dictatorial regimes, the military are frequently in control, and as Sagan has observed, the military appear to be more inclined to initiate preventative attacks against adversaries than civilians.52 Second, the more widely proliferated nuclear weapons become, the more theoretical opportunities may be presented for theft of nuclear material. Third, proliferation increases the risk of nuclear intervention by an established nuclear power, including the five NWSs. Stephen Younger envisages several scenarios in which currently established nuclear powers might “feel a need” to intervene with nuclear weapons in present regional conflicts, especially if WMD are being employed or threatened. Moreover, since proliferation is frequently associated with reaction to nuclear development either within a bordering nation or regional counterpart, further proliferation is in turn likely to generate a quasi-exponential expansion of similar regional scenarios.53 Ambassador Lehman envisages a scenario in which proliferation may induce a chain reaction of related regional arms races that could result in unintended and unexpected consequences far removed from the objectives of the proliferating nations, and in the United States’ specific case, a risk that the nation could get sucked into a conventional regional conflict which is subsequently escalated into nuclear warfare by its allies or their opponents.

#### The Middle East in particular is developing new nuclear power plants

Williams, Utilities Management Consultant, 8-17

[Glenn Williams, Management Consultant for Regulated Utilities and Energy Service Organization, 30 years of expereinece in startup and operation of large-scale power projects including coal plants, natural gas facilities and half of the nation’s nuclear power facilities, Masters in Technology Management from the University of Maryland, “The Nuclear Renaissance Has Arrived,” August 17th 2012, http://realmoney.thestreet.com/articles/08/17/2012/nuclear-renaissance-has-arrived]

If you thought the U.S. would see a nuclear renaissance, you need to think again. No new licenses can be granted until the federal government resolves policy, technical and regulatory issues associated with the disposal of spent nuclear fuel. Meanwhile, on the other side of the world, Middle Eastern countries are doing what America cannot; they are building a fleet of new nuclear power plants. And those foreign plants are turning out to be incredibly good investments. In the U.S., regulators are allowing only three new power stations to be constructed. Unlike nuclear plants in other nations, these three plants may not be great investments. Over the last several weeks, all three projects warned their construction schedules will be delayed and their costs will increase. One is already beginning to question the urgency for their new plant. Southern Company's (SO) Plant Vogtle project just announced a possible cost and schedule change. According to the most recent Securities and Exchange Commission (SEC) Form 10-Q, Southern is "evaluating whether maintaining the currently scheduled commercial operation dates remains in the best interest of their customers." It may not matter if it's in the customers' best interests. The company's 10-Q also revealed that Southern received an official violation notice from the Nuclear Regulatory Commission (NRC). It appears to have a compliance problem based on how it constructed the plant's nuclear island, which is a critical path item. This violation could take weeks to resolve as the utility works its way through a burdensome regulatory process. SCANA (SCG) also announced a possible cost increase and schedule delay for its V.C. Summer project. According to page 10 of its 10-Q, SCANA is filing a petition with state regulators to "revise substantial completion dates for the New Units." SCANA's petition also includes new costs to, "resolve claims for costs related to regulatory delays, design modifications of the shield building, certain prefabricated structural modules for the New Units and unanticipated rock conditions at the site." Tennessee Valley Authority TVA recently discovered its Watts Bar project would not be completed in 2013. Last April, TVA advised stakeholders that their schedule was delayed an additional two years. But construction schedules may be the least of TVA's concerns. Watts Bar 2 lacks an operating license from the NRC. It appears Watts bar cannot enter into commercial operations will be delayed further until the federal government resolves spent fuel issues, allowing the NRC to grant licenses. So it seems that all three nuclear projects are caught in regulatory purgatory. Until policy, regulatory and financial issues are resolved, these projects are effectively on hold. There is no assurance that any new nuclear plant will be operating soon. Meanwhile, Middle Eastern countries are proceeding to build fleets of new nuclear power plants. According to Nuclear Energy Insider, Saudi Arabia, United Arab Emirates (UAE), Jordan, Egypt, Turkey and South Africa are pushing forward with more than $500 billion worth of new nuclear construction projects. It all started in 2009, when Korea Electric Power Corporation secured a tender for four nuclear units in the United Arab Emirates. Last month, UAE started construction on a 1,400-megawatt unit. UAE also announced plans for an additional 12 units. Saudi Arabia is planning the regions' largest nuclear project, called King Abdullah City of Atomic and Renewable Energy. Nuclear Energy Insider reports this complex will cost over $250 billion. UAE, Saudi Arabia and other oil producing nations are highly motivated to build nuclear power plants. For them, nuclear power is an incredibly worthwhile investment because a single megawatt-hour from a nuclear power plant costs approximately $21.00 to produce. To manufacture that megawatt-hour requires approximately 10 million British thermal units (MMBtu) of fuel. Combining fuel and other production costs, a nuclear power plant can produce energy for approximately $2.00 per MMBtu. In contrast, a barrel of crude oil contains approximately 5.8 MMBtu. With Brent trading at $116 per barrel, crude oil is worth approximately $20.00 per MMBtu. With almost a 10-to-1 difference, it's in their economic interest to consume cheap nuclear power and export pricy crude oil. For oil producing nations, nuclear power plants pay for themselves several times over. Nuclear power also works for some oil consuming nations, such as Jordan and China. Instead of consuming $20 of oil-based energy, they use nuclear power to produce $2 energy. The savings to the local economy can be enormous. But substituting nuclear power for oil only works in special circumstances. In the U.S., the substitution is difficult because electricity and oil are independent and non-correlated commodities. Accordingly, investing in nuclear power to supplant oil cannot reward US utilities with financial returns. Yes, the nuclear renaissance arrived. Unfortunately, it's over there and not here.

#### Middle East civilian nuclear power programs will be turned into military nuclear weapons programs

Russell, National Security Prof @ NDU, August ’12

[Richard L. Russell, Professor of National Security Affairs at the National Defense University’s Near East and South Asia Center for Strategic Studies, Special Advisor to the U.S. Central Command, the U.S. Special Operations Command, and the Joint Special Operations University, Former Adjunct Professor of Security Studies at Georgetown, Former Political-Military Analyst for the Central Intelligence Agency, “CHAPTER 6: THE MIDDLE EAST’S NUCLEAR FUTURE,” The Next Arms Race, August 2012]

The great danger is that the United States is “cutting off its nose to spite its face” with nuclear weapons proliferation in the Middle East. Washington has shown an eagerness to support nuclear power infrastructure in the Gulf based largely on commercial interests. It is actively marketing nuclear plants and assistance to the UAE and Kuwait. The United States no doubt wants American industry to win regional commercial competition against French and other foreign firms that are aggressively marketing their nuclear wares in the region. The American, French, and European commercial perspectives on nuclear power in the Middle East, however, neglects the stubborn key determinants of nuclear developments discussed in this chapter. Middle Eastern states will be under heavy pressure in the future to convert ostensibly civilian nuclear power programs into clandestine military nuclear weapons programs, given the key determinants at play in the region. The Western community is putting itself at risk by essentially replaying the French mistake of supplying Israel and Iraq with ostensibly civilian nuclear power reactors that in the last century were clandestinely harnessed for military nuclear weapons programs.

Even if Western nuclear technology is not directly harnessed for military nuclear weapons programs, the expertise and technology could be easily diverted to the military. The United States, France, and other Western countries, for example, made that mistake in supplying South Africa with civilian nuclear technology and assistance. Although that assistance did not directly build South Africa’s nuclear weapons before the 1990 abandonment, the assistance substantially increased the technical competence of Pretoria’s nuclear engineers, technicians, and scientists, who made up South Africa’s nuclear weapons intellectual capital.29 Some observers might argue that Arab states would not dare risk jeopardizing their bilateral security relationships with the United States by embarking on clandestine nuclear weapons programs. But these programs could be very small and difficult to detect. The South African case is illustrative of how medium-sized powers like the Arab states could nurture nuclear weapons programs that could go undetected. The South African bomb program in the 1980s employed only 100 people, of whom about 40 were directly involved in the weapons program and only 20 built South Africa’s small nuclear arsenal. By the time the program was cancelled in 1990, the work force still had only about 300 people.30 International safeguards under the auspices of the IAEA would be little more than speed bumps for determined Middle Eastern proliferators to overcome. North Korea has set a model of behavior in which nation-states could ostensibly comply with IAEA safeguards for years until their nuclear capabilities have sufficiently matured to allow them to go it alone without international community assistance, after they had withdrawn from the NPT. Or, if they were the least bit cunning, they could play along with IAEA inspections and hide military nuclear weapons programs for as long as possible, much as Iraq had done prior to the 1991 war. IAEA safeguards would hamper, but not stop, determined Arab efforts to shift or divert civilian nuclear power infrastructure toward military nuclear weapons programs. Arab states, for example, might acquire large uranium holdings from the international market and then give formal notice and withdraw from the treaty and its inspection requirements. Uranium stocks could then be run through reactors and reprocessed for weapons-grade plutonium, perhaps by parallel and clandestine plutonium-reprocessing facilities purchased from China or other states. Uranium stocks too could be run through clandestine centrifuges—perhaps acquired from Pakistan, much like North Korea appears to have done—and refined to weapons grade. The Arab Gulf states are relying on international technical assistance from France, the United States, China, and Russia, to name just a few, to get their nuclear power infrastructure foundations laid and then up and running. In the meantime, the Arab Gulf states are training a cadre of domestic talent, which over a generation could be ready to fill foreign shoes and assume the reigns of the nuclear power infrastructure, especially if these states withdrew from IAEA safeguards and the NPT and shifted their civilian programs to wartime-like military nuclear weapons programs. Emirati officials, for example, readily admit today that they are developing domestic talent to run and maintain nuclear reactors by creating nuclear science and engineering degree programs at Khalifa University, the country’s largest technical school.31 One cannot help but suspect that UAE officials look to how far Iran has progressed with its nuclear program, and are determined to keep pace—even though the Emirates got a late start.

#### Middle East proliferation ensures nuclear exchange

Edelman & Krepinevich, Former Undesecretary for Defense, ‘11

[Eric Edelman, Fellow at the Center for Strategic and Budgetary Assessments, Former Undersecretary for Defense, Andrew Krepinevich, President of the Center for Strategic and Budgetary Assessment, Evan Montgomery, Research Fellow at the Center for Strategic and Budgetary Assessments, “The dangers of a nuclear Iran,” http://www.csbaonline.org/wp-content/uploads/2010/12/2010.12.27-The-Dangers-of-a-Nuclear-Iran.pdf]

During the Cold War, the United States and the Soviet Union only needed to concern themselves with an attack from the other. Multi-polar systems are generally considered to be less stable than bipolar systems because coalitions can shift quickly, upsetting the balance of power and creating incentives for an attack. More important, emerging nuclear powers in the Middle East might not take the costly steps necessary to preserve regional stability and avoid a nuclear exchange. For nuclear-armed states, the bedrock of deterrence is the knowledge that each side has a secure second-strike capability, so that no state can launch an attack with the expectation that it can wipe out its opponents' forces and avoid a devastating retaliation. However, emerging nuclear powers might not invest in expensive but survivable capabilities such as hardened missile silos or submarine-based nuclear forces. Given this likely vulnerability, the close proximity of states in the Middle East, and the very short flight times of ballistic missiles in the region, any new nuclear powers might be compelled to "launch on warning" of an attack or even, during a crisis, to use their nuclear forces preemptively. Their governments might also delegate launch authority to lower-level commanders, heightening the possibility of miscalculation and escalation. Moreover, if early warning systems were not integrated into robust command-and-control systems, the risk of an unauthorized or accidental launch would increase further still. And without sophisticated early warning systems, a nuclear attack might be unattributable or attributed incorrectly. That is, assuming that the leadership of a targeted state survived a first strike, it might not be able to accurately determine which nation was responsible. And this uncertainty, when combined with the pressure to respond quickly, would create a significant risk that it would retaliate against the wrong party, potentially triggering a regional nuclear war. Most existing nuclear powers have taken steps to protect their nuclear weapons from unauthorized use: from closely screening key personnel to developing technical safety measures, such as permissive action links, which require special codes before the weapons can be armed. Yet there is no guarantee that emerging nuclear powers would be willing or able to implement these measures, creating a significant risk that their governments might lose control over the weapons or nuclear material and that nonstate actors could gain access to these items. Some states might seek to mitigate threats to their nuclear arsenals; for instance, they might hide their weapons. In that case, however, a single intelligence compromise could leave their weapons vulnerable to attack or theft.

#### Most likely scenario for global escalation – Middle East instability draws in major powers

Russell, National Security Professor Naval Postgraduate School, ’09

[James Russell, Associate Professor of National Security at the Naval Postgraduate School, “Strategic Stability Reconsidered: Prospects for Escalation and Nuclear War in the Middle East,” Security Studies Center Proliferation Papers, http://www.analyst-network.com/articles/141/StrategicStabilityReconsideredProspectsforEscalationandNuclearWarintheMiddleEast.pdf]

Strategic stability in the region is thus undermined by various factors: (1) asymmetric interests in the bargaining framework that can introduce unpredictable behavior from actors; (2) the presence of non-state actors that introduce unpredictability into relationships between the antagonists; (3) incompatible assumptions about the structure of the deterrent relationship that makes the bargaining framework strategically unstable; (4) perceptions by Israel and the United States that its window of opportunity for military action is closing, which could prompt a preventive attack; (5) the prospect that Iran’s response to pre-emptive attacks could involve unconventional weapons, which could prompt escalation by Israel and/or the United States; (6) the lack of a communications framework to build trust and cooperation among framework participants. These systemic weaknesses in the coercive bargaining framework all suggest that escalation by any the parties could happen either on purpose or as a result of miscalculation or the pressures of wartime circumstance. Given these factors, it is disturbingly easy to imagine scenarios under which a conflict could quickly escalate in which the regional antagonists would consider the use of chemical, biological, or nuclear weapons. It would be a mistake to believe the nuclear taboo can somehow magically keep nuclear weapons from being used in the context of an unstable strategic framework. Systemic asymmetries between actors in fact suggest a certain increase in the probability of war – a war in which escalation could happen quickly and from a variety of participants. Once such a war starts, events would likely develop a momentum all their own and decision-making would consequently be shaped in unpredictable ways. The international community must take this possibility seriously, and muster every tool at its disposal to prevent such an outcome, which would be an unprecedented disaster for the peoples of the region, with substantial risk for the entire world.

#### Power Purchasing Agreements allow the DOD to act as a first mover jumpstarting the SMR industry

Madia, Chairman Stanford National Accelerator Lab, ’12

[Dr. Madia, Chairman of the Board of Overseers & Vice President for the SLAC National Accelerator Laboratory at Stanford University, Former Laboratory Director at the Oak Ridge National Laboratory, Former Laboratory Director at the Pacific Northwest National Laboratory, “SMALL MODULAR REACTORS: A POTENTIAL GAME-CHANGING TECHNOLOGY,” Stanford Energy Journal, Spring 2012, http://energyclub.stanford.edu/index.php/Journal/Small\_Modular\_Reactors\_by\_William\_Madia]

Throughout the history of NPP development, plants grew in size based on classic “economies of scale” considerations. Bigger was cheaper when viewed on a cost per installed kilowatt basis. The drivers that caused the industry to build bigger and bigger NPPs are being offset today by various considerations that make this new breed of SMRs viable. Factory manufacturing is one of these considerations. Most SMRs are small enough to allow them to be factory built and shipped by rail or barge to the power plant sites. Numerous industry “rules of thumb” for factory manufacturing show dramatic savings as compared to “on-site” outdoor building methods. Significant schedule advantages are also available because weather delay considerations are reduced. Of course, from a total cost perspective, some of these savings will be offset by the capital costs associated with building multiple modules to get the same total power output. Based on analyses I have seen, overnight costs in the range of $5000 to $8000 per installed kilowatt are achievable. If these analyses are correct, it means that the economies of scale arguments that drove current designs to GW scales could be countered by the simplicity and factory-build possibilities of SMRs. No one has yet obtained a design certification from the Nuclear Regulatory Commission (NRC) for an SMR, so we must consider licensing to be one of the largest unknowns facing these new designs. Nevertheless, since the most developed of the SMRs are mostly based on proven and licensed components and are configured at power levels that are passively safe, we should not expect many new significant licensing issues to be raised for this class of reactor. Still, the NRC will need to address issues uniquely associated with SMRs, such as the number of reactor modules any one reactor operator can safely operate and the size of the emergency planning zone for SMRs. To determine if SMRs hold the potential for changing the game in carbon-free power generation, it is imperative that we test the design, engineering, licensing, and economic assumptions with some sort of public-private development and demonstration program. Instead of having government simply invest in research and development to “buy down” the risks associated with SMRs, I propose a more novel approach. Since the federal government is a major power consumer, it should commit to being the “first mover” of SMRs. This means purchasing the first few hundred MWs of SMR generation capacity and dedicating it to federal use. The advantages of this approach are straightforward. The government would both reduce licensing and economic risks to the point where utilities might invest in subsequent units, thus jumpstarting the SMR industry. It would then also be the recipient of additional carbon-free energy generation capacity. This seems like a very sensible role for government to play without getting into the heavy politics of nuclear waste, corporate welfare, or carbon taxes.

#### The DOD market is the only way to quickly get SMR’s through financial and regulatory barriers

Andres & Breetz, Security Prof @ National War College, ’11

[Richard B. Andres, Professor of National Security Strategy at the National War College, Senior Fellow and Energy and Environmental Security and Policy Chair in the Center for Strategic Research, Institute for National Strategic Studies, at the National Defense University, Hanna L. Breetz, Political Science PhD Candidate at MIT, “Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications,” Strategic Forum, INSS, February 2011]

Thus far, this paper has reviewed two of DOD’s most pressing energy vulnerabilities—grid insecurity and fuel convoys—and explored how they could be addressed by small reactors. We acknowledge that there are many uncertainties and risks associated with these reactors. On the other hand, failing to pursue these technologies raises its own set of risks for DOD, which we review in this section: first, small reactors may fail to be commercialized in the United States; second, the designs that get locked in by the private market may not be optimal for DOD’s needs; and third, expertise on small reactors may become concentrated in foreign countries. By taking an early “first mover” role in the small reactor market, DOD could mitigate these risks and secure the long-term availability and appropriateness of these technologies for U.S. military applications. The “Valley of Death.” Given the promise that small reactors hold for military installations and mobility, DOD has a compelling interest in ensuring that they make the leap from paper to production. However, if DOD does not provide an initial demonstration and market, there is a chance that the U.S. small reactor industry may never get off the ground. The leap from the laboratory to the marketplace is so difficult to bridge that it is widely referred to as the “Valley of Death.” Many promising technologies are never commercialized due to a variety of market failures— including technical and financial uncertainties, information asymmetries, capital market imperfections, transaction costs, and environmental and security externalities— that impede financing and early adoption and can lock innovative technologies out of the marketplace. 28 In such cases, the Government can help a worthy technology to bridge the Valley of Death by accepting the first mover costs and demonstrating the technology’s scientific and economic viability.29 Historically, nuclear power has been “the most clear-cut example . . . of an important general-purpose technology that in the absence of military and defenserelated procurement would not have been developed at all.”30 Government involvement is likely to be crucial for innovative, next-generation nuclear technology as well. Despite the widespread revival of interest in nuclear energy, Daniel Ingersoll has argued that radically innovative designs face an uphill battle, as “the high capital cost of nuclear plants and the painful lessons learned during the first nuclear era have created a prevailing fear of first-of-a-kind designs.”31 In addition, Massachusetts Institute of Technology reports on the Future of Nuclear Power called for the Government to provide modest “first mover” assistance to the private sector due to several barriers that have hindered the nuclear renaissance, such as securing high up-front costs of site-banking, gaining NRC certification for new technologies, and demonstrating technical viability.32 It is possible, of course, that small reactors will achieve commercialization without DOD assistance. As discussed above, they have garnered increasing attention in the energy community. Several analysts have even argued that small reactors could play a key role in the second nuclear era, given that they may be the only reactors within the means of many U.S. utilities and developing countries.33 However, given the tremendous regulatory hurdles and technical and financial uncertainties, it appears far from certain that the U.S. small reactor industry will take off. If DOD wants to ensure that small reactors are available in the future, then it should pursue a leadership role now. Technological Lock-in. A second risk is that if small reactors do reach the market without DOD assistance, the designs that succeed may not be optimal for DOD’s applications. Due to a variety of positive feedback and increasing returns to adoption (including demonstration effects, technological interdependence, network and learning effects, and economies of scale), the designs that are initially developed can become “locked in.”34 Competing designs—even if they are superior in some respects or better for certain market segments— can face barriers to entry that lock them out of the market. If DOD wants to ensure that its preferred designs are not locked out, then it should take a first mover role on small reactors. It is far too early to gauge whether the private market and DOD have aligned interests in reactor designs. On one hand, Matthew Bunn and Martin Malin argue that what the world needs is cheaper, safer, more secure, and more proliferation-resistant nuclear reactors; presumably, many of the same broad qualities would be favored by DOD.35 There are many varied market niches that could be filled by small reactors, because there are many different applications and settings in which they can be used, and it is quite possible that some of those niches will be compatible with DOD’s interests.36 On the other hand, DOD may have specific needs (transportability, for instance) that would not be a high priority for any other market segment. Moreover, while DOD has unique technical and organizational capabilities that could enable it to pursue more radically innovative reactor lines, DOE has indicated that it will focus its initial small reactor deployment efforts on LWR designs.37 If DOD wants to ensure that its preferred reactors are developed and available in the future, it should take a leadership role now. Taking a first mover role does not necessarily mean that DOD would be “picking a winner” among small reactors, as the market will probably pursue multiple types of small reactors. Nevertheless, DOD leadership would likely have a profound effect on the industry’s timeline and trajectory.

#### Only DOD action can create widespread adoption of SMR’s which saves the domestic nuclear industry

Loudermilk, Senior Energy Associate @ NDU, ’11

[Micah J. Loudermilk, Senior Associate for the Energy & Environmental Security Policy program with The Institute for National Strategic Studies at The National Defense University, “Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs,” Journal of Energy Security, May 2011, <http://www.ensec.org/index.php?option=com_content&view=article&id=314:small-nuclear-reactors-and-us-energy-security-concepts-capabilities-and-costs&catid=116:content0411&Itemid=375>]

Problematically, despite the immense energy security benefits that would accompany the wide-scale adoption of small modular reactors in the US, with a difficult regulatory environment, anti-nuclear lobbying groups, skeptical public opinion, and of course the recent Fukushima accident, the nuclear industry faces a tough road in the battle for new reactors. While President Obama and Energy Secretary Chu have demonstrated support for nuclear advancement on the SMR front, progress will prove difficult. However, a potential route exists by which small reactors may more easily become a reality: the US military. The US Navy has successfully managed, without accident, over 500 small reactors on-board its ships and submarines throughout 50 years of nuclear operations. At the same time, serious concern exists, highlighted by the Defense Science Board Task Force in 2008, that US military bases are tied to, and almost entirely dependent upon, the fragile civilian electrical grid for 99% of its electricity consumption. To protect military bases’ power supplies and the nation’s military assets housed on these domestic installations, the Board recommended a strategy of “islanding” the energy supplies for military installations, thus ensuring their security and availability in a crisis or conflict that disrupts the nation’s grid or energy supplies. DOD has sought to achieve this through decreased energy consumption and renewable technologies placed on bases, but these endeavors will not go nearly far enough in achieving the department’s objectives. However, by placing small reactors on domestic US military bases, DOD could solve its own energy security quandary—providing assured supplies of secure and constant energy both to bases and possibly the surrounding civilian areas as well. Concerns over reactor safety and security are alleviated by the security already present on installations and the military’s long history of successfully operating nuclear reactors without incident. Unlike reactors on-board ships, small reactors housed on domestic bases would undoubtedly be subject to Nuclear Regulatory Commission (NRC) regulation and certification, however, with strong military backing, adoption of the reactors may prove significantly easier than would otherwise be possible. Additionally, as the reactors become integrated on military facilities, general fears over the use and expansion of nuclear power will ease, creating inroads for widespread adoption of the technology at the private utility level. Finally, and perhaps most importantly, action by DOD as a “first mover” on small reactor technology will preserve America’s badly struggling and nearly extinct nuclear energy industry. The US possesses a wealth of knowledge and technological expertise on SMRs and has an opportunity to take a leading role in its adoption worldwide. With the domestic nuclear industry largely dormant for three decades, the US is at risk of losing its position as the global leader in the international nuclear energy market. If the current trend continues, the US will reach a point in the future where it is forced to import nuclear technologies from other countries—a point echoed by Secretary Chu in his push for nuclear power expansion. Action by the military to install reactors on domestic bases will guarantee the short-term survival of the US nuclear industry and will work to solidify long-term support for nuclear energy. Conclusions: In the end, small modular reactors present a viable path forward for both the expansion of nuclear power in the US and also for enhanced US energy security. Offering highly safe, secure, and proliferation-resistant designs, SMRs have the potential to bring carbon-free baseload distributed power across the United States. Small reactors measure up with, and even exceed, large nuclear reactors on questions of safety and possibly on the financial (cost) front as well. SMRs carry many of the benefits of both large-scale nuclear energy generation and renewable energy technologies. At the same time, they can reduce US dependence on fossil fuels for electricity production—moving the US ahead on carbon dioxide and GHG reduction goals and setting a global example. While domestic hurdles within the nuclear regulatory environment domestically have proven nearly impossible to overcome since Three Mile Island, military adoption of small reactors on its bases would provide energy security for the nation’s military forces and may create the inroads necessary to advance the technology broadly and eventually lead to their wide-scale adoption.

#### An SMR lead revival of the industry restores US nuclear leadership which controls proliferation risks

Loudermilk, Senior Energy Associate @ NDU, ’11

[Micah J. Loudermilk, Senior Associate for the Energy & Environmental Security Policy program with The Institute for National Strategic Studies at National Defense University, “Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs,” Journal of Energy Security, May 2011, <http://www.ensec.org/index.php?option=com_content&view=article&id=314:small-nuclear-reactors-and-us-energy-security-concepts-capabilities-and-costs&catid=116:content0411&Itemid=375>]

Combating proliferation with US leadership: Reactor safety itself notwithstanding, many argue that the scattering of small reactors around the world would invariably lead to increased proliferation problems as nuclear technology and know-how disseminates around the world. Lost in the argument is the fact that this stance assumes that US decisions on advancing nuclear technology color the world as a whole. In reality, regardless of the US commitment to or abandonment of nuclear energy technology, many countries (notably China) are blazing ahead with research and construction, with 55 plants currently under construction around the world—though Fukushima may cause a temporary lull. Since Three Mile Island, the US share of the global nuclear energy trade has declined precipitously as talent and technology begin to concentrate in countries more committed to nuclear power. On the small reactor front, more than 20 countries are examining the technology and the IAEA estimates that 40-100 small reactors will be in operation by 2030. Without US leadership, new nations seek to acquire nuclear technology turn to countries other than the US who may not share a deep commitment to reactor safety and nonproliferation objectives. Strong US leadership globally on nonproliferation requires a vibrant American nuclear industry. This will enable the US to set and enforce standards on nuclear agreements, spent fuel reprocessing, and developing reactor technologies. As to the small reactors themselves, the designs achieve a degree of proliferation-resistance unmatched by large reactors. Small enough to be fully buried underground in independent silos, the concrete surrounding the reactor vessels can be layered much thicker than the traditional domes that protect conventional reactors without collapsing. Coupled with these two levels of superior physical protection is the traditional security associated with reactors today. Most small reactors also are factory-sealed with a supply of fuel inside. Instead of refueling reactors onsite, SMRs are returned to the factory, intact, for removal of spent fuel and refueling. By closing off the fuel cycle, proliferation risks associated with the nuclear fuel running the reactors are mitigated and concerns over the widespread distribution of nuclear fuel allayed.

#### SMR’s are key to negotiation pressure for nonproliferation - they are more desirable than other nuclear systems

Sanders, Associate Director Savannah National Lab, ’12

[Tom Sanders, Associate Laboratory Director for Clean Energy Initiatives at the Savannah River National Laboratory, Department of Energy, Former President of the American Nuclear Society, “Tom Sanders: Great expectations for small modular reactors,” Nuclear News, July 2012, pg. 48-49]

That’s a good question. One of the things that concerned me most in the nonproliferation area was the fact that the United States had lost a lot of its ability to export nuclear goods and services under U.S. export licenses. That’s important to nonproliferation, because it’s through negotiations with other countries’ export controls of nuclear technology that a lot of our goals regarding proliferation risk management are met. By that I mean that if you’re not exporting anything you’re not negotiating anything, and you’re not really establishing a standard for safety, security, and proliferation risk management around the world. Then we evaluated how to regain some of that capability, and small modular reactors became obvious for two reasons. One is that you could probably speed up the construction and licensing process by factory manufacturing and turn them out much more quickly than large reactors. And the other is that for emerging nations, most developing countries could not absorb large nuclear systems, and smaller systems would be more acceptable to them and more affordable. They may cost a little more per megawatt, but the capital costs–the upfront costs–would be significantly less. In addition, the economy of scale you possible get with a large plant doesn’t make any sense if you can’t afford it.

#### Domestic nuclear industry key to prevent global accidents

Wallace and Williams, Senior Adviser on U.S. Nuclear Energy Project at CSIS and Nuclear Policy Analyst at Partnership for Global Security, 12

(Nuclear Energy in America:Preventing its Early Demise, csis.org/files/publication/120417\_gf\_wallace\_williams.pdf)

Second, setting global norms and standards for safety, security, operations, and emergency response. As the world learned with past nuclear accidents and more recently with Fukushima, a major accident anywhere can have lasting repercussions everywhere. As with nonproliferation and security, America’s ability to exert leadership and influence in this area is directly linked to the strength of our domestic industry and our active involvement in the global nuclear enterprise. A strong domestic civilian industry and regulatory structure have immediate national security significance in that they help support the nuclear capabilities of the U.S. Navy, national laboratories, weapons complex, and research institutions. Third, in the past, the U.S. government could exert influence by striking export agreements with countries whose regulatory and legal frameworks reflected and were consistent with our own nonproliferation standards and commitments. At the same time, our nation set the global standard for effective, independent safety regulation (in the form of the Nuclear Regulatory Commission), led international efforts to reduce proliferation risks (through the 1970 NPT Treaty and other initiatives), and provided a model for industry self-regulation. The results were not perfect, but America’s institutional support for global nonproliferation goals and the regulatory behaviors it modeled clearly helped shape the way nuclear technology was adopted and used elsewhere around the world. This influence seems certain to wane if the United States is no longer a major supplier or user of nuclear technology. With existing nonproliferation and safety and security regimes looking increasingly inadequate in this rapidly changing global nuclear landscape, American leadership and leverage is more important and more central to our national security interests than ever. To maintain its leadership role in the development, design, and operation of a growing global nuclear energy infrastructure, the next administration, whether Democrat or Republican, must recognize the invaluable role played by the commercial U.S. nuclear industry and take action to prevent its early demise.

#### Fukushima proves accidents getting worse – extinction

Chossudovsky, Professor of Economics at University of Ottawa, 12

(1/25, Fukushima: A Nuclear War without a War: The Unspoken Crisis of Worldwide Nuclear Radiation, www.globalresearch.ca/fukushima-a-nuclear-war-without-a-war-the-unspoken-crisis-of-worldwide-nuclear-radiation/)

The World is at a critical crossroads. The Fukushima disaster in Japan has brought to the forefront the dangers of Worldwide nuclear radiation. The crisis in Japan has been described as “a nuclear war without a war”. In the words of renowned novelist Haruki Murakami: “This time no one dropped a bomb on us … We set the stage, we committed the crime with our own hands, we are destroying our own lands, and we are destroying our own lives.” Nuclear radiation –which threatens life on planet earth– is not front page news in comparison to the most insignificant issues of public concern, including the local level crime scene or the tabloid gossip reports on Hollywood celebrities. While the long-term repercussions of the Fukushima Daiichi nuclear disaster are yet to be fully assessed, they are far more serious than those pertaining to the 1986 Chernobyl disaster in the Ukraine, which resulted in almost one million deaths (New Book Concludes – Chernobyl death toll: 985,000, mostly from cancer Global Research, September 10, 2010, See also Matthew Penney and Mark Selden The Severity of the Fukushima Daiichi Nuclear Disaster: Comparing Chernobyl and Fukushima, Global Research, May 25, 2011) Moreover, while all eyes were riveted on the Fukushima Daiichi plant, news coverage both in Japan and internationally failed to fully acknowledge the impacts of a second catastrophe at TEPCO’s (Tokyo Electric Power Co Inc) Fukushima Daini nuclear power plant. The shaky political consensus both in Japan, the U.S. and Western Europe is that the crisis at Fukushima has been contained. The realties, however, are otherwise. Fukushima 3 was leaking unconfirmed amounts of plutonium. According to Dr. Helen Caldicott, “one millionth of a gram of plutonium, if inhaled can cause cancer”. The Impacts in Japan The Japanese government has been obliged to acknowledge that “the severity rating of its nuclear crisis … matches that of the 1986 Chernobyl disaster”. In a bitter irony, however, this tacit admission by the Japanese authorities has proven to been part of the cover-up of a significantly larger catastrophe, resulting in a process of global nuclear radiation and contamination: “While Chernobyl was an enormous unprecedented disaster, it only occurred at one reactor and rapidly melted down. Once cooled, it was able to be covered with a concrete sarcophagus that was constructed with 100,000 workers. There are a staggering 4400 tons of nuclear fuel rods at Fukushima, which greatly dwarfs the total size of radiation sources at Chernobyl.” ( Extremely High Radiation Levels in Japan: University Researchers Challenge Official Data, Global Research, April 11, 2011) Worldwide Contamination The dumping of highly radioactive water into the Pacific Ocean constitutes a potential trigger to a process of global radioactive contamination. Radioactive elements have not only been detected in the food chain in Japan, radioactive rain water has been recorded in California: “While Chernobyl was an enormous unprecedented disaster, it only occurred at one reactor and rapidly melted down. Once cooled, it was able to be covered with a concrete sarcophagus that was constructed with 100,000 workers. There are a staggering 4400 tons of nuclear fuel rods at Fukushima, which greatly dwarfs the total size of radiation sources at Chernobyl.” ( Extremely High Radiation Levels in Japan: University Researchers Challenge Official Data, Global Research, April 11, 2011)

### **Advantage Two is Bases**

#### Electrical power disruption on military bases is inevitable – aging infrastructure, severe weather, and cyberattacks; Purchasing electricity from SMR’s solve

Robitaille, Army Environmental Center, ’12

[George E. Robitaille, Department of Army Civilian, US Army Environmental Center, Master of Strategic Studies from The US Army War, “Small Modular Reactors: The Army’s Secure Source of Energy?,” March 21st 2012]

According to a recent report by the Defense Science Board, the DoD gets ninety nine percent of their electrical requirements from the civilian electric grid. The electric grid, as it is currently configured and envisioned to operate for the foreseeable future, may not be reliable enough to ensure an uninterrupted flow of electricity for our critical military facilities given the influences of the aging infrastructure, its susceptibility to severe weather events, and the potential for cyber attacks. The DoD dependency on the grid is reflected in the $4.01 Billion spent on facilities energy in fiscal year 2010, the latest year which data was available.4 The electricity used by military installations amounts to $3.76 billion.5 As stated earlier, the DoD relies on the commercial grid to provide a secure source of energy to support the operations that ensure the security of our nation and it may not be available when we need it. The system could be taken down for extended periods of time by failure of aging components, acts of nature, or intentionally by cyber attacks. Aging Infrastructure. The U.S electric power grid is made up of independently owned power plants and transmission lines. The political and environmental resistance to building new electric generating power plants combined with the rise in consumption and aging infrastructure increases the potential for grid failure in the future. There are components in the U.S. electric grid that are over one hundred years old and some of the recent outages such as the 2006 New York blackout can be directly attributed to this out of date, aging infrastructure.6 Many of the components of this system are at or exceeding their operational life and the general trend of the utility companies is to not replace power lines and other equipment until they fail. 7 The government led deregulation of the electric utility industry that started in the mid 1970s has contributed to a three decade long deterioration of the electric grid and an increased state of instability. Although significant investments are being made to upgrade the electric grid, the many years of prior neglect will require a considerable amount of time and funding to bring the aging infrastructure up to date. Furthermore, the current investment levels to upgrade the grid are not keeping up with the aging system.8 In addition, upgrades to the digital infrastructure which were done to increase the systems efficiency and reliability, have actually made the system more susceptible to cyber attacks. Because of the aging infrastructure and the impacts related to weather, the extent, as well as frequency of failures is expected to increase in the future. Adverse Weather. According to a 2008 grid reliability report by the Edison Electric Institute, sixty seven per cent of all power outages are related to weather. Specifically, lightning contributed six percent, while adverse weather provided thirty one percent and vegetation thirty percent (which was predominantly attributed to wind blowing vegetation into contact with utility lines) of the power outages.10 In 1998 a falling tree limb damaged a transformer near the Bonneville Dam in Oregon, causing a cascade of related black-outs across eight western states.11 In August of 2003 the lights went out in the biggest blackout in North America, plunging over fifty million people into darkness over eight states and two Canadian provinces. Most areas did not have power restored four or five days. In addition, drinking water had to be distributed by the National Guard when water pumping stations and/or purification processes failed. The estimated economic losses associated with this incident were about five billion dollars. Furthermore, this incident also affected the operations of twenty two nuclear plants in the United States and Canada.12 In 2008, Hurricane Ike caused approximately seven and a half million customers to lose power in the United States from Texas to New York.13 The electric grid suffered numerous power outages every year throughout the United States and the number of outages is expected to increase as the infrastructure ages without sufficient upgrades and weather-related impacts continue to become more frequent. Cyber Attacks. The civilian grid is made up of three unique electric networks which cover the East, West and Texas with approximately one hundred eighty seven thousand miles of power lines. There are several weaknesses in the electrical distribution infrastructure system that could compromise the flow of electricity to military facilities. The flow of energy in the network lines as well as the main distribution hubs has become totally dependent on computers and internet-based communications. Although the digital infrastructure makes the grid more efficient, it also makes it more susceptible to cyber attacks. Admiral Mr. Dennis C. Blair (ret.), the former Director of National Intelligence, testified before Congress that “the growing connectivity between information systems, the Internet, and other infrastructures creates opportunities for attackers to disrupt telecommunications, electrical power, energy pipelines, refineries, financial networks, and other critical infrastructures.14” The Intelligence Community assesses that a number of nations already have the technical capability to conduct such attacks.15 In the 2009 report, Annual Threat Assessment of the Intelligence Community for the Senate Armed Services Committee, Adm. Blair stated that “Threats to cyberspace pose one of the most serious economic and national security challenges of the 21st Century for the United States and our allies.”16 In addition, the report highlights a growing array of state and non-state actors that are targeting the U.S. critical infrastructure for the purpose of creating chaos that will subsequently produce detrimental effects on citizens, commerce, and government operations. These actors have the ability to compromise, steal, change, or completely destroy information through their detrimental activities on the internet.17 In January 2008, US Central Intelligence Agency senior analyst Tom Donahue told a gathering of three hundred international security managers from electric, water, oil & gas, and other critical industry, that data was available from multiple regions outside the United States, which documents cyber intrusions into utilities. In at least one case (outside the U.S.), the disruption caused a power outage affecting multiple cities. Mr. Donahue did not specify who executed these attacks or why, but did state that all the intrusions were conducted via the Internet.18 During the past twenty years, advances in computer technologies have permeated and advanced all aspects of our lives. Although the digital infrastructure is being increasingly merged with the power grid to make it more efficient and reliable, it also makes it more vulnerable to cyber attack. In October 2006, a foreign hacker invaded the Harrisburg, PA., water filtration system and planted malware.19 In June 2008, the Hatch nuclear power plant in Georgia shut down for two days after an engineer loaded a software update for a business network that also rebooted the plant's power control system. In April 2009, The Wall Street Journal reported that cyber spies had infiltrated the U.S. electric grid and left behind software that could be used to disrupt the system. The hackers came from China, Russia and other nations and were on a “fishing expedition” to map out the system. 20 According to the secretary of Homeland Security, Janet Napolitano at an event on 28 October 2011, cyber–attacks have come close to compromising the country’s critical infrastructure on multiple occasions.21 Furthermore, during FY11, the United States Computer Emergency Readiness Team took action on more than one hundred thousand incident reports by releasing more than five thousand actionable cyber security alerts and information products.22 The interdependence of modern infrastructures and digital based systems makes any cyber attacks on the U.S. electric grid potentially significant. The December 2008 report by the Commission on Cyber Security for the forty fourth Presidency states the challenge plainly: “America’s failure to protect cyberspace is one of the most urgent national security problems facing the new administration”.23 The susceptibility of the grid to being compromised has resulted in a significant amount of resources being allocated to ensuring the systems security. Although a substantial amount of resources are dedicated to protecting the nation’s infrastructure, it may not be enough to ensure the continuous flow of electricity to our critical military facilities. SMRs as they are currently envisioned may be able to provide a secure and independent alternative source of electricity in the event that the public grid is compromised. SMRs may also provide additional DoD benefit by supporting the recent government initiatives related to energy consumption and by circumventing the adverse ramifications associated with building coal or natural gas fired power plants on the environment.

#### Power disruption severely compromises global military operations – safeguards will fail - only power from SMRs ensures sustained reliability and deters cyber attacks

Andres & Breetz, Security Prof @ National War College, ’11

[Richard B. Andres, Professor of National Security Strategy at the National War College, Senior Fellow and Energy and Environmental Security and Policy Chair in the Center for Strategic Research, Institute for National Strategic Studies, at the National Defense University, Hanna L. Breetz, Political Science PhD Candidate at MIT, “Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications,” Strategic Forum, INSS, February 2011]

The DOD interest in small reactors derives largely from problems with base and logistics vulnerability. Over the last few years, the Services have begun to reexamine virtually every aspect of how they generate and use energy with an eye toward cutting costs, decreasing carbon emissions, and reducing energy-related vulnerabilities. These actions have resulted in programs that have significantly reduced DOD energy consumption and greenhouse gas emissions at domestic bases. Despite strong efforts, however, two critical security issues have thus far proven resistant to existing solutions: bases’ vulnerability to civilian power outages, and the need to transport large quantities of fuel via convoys through hostile territory to forward locations. Each of these is explored below. Grid Vulnerability. DOD is unable to provide its bases with electricity when the civilian electrical grid is offline for an extended period of time. Currently, domestic military installations receive 99 percent of their electricity from the civilian power grid. As explained in a recent study from the Defense Science Board:

DOD’s key problem with electricity is that critical missions, such as national strategic awareness and national command authorities, are almost entirely dependent on the national transmission grid . . . [which] is fragile, vulnerable, near its capacity limit, and outside of DOD control. In most cases, neither the grid nor on-base backup power provides sufficient reliability to ensure continuity of critical national priority functions and oversight of strategic missions in the face of a long term (several months) outage. The grid’s fragility was demonstrated during the 2003 Northeast blackout in which 50 million people in the United States and Canada lost power, some for up to a week, when one Ohio utility failed to properly trim trees. The blackout created cascading disruptions in sewage systems, gas station pumping, cellular communications, border check systems, and so forth, and demonstrated the interdependence of modern infrastructural systems.8 More recently, awareness has been growing that the grid is also vulnerable to purposive attacks. A report sponsored by the Department of Homeland Security suggests that a coordinated cyberattack on the grid could result in a third of the country losing power for a period of weeks or months.9 Cyberattacks on critical infrastructure are not well understood. It is not clear, for instance, whether existing terrorist groups might be able to develop the capability to conduct this type of attack. It is likely, however, that some nation-states either have or are working on developing the ability to take down the U.S. grid. In the event of a war with one of these states, it is possible, if not likely, that parts of the civilian grid would cease to function, taking with them military bases located in affected regions. Government and private organizations are currently working to secure the grid against attacks; however, it is not clear that they will be successful. Most military bases currently have backup power that allows them to function for a period of hours or, at most, a few days on their own. If power were not restored after this amount of time, the results could be disastrous. First, military assets taken offline by the crisis would not be available to help with disaster relief. Second, during an extended blackout, global military operations could be seriously compromised; this disruption would be particularly serious if the blackout was induced during major combat operations. During the Cold War, this type of event was far less likely because the United States and Soviet Union shared the common understanding that blinding an opponent with a grid blackout could escalate to nuclear war. America’s current opponents, however, may not share this fear or be deterred by this possibility. In 2008, the Defense Science Board stressed that DOD should mitigate the electrical grid’s vulnerabilities by turning military installations into “islands” of energy self-sufficiency.10 The department has made efforts to do so by promoting efficiency programs that lower power consumption on bases and by constructing renewable power generation facilities on selected bases. Unfortunately, these programs will not come close to reaching the goal of islanding the vast majority of bases. Even with massive investment in efficiency and renewables, most bases would not be able to function for more than a few days after the civilian grid went offline. Unlike other alternative sources of energy, small reactors have the potential to solve DOD’s vulnerability to grid outages. Most bases have relatively light power demands when compared to civilian towns or cities. Small reactors could easily support bases’ power demands separate from the civilian grid during crises. In some cases, the reactors could be designed to produce enough power not only to supply the base, but also to provide critical services in surrounding towns during long-term outages. Strategically, islanding bases with small reactors has another benefit. One of the main reasons an enemy might be willing to risk reprisals by taking down the U.S. grid during a period of military hostilities would be to affect ongoing military operations. Without the lifeline of intelligence, communication, and logistics provided by U.S. domestic bases, American military operations would be compromised in almost any conceivable contingency. Making bases more resilient to civilian power outages would reduce the incentive for an opponent to attack the grid. An opponent might still attempt to take down the grid for the sake of disrupting civilian systems, but the powerful incentive to do so in order to win an ongoing battle or war would be greatly reduced.

#### The US will lashout with nuclear weapons in response to a military cyber attack

Lawson, Professor of Communication at Utah, 09

(Cross-Domain Response to Cyber Attacks and the Threat of Conflict, 5/13, http://www.seanlawson.net/?p=477)

At a time when it seems impossible to avoid the seemingly growing hysteria over the threat of cyber war,[1] network security expert Marcus Ranum delivered a refreshing talk recently, “The Problem with Cyber War,” that took a critical look at a number of the assumptions underlying contemporary cybersecurity discourse in the United States. He addressed one issue in partiuclar that I would like to riff on here, the issue of conflict escalation–i.e. the possibility that offensive use of cyber attacks could escalate to the use of physical force. As I will show, his concerns are entirely legitimate as current U.S. military cyber doctrine assumes the possibility of what I call “cross-domain responses” to cyberattacks. Backing Your Adversary (Mentally) into a Corner Based on the premise that completely blinding a potential adversary is a good indicator to that adversary that an attack is iminent, Ranum has argued that “The best thing that you could possibly do if you want to start World War III is launch a cyber attack. [...] When people talk about cyber war like it’s a practical thing, what they’re really doing is messing with the OK button for starting World War III. We need to get them to sit the f-k down and shut the f-k up.” [2] He is making a point similar to one that I have made in the past: Taking away an adversary’s ability to make rational decisions could backfire. [3] For example, Gregory Witol cautions that “attacking the decision maker’s ability to perform rational calculations may cause more problems than it hopes to resolve.. Removing the capacity for rational action may result in completely unforeseen consequences, including longer and bloodier battles than may otherwise have been.” [4] Cross-Domain Response So, from a theoretical standpoint, I think his concerns are well founded. But the current state of U.S. policy may be cause for even greater concern. It’s not just worrisome that a hypothetical blinding attack via cyberspace could send a signal of imminent attack and therefore trigger an irrational response from the adversary. What is also cause for concern is that current U.S. policy indicates that “kinetic attacks” (i.e. physical use of force) are seen as potentially legitimate responses to cyber attacks. Most worrisome is that current U.S. policy implies that a nuclear response is possible, something that policy makers have not denied in recent press reports. The reason, in part, is that the U.S. defense community has increasingly come to see cyberspace as a “domain of warfare” equivalent to air, land, sea, and space. The definition of cyberspace as its own domain of warfare helps in its own right to blur the online/offline, physical-space/cyberspace boundary. But thinking logically about the potential consequences of this framing leads to some disconcerting conclusions. If cyberspace is a domain of warfare, then it becomes possible to define “cyber attacks” (whatever those may be said to entail) as acts of war. But what happens if the U.S. is attacked in any of the other domains? It retaliates. But it usually does not respond only within the domain in which it was attacked. Rather, responses are typically “cross-domain responses”–i.e. a massive bombing on U.S. soil or vital U.S. interests abroad (e.g. think 9/11 or Pearl Harbor) might lead to air strikes against the attacker. Even more likely given a U.S. military “way of warfare” that emphasizes multidimensional, “joint” operations is a massive conventional (i.e. non-nuclear) response against the attacker in all domains (air, land, sea, space), simultaneously. The possibility of “kinetic action” in response to cyber attack, or as part of offensive U.S. cyber operations, is part of the current (2006) National Military Strategy for Cyberspace Operations [5]: (U) Kinetic Actions. DOD will conduct kinetic missions to preserve freedom of action and strategic advantage in cyberspace. Kinetic actions can be either offensive or defensive and used in conjunction with other mission areas to achieve optimal military effects. Of course, the possibility that a cyber attack on the U.S. could lead to a U.S. nuclear reply constitutes possibly the ultimate in “cross-domain response.” And while this may seem far fetched, it has not been ruled out by U.S. defense policy makers and is, in fact, implied in current U.S. defense policy documents. From the National Military Strategy of the United States (2004): “The term WMD/E relates to a broad range of adversary capabilities that pose potentially devastating impacts. WMD/E includes chemical, biological, radiological, nuclear, and enhanced high explosive weapons as well as other, more asymmetrical ‘weapons’. They may rely more on disruptive impact than destructive kinetic effects. For example, cyber attacks on US commercial information systems or attacks against transportation networks may have a greater economic or psychological effect than a relatively small release of a lethal agent.” [6] The authors of a 2009 National Academies of Science report on cyberwarfare respond to this by saying, “Coupled with the declaratory policy on nuclear weapons described earlier, this statement implies that the United States will regard certain kinds of cyberattacks against the United States as being in the same category as nuclear, biological, and chemical weapons, and thus that a nuclear response to certain kinds of cyberattacks (namely, cyberattacks with devastating impacts) may be possible. It also sets a relevant scale–a cyberattack that has an impact larger than that associated with a relatively small release of a lethal agent is regarded with the same or greater seriousness.” [7]

#### Grid disruptions undermine strategic deterrence missions which rely on continuous uninterrupted power to DOD locations in the US

Defense Science Board, The DSB is a Federal Advisory Committee established to provide independent advice to the Secretary of Defense, 08

(More Fight – Less Fuel, http://www.acq.osd.mil/dsb/reports/ADA477619.pdf)

Historically, the mission of DoD installations has been to train combat forces and deploy them when needed. Critical missions at most installations were limited to those needed to execute the deployment of forces. In the event commercial electric power failed, small diesel generators with short-term fuel supplies were adequate to power those activities. Installations with substantial Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) and military strategic deterrence missions have higher mission criticality and greater power requirements. Backup power systems at these installations are larger, but are still based on diesel generators and fuel supplies sized for only short-term commercial outages and seldom properly prioritized to critical loads because those are often not wired separately from non-essential loads. DoD’s approach to providing power to installations is based on assumptions that commercial power is highly reliable, subject to infrequent and short term outages, and backup can meet demands. Unfortunately, DoD’s assumptions about commercial power and other critical infrastructure reliability are no longer valid and DoD must take a more rigorous risk-based approach to assuring adequate power to its critical missions. 5.2 A Confluence of Events Adds to Already Unacceptable Risks Critical missions at DoD installations have expanded significantly in recent years. During Hurricane Katrina, military installations became central to recovery efforts in three key ways: by serving as the base of operations for relief and rescue missions using military assets; as the central command and control hubs to coordinate the work of other deployed national resources; and as a source of skilled personnel to provide rescue, recovery, medical and other emergency services required by survivors. Under DoD’s new homeland defense mission, military installations would serve a similar function in the event of a terrorist attack on the homeland, becoming operational bases in theater. As a result, a much larger portion of the installation becomes a critical mission requiring highly reliable power. This drives a fundamental rethinking of what it means to provide power to these installations. Similarly, C4ISR and strategic deterrence missions have taken on new real-time tactical and strategic criticality. They directly support real-time operations, and must be an uninterrupted, dependable, credible and trusted source of command, control and execution capability. As a result, their power requirements and need for resiliency have also increased. For various reasons, the grid has far less margin today than in earlier years between capacity and demand. The level of spare parts kept in inventory has declined, and spare parts are often co-located with their operational counterparts putting both at risk from a single act. In some cases, industrial capacity to produce critical spares is extremely limited, available only from overseas sources and very slow and difficult to transport due to physical size. In many cases, installations have not distinguished between critical and non-critical loads when configuring backup power systems, leaving critical missions competing with non-essential loads for power. The Task Force finds that separating critical from noncritical loads is an important first step toward improving the resilience of critical missions using existing backup sources in the event of commercial power outage. The confluence of these trends, namely increased critical load demand, decreased resilience of commercial power, inadequacy of backup generators, and lack of transformer spares in sufficient numbers to enable quick repair, create an unacceptably high risk to our national security from a long-term interruption of commercial power. 5.3 Four Sources of Risk for Grid Outages The first risk is from overload. As wires become overloaded, they heat up and sag, making them vulnerable to entanglement with trees and other objects. This happened near Cleveland, Ohio on August 14, 2003. According to the U.S.-Canada Power System Outage Task Force, high demand caused a high-voltage line to come in contact with overgrown trees. The resulting cascade of failures plunged many of the 50 million people in the Northeast U.S. and Canada living in an area covering 9,300 square miles into darkness. It shut down more than 500 generating units at 265 power plants, including 22 nuclear plants. A second risk comes from natural disasters, such as hurricanes, tornadoes, electrical storms or other extreme weather events. The consequences could be very much as described above, but with the added risk of physical damage to the infrastructure. Favorable commentary about the performance of the grid following the August 2003 outage focused on the fact that restoration occurred fairly quickly. Within a few days power was restored virtually everywhere, with much of the area back up within a few hours. This was largely because safety features built into the grid successfully prevented damage to critical equipment such as generators, breakers and transformers. However, the Task Force is concerned that such an extensive outage could be caused by such a commonplace event – a single line contacting a tree. This inevitably raises the next issue below: what the result might have been had there been physical damage to infrastructure, such as from a deliberate attack by knowledgeable adversaries? A third risk comes from sabotage or terrorist activity, whether local, trans-national, or state-sponsored, and including both conventional and nuclear attack. Nuclear attack could take place either directly or through the generation of a high altitude electromagnetic pulse (EMP). The grid is a relatively easy target for a terrorist. It is brittle, increasingly centralized, capacity-strained, and largely unprotected from physical attack, with little stockpiling of critical hardware. Although the system is designed to survive single points of failure, increasing demand on the system and increasing network constraints make multiple points of failure more likely. These are difficult to anticipate and more likely to result in cascading outages and catastrophic outages that cover large areas for long periods of time. Network Single Points of Failure (NSPF) are abundant. High voltage transformers, breakers, and other long-lead time items are particularly critical system elements. They can be easily targeted and destroyed. Grid sections could be taken down for months even if replacement transformers and breakers could be found; or for years if certain components need to be newly manufactured and transported. There are only limited backups located around the country—generally co-located with operating equipment. For some of the largest equipment, there is no domestic supply and only limited overseas production capacity which is fully booked years ahead. For example, 765 kV transformers are manufactured only by one company in Canada. Armed with the right knowledge, a small number of people could shut down electricity over significant areas for an extended period of time, including power to critical DoD missions. The grid is not designed to withstand a coordinated multi-pronged or wide-area attack. The Task Force noted that attacks on the grid are one of the most common and effective tactics of insurgents in Iraq, and are increasingly seen in Afghanistan. In addition to physical attacks on the grid, there is the potential for cyber attacks. U.S. grid control systems are continuously probed electronically, and there have been numerous attempted attacks on the Supervisory Control and Data Acquisition (SCADA) systems that operate the grid. None have yet resulted in major problems in the U.S., but the potential exists for major outages in the same way successful hackers can disrupt computer networks. Further details regarding the potential for deliberate attacks to the grid and their potential consequences are contained in a classified annex to this report. A fourth risk comes from interruptions in supplies to generating plants, which can be caused by natural events, infrastructure failures, attack or even market forces. This occurred in California during 2000 and 2001 when supplies of natural gas were interrupted and forced a reduction in electricity generation. Approximately 20% of U.S. electricity is generated by natural gas and market prices have swung wildly over the past several years. Approximately 52% of U.S. electricity is generated by coal and transportation routes that move coal from mines to generating plants are sometimes remote and lacking in alternatives. Critical rail lines or bridges could be taken out by determined saboteurs. For example, in May 2005, 43 rail cars came off the tracks. The disruption to coal deliveries caused prices to spike, and raised electricity prices by 6% nationally, according to the Bureau of Labor Statistics. The 100 mile length of rail line through Wyoming that carries the output of the Western coal belt to power plants is the most heavily traveled in the nation. So in addition to risks from grid outage, there are risks to the supply chain that enables the grid to work—not least from electricity supply failures themselves, which could disable the pipelines and controls used by other forms of energy, notably oil and gas. 5.4 National Security Implications of Reliability Standards The Task Force noted that in addition to degrading national military and homeland defense capabilities, failure of the grid for any extended period could significantly affect national economic and social stability. Pumps that move natural gas and oil through pipelines rely on electricity, as do refineries, communications systems, water and sewage systems, hospitals, traffic systems, first response systems, border crossing detection systems and major transportation hubs such as airports. Despite the criticality of the grid to the very functioning of the nation, until the EPAct 2005, we relied on industry to establish reliability standards. EPAct 2005 gave the Federal Energy Regulatory Commission (FERC) authority to direct the industry to develop reliability standards and the authority to designate an Electric Reliability Organization (ERO) to develop and propose mandatory reliability standards for all owners, users and operators of the bulk power system. Once such standards are approved by FERC, the ERO and regional entities may enforce the standards, subject to FERC oversight. FERC selected the North American Electric Reliability Counsel (NERC), a voluntary private industry coordinating body, as the ERO in 2006 and, by rulemaking, approved 83 reliability standards proposed by NERC in March 2007. While the regulatory structure created by EPAct 2005 is an improvement, it is not the same as government authority to directly establish and enforce reliability standards. From a commercial utility’s perspective, risk mitigation actions such as hardening facilities and systems and stockpiling critical spare parts incur significant costs that it may not be possible to fully pass on to customers. This lack of proper economic incentives is one reason the grid is not as secure as it could or should be. 5.5 Assessing Risk The Task Force observes that DoD has conducted vulnerability analyses of its installations regarding energy supply disruption but has not developed a risk management strategy to deal with those vulnerabilities. The latter requires understanding of the potential impacts on its operations, identifying options to deal with the vulnerabilities, and selection of those that are most cost effective 5.5.1 Vulnerability Assessments DoD and DoE (Department of Energy) have conducted many vulnerability assessments of critical infrastructure. Taking the next step requires understanding the threats to specific locations, their likelihood of occurring, and their consequences. The vulnerabilities briefed to the Task Force described points and modes of power failure. The Task Force was briefed in depth on points of failure on the grid, at installations in the U.S. and OCONUS, with emphasis on infrastructure that powers some of DoD’s most critical missions. Modes of failure relate to how something failed. A transmission line coming into contact with a grounded object is a failure mode. Equipment failure and information compromise are two key vulnerabilities that represent failure modes not usually discovered until after the fact. Understanding these modes before the fact is an element of risk assessment. Specific vulnerabilities identified are discussed in the classified annex (Appendix G) to this report. 5.5.2 Potential Impacts Assessing risk also requires understanding the consequences of a failure. The events of the August 2003 outage provide insight into the scale of destruction that could be caused by a sophisticated and multi-pronged terrorist attack. It is useful to think of two separate types of consequences. The first is the threat to critical missions hosted on installations, including some defense industrial base facilities. There are a number of installations and industrial locations in the U.S. and OCONUS which host missions that are critical in strategic and tactical terms and must function 24/7. The resilience of these missions is wholly dependent on continued power to the buildings and equipment involved. The size and scope of the critical missions vary greatly among installations. Concern over domestic terrorist attacks, the establishment of the Department of Homeland Security and a new homeland defense mission for DoD has also expanded the critical loads at some installations.

#### The effect on global military operations will be catastrophic

Snider 12

[Annie Snider, Reporter for Environment & Energy Daily, “Pentagon still can't define 'energy security,' much less achieve it,” January 16th 2012, <http://www.eenews.net/public/Greenwire/2012/01/16/1>]

A terrorist attack that caused a long-term grid disruption "could significantly affect our military forces globally -- potentially blinding them, neutering their command and control, degrading their mobility and isolating them from their principal sources of logistics support," Paul Stockton, the Pentagon's assistant secretary for homeland defense, wrote recently in the online journal Homeland Security Affairs. A board of outside experts tasked by the Department of Defense to study the issue found in a 2008 report that there are significant gaps in DOD's ability to prevent and respond to major electrical outages. "Critical national security and homeland defense missions are at an unacceptably high risk of extended outages from failure of the grid," the Defense Science Board concluded. "The grid is fragile, vulnerable, near its capacity limit, and outside of DOD control. In most cases, neither the grid nor on-base backup power provides sufficient reliability to ensure continuity of critical national priority functions and oversight of strategic missions in the face of long-term (several months) outage." And while the Pentagon has joined interagency efforts to beef up grid security, experts say solutions remain elusive. Four years after the Defense Science Board report, DOD has yet to define what "energy security" means at its bases, let alone how to assure it, according to dozens of interviews with military officials, lawmakers, defense energy experts, project developers and utilities. How DOD ultimately answers these questions will not only determine the limits of U.S. defenses; it is also likely to send waves through civilian energy and technology industries.

#### China/Taiwan tensions growing – conflict risks high

Bloomberg 12

(2/26, China-Taiwan Tensions Could Loom Over U.S. ‘Pivot’ to Asia: View, www.bloomberg.com/news/2012-02-27/china-taiwan-tensions-could-loom-over-u-s-pivot-to-asia-view.html)

As China’s economic and military power grows, and Taiwan’s long-term future remains unclear, that debate deserves a wider airing. The tension, and the stakes, will only increase as the Obama administration undertakes its much-trumpeted “pivot” to Asia. Taiwan didn’t surface as a big issue in Chinese Vice President Xi Jinping’s recent visit to Washington. The re- election of Taiwan’s President Ma Ying-jeou, who has downplayed talk of independence and promoted ties with China, has also reduced cross-strait tensions. And the recent U.S. decision to upgrade Taiwan’s F-16s fighter planes rather than sell it newer ones provoked relatively mild heartburn in Beijing. Nonetheless, the status quo that has prevailed since the U.S. recognition of China in 1979 -- a delicate balance that has supported not just China’s growth, but also the development of a vibrant, democratic Taiwan -- is under threat. China’s military edge over Taiwan is growing, as is the influence of its military on policy and the volatility of Chinese nationalist sentiment. Future U.S. sales to Taiwan of advanced weapons necessary to counter China’s advantage may trigger a harsher reaction. (Under the Taiwan Relations Act that Congress passed in 1979, the U.S. is required to “provide Taiwan with arms of a defensive character.”) Meanwhile, as the economic and strategic importance of U.S.-China relations grows, so does the U.S. temptation to advance those ties at Taiwan’s expense.

#### Military power disruption ensures an invasion of Taiwan by creating a window of opportunity for China to strike while US forces are out of commission

Gerson, Research analyst at the Center for Naval Analyses, 09

(Conventional Deterrence in the Second Nuclear Age http://www.carlisle.army.mil/usawc/parameters/Articles/09autumn/gerson.pdf)

Deterrence is once again a topic of discussion and debate among US defense and policy communities. Although the concept has received comparatively little attention since the end of the Cold War, it seems poised to take center stage in America’s national security policy during the coming decades. With two ongoing wars already straining the military, concerns about a recalcitrant and militarized Russia, Iran’s continued uranium enrichment activities, North Korea’s nascent nuclear arsenal, and top-to-bottom military modernization in China, adversary-specific deterrence strategies will likely become a prominent component of national and international security in an increasingly multipolar world. As part of this renewed interest in deterrence, conventional weapons are playing an important role. The “New Triad,” consisting of both nuclear and advanced conventional weapons; proposals for conventionally armed intercontinental ballistic missiles; and, more generally, the concept of Prompt Global Strike all represent a growing belief that advanced conventional capabilities can substitute for some missions previously relegated solely to nuclear weapons. Although there has been considerable debate over these specific initiatives—for example, the effect that putting conventional warheads on ballistic missiles would have on strategic stability—most specialists agree that conventional forces can help reduce the role of nuclear weapons in US security strategy. In fact, in recent years the US military has expanded the concept of “strategic deterrence,” a term that once encompassed only intercontinental nuclear weapons, to incorporate both nuclear and conventional forces, as well as diplomatic, economic, and informational tools.The recent emphasis on substituting conventional for nuclear weapons in selected missions is an important step in developing a credible and robust twenty-first century deterrent, but it does not fully consider the unique logic and strategy of conventional deterrence. The current debate focuses primarily on the use of conventional weapons for “deterrence by punishment,” the threat to impose unacceptable costs, such as the destruction of an adversary’s strategic and high-value targets, in response to unwanted actions. Yet, one of the most important contributions of conventional forces is “deterrence by denial,” the threat to deny an adversary the ability to achieve its military and political objectives through aggression. If some early strategists were accused of “conventionalization” by treating nuclear weapons merely as more powerful and effective tools of war, the current debate regarding conventional contributions to deterrence may be accused of “nuclearization” in that it treats conventional capabilities merely as a substitute for nuclear weapons. This article seeks to expand the current debate about the role and utility of conventional forces in US deterrence strategies by reexamining the traditional logic of conventional deterrence, which focuses on deterrence b y denial, in the context of the modern international security environment. It is primarily concerned with the role of US conventional forces in extended deterrence, defined as the threat of force to protect allies and friends, rather than “central” or “homeland” deterrence. This focus on extended deterrence—and especially on the role of deterrence by denial in extended deterrence—highlights the central importance of protecting territory from attack and invasion. Historically, the desire for control over specific territory has been a frequent motivator of interstate crises and conflict. While interstate conventional wars have significantly declined since the end of the Second World War, the potential for conflict over Taiwan or on the Korean Peninsula, the prospect of future clashes over control of scarce natural resources, and the 2008 war between Georgia and Russia attest to the continued possibility of conflict over specific territory that has important strategic, economic, political, religious, historical, or socio-cultural significance. Consequently, this article examines how US conventional military power can be used to deter conventional aggression against friends and allies by threatening to deny an adversary its best chance of success on the battlefield—a surprise or short-notice attack with little or no engagement with American military forces. The ability to prevent an opponent from presenting the United States with a fait accompli—that is, from striking quickly and achieving victory before substantial US (and perhaps coalition) forces can be deployed to the theater—is a central component of modern conventional deterrence. Conventional Deterrence in US Strategy Broadly defined, deterrence is the threat of force intended to convince a potential aggressor not to undertake a particular action because the costs will be unacceptable or the probability of success extremely low. This threat has always been one of the central strategic principles by which nations attempted to prevent conflict. Even so, the development and rigorous analysis of deterrence as a discrete strategic concept did not occur until the advent of nuclear weapons. Deterrence theory was developed against the backdrop of the Cold War nuclear arms race and focused on the prevention of nuclear conflict. Yet, while the majority of academic research and public debate was concerned with the prevention of nuclear war—the net result was that deterrence became synonymous with nuclear weapons—conventional deterrence, appropriately, assumed an increasingly important role in the development of military strategy during this period. As the Soviet Union began to amass a large and survivable nuclear arsenal that was capable of global reach in the late 1950s and early 1960s, the credibility of the Eisenhower Administration’s policy of “Massive Retaliation,” which threatened an overwhelming nuclear response to virtually any Soviet aggression, was brought into question. Once the Soviet Union developed survivable nuclear capabilities that could reach the US homeland, many defense officials and analysts argued that the threat of Massive Retaliation lacked credibility against anything other than an all-out Soviet nuclear attack. As a result, western military strategy eventually shifted from total reliance on nuclear weapons as a means of deterring both Soviet conventional and nuclear aggression to a strategy of “Flexible Response,” which included conventional and nuclear elements. From the mid-1960s onward, NATO relied on conventional power, backed by the threat of nuclear escalation, to deter any conventional assault on Europe by the numerically superior Warsaw Pact, and relied on nuclear weapons to deter nuclear attacks. By incorporating “direct defense”—the ability to respond to Warsaw Pact aggression, especially conventional aggression, with proportionate (i.e., conventional) force—into NATO strategy, the concept of Flexible Response sought to create a more credible means of deterrence across the entire spectrum of conflict. A potential enemy is more likely to attack neighbors if the regime believes it can accomplish its objectives before US forces respond

#### Global Nuclear Conflict

Hunkovic, Professor American Military University, 09

(Lee J, 2009, “The Chinese-Taiwanese Conflict Possible Futures of a Confrontation between China, Taiwan and the United States of America”, <http://www.lamp-method.org/eCommons/Hunkovic.pdf>)

A war between China, Taiwan and the United States has the potential to escalate into a nuclear conflict and a third world war, therefore, many countries other than the primary actors could be affected by such a conflict, including Japan, both Koreas, Russia, Australia, India and Great Britain, if they were drawn into the war, as well as all other countries in the world that participate in the global economy, in which the United States and China are the two most dominant members. If China were able to successfully annex Taiwan, the possibility exists that they could then plan to attack Japan and begin a policy of aggressive expansionism in East and Southeast Asia, as well as the Pacific and even into India, which could in turn create an international standoff and deployment of military forces to contain the threat. In any case, if China and the United States engage in a full-scale conflict, there are few countries in the world that will not be economically and/or militarily affected by it. However, China, Taiwan and United States are the primary actors in this scenario, whose actions will determine its eventual outcome, therefore, other countries will not be considered in this study.

#### SMRs are competitive with large reactors – will be adopted in developed and developing economies

Solan et al., Public Policy Prof @ Boise State, ’10

[David Solan, Director, Energy Policy Institute (EPI), Associate Director, Center for Advanced Energy Studies (CAES), Assistant Professor, Public Policy and Administration, Boise State, Geoffrey A Black, PhD, Associate Professor, Department Chair, Economics, Boise State, et al. “Economic and Employment Impacts of Small Modular Reactors,” June 2010]

Other advantages of SMRs over conventional nuclear reactor designs include less risk for cost overrun due to the modular construction, increased flexibility to increase generating capacity (add modules) as needed (Ingersoll, 2009), and potential lower overall cost per kW of electricity generation capacity. The modularity of SMRs is of particular relevance when considering investment flexibility in shifting market conditions. SMRs are better suited to match demand growth by incrementally increasing supply (Carelli, et al., 2010). In stable or predictable market conditions where long-­‐term planning is feasible, the modularity of SMRs promotes scalability, while in uncertain market conditions this feature will enhance the adaptability of plant deployment (Carelli et al., 2010, p. 405). Since SMRs are assumed to require much shorter lead times financing is one example than large reactor deployments, these smaller reactors allow investors the flexibility to quickly adapt to changes within the market. Additionally, SMRs can be mass produced, are exportable, and, in some designs, can offer longer-­‐term energy reliability because of infrequent refueling requirements. SMRs are also capable of facilitating improved matching between plant capacity and grid capacity in areas that are not well interconnected to sizable power grids (Carelli, et al., 2010). Some developing country environments present less mature technical infrastructures or smaller electrical grids. These areas would generally not able to accept connection to large, concentrated power stations where one unit could represent a significant fraction of a country’s electricity generation capacity. This can reduce the market potential for large nuclear reactors and fossil fuel plants and, at the same time, reduce electricity availability in some countries. Due to their design approach, SMRs are capable of providing electric power to these areas with small or limited electrical grid infrastructures. Based on the aforementioned attributes, SMRs may be well-­‐suited for the following applications: electricity generation in both developed and developing markets, industrial process heat, desalination, hydrogen production, oil shale recovery, transmission boosting, and district heating (Sanders, 2009). The next sections highlight the applications that have the most potential for large-­‐scale commercialization.

#### Current DOE funding non-uniques the DA but doesn’t solve

Westenhaus, Editor of New Energy & Fuel, ’12

[Brian Westenhaus, Editor of New Energy and Fuel, “A Government Divided Against Itself Is a Mess,” January 27th 2012, http://newenergyandfuel.com/http:/newenergyandfuel/com/2012/01/27/a-government-divided-against-itself-is-a-mess/]

World Nuclear News is reporting that the U.S. Department of Energy (DOE) is to help push forward the manufacture of small modular nuclear reactors. This contrasts with the Nuclear Regulatory Commission’s (NRC) standing record of never approving a new reactor design. The December 2011 “approval” by the NRC of the Westinghouse AP1000 is not a new reactor at all; rather it’s a next generation design of existing technology. Clearly U.S. Federal government is working at cross-purposes. A fine, expensive and consumer and industrial damaging mess is sure to ensue. The DOE has new cost-sharing arrangements with private industry to support design and licensing activities. With considerable astonishment, taxpayers are going to be funding one agency to pay the fees of another. Make that Astounded. The good news, aside from the circumstances is the DOE intends ultimately to fund up to two designs for small modular reactors (SMR) through a cost-shared partnership, which will support first-of-a-kind engineering, design certification and licensing. The draft Funding Opportunity Announcement (FOA) is now out to solicit input from the industry for preparing a full FOA that’s aiming at a reactor deployment date about 2022. The DOE’s FOA seeks applications for two grants, estimated to total $452 million over five years. The funding anticipates paying up to half the cost of developing and deploying perhaps two small modular reactor designs. The tooth gnashing fact is that’s not going to be enough money and it leaves all but the chosen one or two designs at a major disadvantage. This after the Solyndra debacle and others has thoughtful observers realizing that bureaucrats are picking the winners before the competition starts. That is a terrible policy; a huge waste of resources and the best design is sure to be left out when historic experience is considered. It will be a lobbyist’s game any moment now. At issue are small, compact reactors of around 300 MWe and lower in capacity, a third or less of the size of the typical commercial nuclear power plant built so far. These kinds of plants could potentially offer a range of features in terms of safety, construction and siting as well as potential economic benefits. But if only one or two are chosen the circumstances for users will be limited or force excess costs to make a mandated choice instead of an optimal one for the situation. At this size reactors are modular or have a ‘plug and play’ nature, which means they could be made in factories and transported to generation sites. That manufacturing approach over a custom build method offers economies of scale reducing both capital costs and construction times. The small size could make them suitable for small electric grids and markets that cannot support large reactors costs, production or regulatory expense. Bravely, US Energy Secretary Steven Chu described the funding as a “significant step” in designing, manufacturing, and exporting small modular reactors. It takes courage to come out with what is obviously a poorly thought out policy. Yet, the bravery may be driven by the Congress abandoning its responsibility to organize the law in a fashion that resembles common sense. Chu is bright enough and has enough outside the beltway experience to understand and say, “America’s choice is clear – we can either develop the next generation of clean energy technologies, which will help create thousands of new jobs and export opportunities here in America, or we can wait for other countries to take the lead.” Meanwhile – the NRC remains embroiled in a managerial mess. The commissioners and the Chairman are still at odds, and the oversight of the media has disappeared, the Congress along with it. There is no reasonable expectation anything of consequence is going to happen any time soon, and it’s an election year as well. There is a lot at stake if such a plan proceeds. Westinghouse is developing its own 200 MWe SMR, and the information has escaped that Westinghouse’s approved AP1000 nuclear reactor design was supported through a cost-shared agreement with DOE. This information leads one to suspect that Westinghouse may be looking for a quick taxpayer funded catch up. There is a long list of technologies with potential. (See Brian Wang’s page at NextBigFuture.) NuScale Power Inc’s 45 MWe NuScale reactor and Babcock & Wilcox’s 160 MWe mPower should both be eligible, too. The NRC is currently involved in pre-application activities on both designs in anticipation of a design certification application for the NuScale reactor in the first months of 2012, followed by one for the mPower design towards the end of 2013. These one should think, are the leaders. The list of good ideas out there is grand, covering three major technologies. The light water reactors list includes Babcock & Wilcox, NuScale Power Inc., Westinghouse and Holtec’s Inherently Safe Modular Underground Reactor at 140 MWe. The high temperature gas-cooled reactors are coming from AREVA’s Antares, General Atomics model called Gas Turbine Modular Helium Reactor and Pebble Bed Modular Reactor Ltd.’s reactor named conveniently, the Pebble Bed Modular Reactor. The liquid metal cooled and fast reactor list is equally impressive. Here are GE Hitachi’s Nuclear Power Reactor Innovative Small Module, Hyperion Power Generation’s Hyperion Power Module and Toshiba’s – Toshiba 4S for Super Small, Safe and Simple. That’s 10, add in a couple of thorium fueled ones and that would be a dozen. The Feds expect to give one or two 40% of a billion dollars head start. How is that going to work out for the country? Wouldn’t it be better to just completely revamp the NRC? Admittedly the DOE must be under stress from the machinations over at the NRC. And from a government mind, that plan might seem great. For the rest of us it looks like a waste from the start and a market distortion for decades, perhaps centuries to come.