## RD 7

**Contention 1- Grid**

**Domestic DoD bases are vulnerable due to connectivity to the civilian grid–only SMRs solve**

**Robitaille 12**

(George, Department of Army Civilian, United States Army War College, “Small Modular Reactors: The Army’s Secure Source of Energy?” 21-03-2012, Strategy Research Project)

In recent years, **the** U.S Department of Defense (**DoD**) **has identified a security issue at our installations related to the dependence on the civilian electrical grid**. 1 **The DoD depends on a steady source of electricity at military facilities to perform the functions that secure our nation**. The **flow of electricity into military facilities is controlled by a public grid system that is susceptible to being compromised because of the age of the infrastructure, damage from natural disasters and the potential for cyber attacks.** Although most major functions at military installations employ diesel powered generators as temporary backup, **the public grid may not be available to provide electricity when it is needed the most. The U**nited **S**tates **electrical infrastructure system is prone to failures and susceptible to terrorist attacks**. 2 It is critical that the source of electricity for our installations is reliable and secure. In order to ensure that our military facilities possess a secure source of electricity, either the public system of electric generation and distribution is upgraded to increase its reliability as well as reducing its susceptibility to cyber attack or another source of electricity should be pursued. **Although** significant **investments are being made to upgrade the electric grid, the current investment levels are not keeping up with the aging system.** Small modular reactors (SMRs) are nuclear reactors that are about an order of magnitude smaller than traditional commercial reactor used in the United States. SMRs are capable of generating electricity and at the same time, they are not a significant contributor to global warming because of green house gas emissions. The DoD needs to look at small modular nuclear reactors (SMRs) to determine if they can provide a safe and secure source of electricity. Electrical Grid Susceptibility to Disruptions 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.** 3 **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**. 9 **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 U**nited **S**tates **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 U**nited **S**tates 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 U**nited **S**tates, **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 executedthese 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.

**The grid is vulnerable – multiple different threats cause year long blackouts**

**Magnuson 12**

(Stew Magnuson, managing editor of National Defense Magazine, Washington, D.C.-based journalist and the author of The Death of Raymond Yellow Thunder: And Other True Stories from the Nebraska-Pine Ridge Border Towns, the Nebraska Nonfiction Book of the Year for 2009, bronze medal in the regional nonfiction category, September 2012, “Feds Fear Coordinated Physical, Cyber-Attacks on Electrical Grids,” http://www.nationaldefensemagazine.org/archive/2012/september/Pages/FedsFearCoordinatedPhysical,Cyber-AttacksonElectricalGrids.aspx)

Electrical grids in the United States are vulnerable to both cyber-attacks and space weather, federal officials have said. But an assault that combines the skills of a hacker with a physical attack on key parts of a grid’s infrastructure may result in hundreds of millions of U.S. homes and businesses losing electricity. “I am most concerned about coordinated physical and cyber-attacks intended to disable elements of the power grid or deny electricity to specific targets, such as government or business centers, military installations, or other infrastructures,” Gerry Cauley, president and CEO of the North American Electric Reliability Corp., said at a recent Senate hearing. Scott Pugh, of the Department of Homeland Security’s interagency program office, said at an energy conference in April that there are maps — not available for public viewing — that “show you a handful of substations — six or so — [where] you could take out those six substations and black out most of the U.S. east of the Mississippi, if you knew which six [they] were. And in many cases you could do it **with a hunting rifle from a couple hundred yards away**.” There are some 1,500 companies that generate electricity in the United States, and the hodgepodge of federal agencies that oversee them have limited statutory authorities to force them to protect themselves against attacks, the Senate Energy and Natural Resources Committee hearing revealed. “Limitations in federal authority do not fully protect the grid against physical and cyberthreats,” Joseph McClelland, director of the office of reliability at the Federal Energy Regulatory Commission, said. Legislation passed in 2005 gave the agency the authority to impose reliability standards on “bulk,” or large-scale, power systems. That law excludes local distribution facilities, federal installations located inside grids, and major cities such as New York. Hawaii and Alaska also don’t fall under the commission’s jurisdiction. Officials are concerned about two threats: electromagnetic pulses, which come from solar storms or weapons, and cyber-attacks, particularly on “smartgrids,” which it turns out, are not very “smart” when it comes to protecting against hackers. “No single security asset, technique, procedure or standard — even if strictly followed — will protect an entity from all potential cyberthreats,” said Gregory Wilshusen, director of information security issues at the Government Accountability Office. “The cybersecurity threat environment is constantly changing and our defenses must keep up.” However, in the case of smartgrids, utilities continue to employ them without the necessary safeguards, the GAO has found. There is a lack of security features consistently being integrated into smartgrids and the current regulatory environment makes it difficult to ensure that power companies are properly protecting them. Physical attacks against the grid can cause equal or greater destruction than cyber-attacks, McClelland said. An electromagnetic pulse, or EMP event, could seriously degrade or shut down large swaths of the nation. Depending on the attack, **a significant part of the infrastructure could be “out of service for** periods measured in months to **a year or more**,” he said. “The self-reporting requirements, the enforcement provisions under the existing standards are important,” he said. “But at the end of the day, if there’s no enforcement provisions, there’s no teeth behind the provisions.” The National Institute of Standards and Technology has guidelines for utilities to gird themselves from physical and cyber-attacks, but they do not address coordinated attacks, said Wilshusen. NIST “guidelines did not address an important element essential to securing smartgrid systems — the risk of attacks using both cyber and physical means.” Meanwhile, there have been three major studies that looked at the possible effects of a massive solar storm on U.S. electrical grids. They reached different conclusions, Pugh said at the National Defense Industrial Association Environment, Energy Security and Sustainability symposium in New Orleans. Experts are trying to map the grid and figure out what would happen in the event of an attack or solar storm, Pugh said. But there is nothing that requires the 1,500 companies to share proprietary data about their equipment, so coming to firm conclusions is difficult. Transformers — which number about 2,000 nationwide — are a key vulnerability. Strong electrical pulses caused by a weapon or solar storm can irreparably damage them, he said. “If you need a dozen of those tomorrow because somebody attacked the grid, or we had a space weather event that took out a dozen, you might be waiting quite a while,” he said. They weigh about 300 tons, can only be delivered by special rail car, and most are now manufactured overseas.

**Those communication breakdowns go nuclear and decimate military operations**

**Andres 11**

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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 almostentirely 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**.7 **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 blackoutcould 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. **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**.

**Regardless of relative power, military operations solve all conflict.**

**Kagan and O’Hanlon 7**

Frederick Kagan andMichael O’Hanlon, Fred’s a resident scholar at AEI, Michael is a senior fellow in foreign policy at Brookings, “The Case for Larger Ground Forces”, April 24, 2007, <http://www.aei.org/files/2007/04/24/20070424_Kagan20070424.pdf>

We live at a time when **wars not only rage in nearly every region but threaten to erupt in many places where the current relative calm is tenuous**. **To view this as a strategic military challenge for the U**nited **S**tates **is not to espouse a specific theory of America’s role in the world or a certain political philosophy**. Such an assessment flows directly from the basic bipartisan view of American foreign policy makers since World War II that overseas threats must be countered before they can directly threaten this country’s shores, that the basic stability of the international system is essential to American peace and prosperity, and that **no country besides the United States** **is in a position to lead the way in countering major challenges to the global order**. **Let us highlight the threats and their consequences with a few concrete examples, emphasizing** those that involve key strategic regions of the world such as **the Persian Gulf and East Asia, or** key potential threats to American security, such as **the** spread of nuclear weapons **and the strengthening of the global Al Qaeda/jihadist movement**. **The Iranian government has rejected a series of international demands to halt its efforts at enriching uranium and submit to international inspections**. **What will happen if the US—or Israeli—government becomes convinced that Tehran is on the verge of fielding a nuclear weapon? North Korea, of course, has already done so, and the ripple effects are beginning to spread**. **Japan’s** recent **election** to supreme power **of a leader who has promised** to rewrite that country’s constitution **to support increased armed forces—and**, possibly, **even nuclear weapons**— **may** well **alter the delicate balance of fear in Northeast Asia fundamentally and rapidly**. Also, in the background, at least for now, **SinoTaiwanese tensions continue to flare, as do tensions between India and Pakistan, Pakistan and Afghanistan, Venezuela and the U**nited **S**tates, and so on. Meanwhile, **the world’s nonintervention in Darfur** troubles consciences from Europe to America’s Bible Belt to its bastions of liberalism, yet with no serious international forces on offer, the bloodletting **will probably, tragically, continue unabated**. And as bad as things are in Iraq today, they could get worse. What would happen if the key Shiite figure, Ali al Sistani, were to die? If another major attack on the scale of the Golden Mosque bombing hit either side (or, perhaps, both sides at the same time)? Such deterioration might convince many Americans that the war there truly was lost—but the costs of reaching such a conclusion would be enormous. Afghanistan is somewhat more stable for the moment, although a major Taliban offensive appears to be in the offing. Sound US grand strategy must proceed from the recognition that, **over the next few years and decades, the world is going to be a very unsettled and quite dangerous place**, with Al Qaeda and its associated groups as a subset of a much larger set of worries. **The only serious response to this international environment is to develop armed forces capable of protecting America’s vital interests throughout this dangerous time. Doing so requires a military capable of a wide range of missions—including not only deterrence of great power conflict in dealing with potential hotspots in Korea, the Taiwan Strait, and the Persian Gulf but also associated with a variety of Special Forces activities and stabilization operations**. For today’s US military, which already excels at high technology and is increasingly focused on re-learning the lost art of counterinsurgency, this is first and foremost a question of finding the resources to field a large-enough standing Army and Marine Corps to handle personnel intensive missions such as the ones now under way in Iraq and Afghanistan.

**And it makes the military ineffective–collapses hegemony.**

**CNA 9**

Center for Naval Analyses Military Adviser Board, Chaired by General Charles Wald, USAF (Ret.) Former Deputy Commander, Headquarters U.S. European Command (USEUCOM), May 2009, Powering America’s Defense: Energy and the Risks to National Security, https://www.cna.org/sites/default/files/Powering%20Americas%20Defense.pdf

Our **vulnerabilities from energy use** are not limited to battlefields and forward operating bases; they also **exist at home. The biggest impacts** may be local, but can **extend to locations and operations around the world.** In August 2003, 50 million people living in the Northeast, Midwest, and Ontario were suddenly left in the dark when their electric power failed. More than 500 generating units at 265 power plants shut down—a quiet collapse cascading across the landscape. Most homes and businesses regained power within a day (though some plants took two weeks to regain full capacity), a quick restoration that was possible primarily because no significant equipment was damaged. Still, critical national security systems failed. U.S. border check systems were not fully operational, causing a severe backup of truck traffic on our northern boundary. There were related effects from the outage as well. Water and sewage plants shut down. Gas stations stopped working, and rail service was curtailed. Many cellular phone providers, radio stations, and television stations lost service—their backup power systems were insufficient. The blackout is estimated to have caused economic losses of $7 to $10 billion [55]. The trigger for this massive blackout was tragically simple: An Ohio utility had failed to properly trim trees near a power line. American utilities have experience responding to interruptions caused by extreme weather. Even after severe ice storms and hurricanes, power is most often restored within a few days. But the effects of a long-term power outage are unknown. Our ability to recover from a dedicated attack is also not known—except to say that a deliberate attack would require a different response. There have been numerous attacks on the operating systems of major critical infrastructure facilities, including power grids, around the world in recent years: • In one instance outside the U.S., a power outage was triggered that affected multiple cities; in other instances, hackers have extorted hundreds of millions of dollars out of their victims [57, 58]. • Foreign cyber spies are also a serious concern: U.S. Homeland Security and Intelligence officials revealed that Chinese and Russian spies have “penetrated the U.S. electrical grid” and left behind dormant but malicious software [59]. • In 2007, the discovery of what is now known as the “Aurora threat” revealed the possibility that sophisticated hackers could seriously dam age the grid by destroying mechanisms downstream from the initial point of attack. Aurora involves opening and quickly closing a high voltage circuit breaker, which can result in an out-of-synchronism condition that can physically damage rotating equipment connected to the power grid [60-63]. At military installations across the country, a myriad of **critical systems** **must be operational 24 hours a day**, 365 days a year. They receive and analyze data to keep us safe from threats, they provide direction and support to combat troops, and stay ready to provide relief and recovery services when natural disasters strike or when someone attempts to attack our homeland. These installations are almost completely dependent on commercial electrical power delivered through the national electrical grid. When the DSB studied the 2003 blackout and the condition of the grid, they concluded it is “fragile and vulnerable... placing critical military and homeland defense missions at unacceptable risk of extended outage”. As the resiliency of the grid continues to decline, it increases the potential for an expanded and/ or longer duration outage from natural events as well as deliberate attack. The DSB noted that the military’s backup power is inadequately sized for its missions and military bases cannot easily store sufficient fuel supplies to cope with a lengthy or widespread outage. An extended **outage could jeopardize ongoing missions in far-flung battle spaces** for a variety of reasons: • The American military’s logistics chains operate a just-in-time delivery system familiar to many global businesses. If an aircraft breaks down in Iraq, parts may be immediately shipped from a supply depot in the U.S. If the depot loses power, personnel there may not fill the order for days, increasing the risk to the troops in harm’s way. • Data collected in combat zones are often analyzed at data centers in the U.S. In many cases, the information helps battlefield commanders plan their next moves. If the data centers lose power, the next military move can be delayed, or taken without essential information. • The loss of electrical power affects refineries, ports, repair depots, and other commercial or military centers that help assure the readiness of American armed forces. When power is lost for lengthy periods, vulnerability to attack increases. President Obama, Congress, and major utilities, among others, are discussing an upgrade of the national electrical grid for a variety of reasons. We add our voice to this discussion with a singular perspective: we see that our **national security is directly linked to the security and reliability of our system of energy production and delivery.**

**Hegemonic decline causes nuclear war**

**Barnett ‘11**

Thomas, American military geostrategist and Chief Analyst at Wikistrat, “The New Rules: Leadership Fatigue Puts U.S., and Globalization, at Crossroads,” <http://www.worldpoliticsreview.com/articles/8099/the-new-rules-leadership-fatigue-puts-u-s-and-globalization-at-crossroads>, AM

Let me be more blunt: As the guardian of globalization, **the U.S. military has been the greatest force for peace the world has ever known**. Had America been removed from the global dynamics that governed the 20th century, the mass murder never would have ended. Indeed**, it's entirely conceivable** **there would** now **be no** identifiable **human civilization left**, **once nuclear weapons entered the** killing **equation**. But the world did not keep sliding down that path of perpetual war. Instead, America stepped up and changed everything by ushering in our now-**perpetual great-power peace**. **We introduced the** international **liberal trade** **order** known as globalization **and played loyal Leviathan over its spread**. **What resulted was the collapse of empires, an explosion of democracy, the persistent spread of human rights, the liberation of women, the doubling of life expectancy, a roughly 10-fold increase in adjusted global GDP and a profound and persistent reduction in battle deaths from state-based conflicts.** That is what American "hubris" actually delivered.

**DoD procurement of SMR’s solves security and islands military bases.**

**Loudermilk 11**

Micah J. Loudermilk, Research Associate for the Energy & Environmental Security Policy program with the Institute for National Strategic Studies at National Defense University, 5/31/11, Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs, [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](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)

Path forward: Department of Defense as first-mover 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 U**nited **S**tates. **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**.

**Contention 2- Russia**

**A strong SMR industry is key to displacing Russian SMR exports—rapid commercialization key**

Charles D. **Ferguson**, President, Federation of American Scientists, 5/19/20**10**, http://www.fas.org/press/\_docs/05192010\_Testimony\_HouseScienceCommHearing%20.pdf

**The U**nited **S**tates **and** several **other countries have considerable experience in** building and operating **small** and medium **power reactors**. **The** U.S. **Navy**, for example, has **used small power reactors since the 1950s** to provide propulsion and electrical power for submarines, aircraft carriers, and some other surface warships. China, France, Russia, and the United Kingdom have also developed nuclear powered naval vessels that use small reactors. Notably, **Russia has** deployed its KLT-40S and similarly **designed small power reactors on icebreakers and** has in recent years proposed building and selling barges that **would carry these types of reactors for use in sea-side communities throughout the world**. China has already exported small and medium power reactors. In 1991, China began building a reactor in Pakistan and started constructing a second reactor there in 2005. In the wake of the U.S.-India nuclear deal, Beijing has recently reached agreement with Islamabad to build two additional reactors rated at 650 MWe.2 One of the unintended consequences of more than 30 years of sanctions on India’s nuclear program is that India had concentrated its domestic nuclear industry on building small and medium power reactors based on Canadian pressurized heavy water technology, or Candu-type reactors. Pressurized heavy water reactors (PHWRs) pose proliferation concerns because they can be readily operated in a mode optimal for producing weapons-grade plutonium and can be refueled during power operations. Online refueling makes it exceedingly difficult to determine when refueling is occurring based solely on outside observations, for example, through satellite monitoring of the plant’s operations. Thus, the chances for potential diversion of fissile material increase. This scenario for misuse underscores the need for more frequent inspections of these facilities. But the limited resources of the International Atomic Energy Agency have resulted in a rate of inspections that are too infrequent to detect a diversion of a weapon’s worth of material.3 The opening of the international nuclear market to India may lead to further spread of PHWR technologies to more states. For example, last year, the Nuclear Power Corporation of India, Ltd. (NPCIL) expressed interest in selling PHWRs to Malaysia.4 NPCIL is the only global manufacturer of 220 MWe PHWRs. New Delhi favors Southto-South cooperation; consequently developing states in Southeast Asia, sub-Saharan Africa, and **South America could become recipients of these technologies** in the coming years to next few decades.5 Many of these **countries** would **opt for small** and medium **power reactors because their electrical grids do not** presently **have the capacity to support large power reactors and they would likely not have the financial ability to purchase large reactors**. What are the implications for the United States of Chinese and Indian efforts to sell small and medium power reactors? Because China and India already have the manufacturing and marketing capability for these reactors, the United States faces an economically competitive disadvantage. **Because the U**nited **S**tates **has yet to license such reactors** for domestic use, **it has placed itself at a**n additional **market disadvantage**. **By the time the U**nited **S**tates **has licensed** such **reactors**, China and India as well as other **competitors may have established a strong hold on this emerging market.** The U.S. Nuclear Regulatory Commission cautioned on December 15, 2008 that the “licensing of new, small modular reactors is not just around the corner. The NRC’s attention and resources now are focused on the large-scale reactors being proposed to serve millions of Americans, rather than smaller devices with both limited power production and possible industrial process applications.” The NRC’s statement further underscored that “examining proposals for radically different technology will likely require an exhaustive review” ... before “such time as there is a formal proposal, the NRC will, as directed by Congress, continue to devote the majority of its resources to addressing the current technology base.”6 Earlier this year, the NRC devoted consideration to presentations on small modular reactors from the Nuclear Energy Institute, the Department of Energy, and the Rural Electric Cooperative Association among other stakeholders.7 At least seven vendors have proposed that their designs receive attention from the NRC.8 **Given the differences in design philosophy among** these **vendors** **and the fact that none of these designs have penetrated the commercial market, it is too soon to tell which**, if any, **will emerge as market champions**. Nonetheless, because of the early stage in development, the United States has an opportunity to state clearly the criteria for successful use of SMRs. But because of the head start of China and India, **the U**nited **S**tates **should not procrastinate and should take a leadership role** in setting the standards for safe, secure, and proliferation-resistant SMRs that can compete in the market. Several years ago, the United States sponsored assessments to determine these criteria.9 While the Platonic ideal for small modular reactors will likely not be realized, it is worth specifying what such an SMR would be. N. W. Brown and J. A. Hasberger of the Lawrence Livermore National Laboratory assessed that reactors in developing countries must: • “achieve reliably safe operation with a minimum of maintenance and supporting infrastructure; • offer economic competitiveness with alternative energy sources available to the candidate sites; • demonstrate significant improvements in proliferation resistance relative to existing reactor systems.”10 **Pointing to the available technologies** at that time **from** Argentina, China, and **Russia, they determined that “these countries tend to focus on the development of the reactor without integrated considerations of the** overall **fuel cycle**, proliferation, **or waste issues**.” They emphasized that **what is required for successful development of an SMR is “a comprehensive systems approach** that considers all aspects of manufacturing, transportation, operation, and ultimate disposal.”

**US nuclear energy market control of Latin America key to prevent Latin America instability and Russian regional dominance**

Steve **Dobransky**, Cleveland State University International Relations Adjunct Professor, March 20**11**, The Nuclear Penetration of the Monroe Doctrine, http://www.airpower.au.af.mil/apjinternational/apj-s/2011/2011-1/2011\_1\_02\_dobransky\_eng\_s.pdf

Finally, the U.S. can just go all-out and compete with the Russians and others in the nuclear energy field throughout Latin America and the rest of the world. **The U.S. can use** all of **its** **powers**, influences, and **position to run the nuclear energy gauntlet in Latin America.** If this option is pursued, the U.S. could make billions of dollars. And, **it may transform the Latin American countries into** much **more compliant and friendly states**, by **engendering a tremendous amount of influence and goodwill throughout the region**; though, on the other hand**, it may make them** a lot more **independent of** the U.S. and **outside energy sources** and supply lines. In the long term, **it may even help prevent a major economic collapse of Latin American countries** **due to future major shortages and extreme costs of energy resources**, primarily oil**. This could save the U.S.** much **money, influence, and hardship by not having the negative impact of collapsing and unstable Latin American countries**, as well as **allowing the U.S. to avoid the pressures to intervene to protect American interests and citizens**. In the end, **if the U.S. does not** fundamentally **reassess its** current **nuclear energy policies** particularly towards Latin America, then **Russia may** very well **supplant the U.S. as the most influential power in Latin America and throughout the world**. **The Monroe Doctrine**, subsequently, **will go from penetrated to destroyed**. **Energy security will be the supreme power** and goal in the world in the coming decades. **The Russians are going full speed ahead in promoting energy as a foreign policy instrument** that has the potential to reap billions of dollars and tremendous diplomatic influence. **Will the U.S. alter course and react accordingly**, especially **in its own “backyard”? The U.S. needs to fully consider all the consequences of maintaining the status quo.** **Nuclear exports hold the promise of greater political, economic, and security influence**. On the other hand, **lost nuclear energy opportunities will mean significant reductions in power**, money, **and position**. **It is ultimately up to the U.S. to determine whether to meet the Russian challenge in the nuclear energy arena or to throw up the flag and go out with a whimper**. **The U.S. can compete full-scale** with the Russians and others in the nuclear energy field, stand by on the sidelines and try to minimize the nuclear expansion in Latin America, or go all-out to quarantine the region in some form or another. **The U.S. must soon determine its policy stance** and clearly define and update the Monroe Doctrine. But, **if** complete **inaction is the final choice, then there is no need to worry. The Russians will be sure to turn off the lights when the U.S. is gone—and, turn on its nuclear energy plants in Latin America**. **Thus will go the nuclear chess board and Russia’s ascendance**. And, thus, will go the Monroe Doctrine.

**US leadership in Latin America necessary to contain escalatory instability and make international institutions effective**

Christopher **Sabatini**, editor-in-chief of Americas Quarterly and senior director of policy at Americas Society/Council of the Americas, **and** Ryan **Berger**, policy associate at the Americas Society/Council of the Americas, 6/13/**2012**, Why the U.S. can't afford to ignore Latin America, globalpublicsquare.blogs.cnn.com/2012/06/13/why-the-u-s-cant-afford-to-ignore-latin-america/

Speaking in Santiago, Chile, in March of last year, President Obama called **Latin America** “a region on the move,” one that **is “more important to the prosperity and security of the U**nited **S**tates **than ever before**.” Somebody forgot to tell the Washington brain trust. The Center for a New American Security, a respected national security think tank a half-mile from the White House, recently released a new series of policy recommendations for the next presidential administration. The 70-page “grand strategy” report only contained a short paragraph on Brazil and made only one passing reference to Latin America. Yes, we get it. The relative calm south of the United States seems to pale in comparison to other developments in the world: China on a seemingly inevitable path to becoming a global economic powerhouse, the potential of political change in the Middle East, the feared dismemberment of the eurozone, and rogue states like Iran and North Korea flaunting international norms and regional stability. But the need to shore up our allies and recognize legitimate threats south of the Rio Grande goes to the heart of the U.S.’ changing role in the world and its strategic interests within it. Here are three reasons why the U.S. must include Latin America in its strategic calculations: 1. Today, **pursuing a global foreign policy requires regional allies**. Recently, **countries with emerging economies** have **appeared to be taking positions diametrically opposed to the U.S. when it comes to matters of global governance** and human rights. Take, for example, Russia and China’s stance on Syria, rejecting calls for intervention. Another one of the BRICS, **Brazil, tried to stave off the tightening of U.N. sanctions on Iran** two years ago. And last year, Brazil also voiced its official opposition to intervention in Libya, leading political scientist Randall Schweller to refer to Brazil as “a rising spoiler.” **At a time of (perceived) declining U.S. influence, it’s important that America deepens its ties with regional allies that might have been once taken for granted. As emerging nations** such as Brazil **clamor for permanent seats on the** U.N. **Security Council and more representatives** **in the higher reaches of the World Bank and** the **I**nternational **M**onetary **F**und, **the U.S. will need to integrate them into global decision-making rather than isolate them.** **If not, they could be a thorn in the side of the U.S. as it tries to implement its foreign policy agenda**. Worse, **they could threaten to undermine efforts to defend international norms and human rights.** 2. Latin America is becoming more international. It’s time to understand that **the U.S. isn’t the only country that has clout in Latin America**. For far too long, U.**S. officials and Latin America experts have tended to treat the region as separate,** politically and strategically, **from the rest of the world**. But as they’ve fought battles over small countries such as Cuba and Honduras and narrow bore issues such as the U.S.-Colombia free-trade agreement, other countries like China and India have increased their economic presence and political influence in the region. It’s also clear that **countries** such as Brazil and Venezuela **present** their own **challenges to U.S. influence in the region and** even on the **world forum**. **The U.S. must embed** its **Latin America** relations in the conceptual framework and strategy that it has for the rest of the world, rather than just focus on human rights and development as it often does toward southern neighbors such as Cuba. 3. **There are security and strategic risks** in the region. Hugo Chavez’s systematic deconstruction of the **Venezuelan** state and alleged **ties between** **FARC** rebels and some of Chavez’s senior officials have **created a volatile cocktail that could explode south of the U.S. border**. FARC, a left-wing guerrilla group based in Colombia, has been designated as a “significant foreign narcotics trafficker” by the U.S. government. At the same time, gangs, **narcotics traffickers and transnational criminal syndicates are overrunning Central America**. In 2006, Mexican President Felipe Calderón launched a controversial “war on drugs” that has since resulted in the loss of over 50,000 lives and increased the levels of violence and corruption south of the Mexican border in Guatemala, El Salvador, Honduras and even once-peaceful Costa Rica. Increasingly, these **already-weak states are finding themselves overwhelmed by the corruption and violence** that has come with the use of their territory as a transit point for drugs heading north. Given their proximity and close historical and political connections with Washington, **the U.S. will find it increasingly difficult not to be drawn in**. Only this case, it won’t be with or against governments — as it was in the 1980s — but **in the far more complex, sticky situation of failed states.** There are many other reasons why Latin America is important to U.S. interests. It is a market for more than 20% of U.S. exports. With the notable exception of Cuba, it is nearly entirely governed by democratically elected governments — a point that gets repeated ad nauseum at every possible regional meeting. The Western Hemisphere is a major source of energy that has the highest potential to seriously reduce dependence on Middle East supply. And through immigration, Latin America has close personal and cultural ties to the United States. These have been boilerplate talking points since the early 1990s. But **the demands of the globe** today are different, and they **warrant a renewed engagement with Latin America — a strategic pivot point for initiatives the U.S. wants to accomplish elsewhere**. We need to stop thinking of Latin America as the U.S. “backyard” that is outside broader, global strategic concerns.

**Escalating instability in Latin America causes global war**

**Rochlin ’94** (James Francis, Prof. Pol. Sci. @ Okanagan University College, “Discovering the Americas: the evolution of Canadian foreign policy towards Latin America”, p. 130-131)

While there were economic motivations for Canadian policy in Central America, security considerations were perhaps more important. Canada possessed an interest in promoting stability in the face of a potential decline of U.S. hegemony in the Americas. **Perceptions of declining U.S. influence in** the region – which had some credibility in 1979-1984 due to the wildly inequitable divisions of wealth in some U.S. client states in **Latin America**, in addition to political repression, under-development, mounting external debt, anti-American sentiment produced by decades of subjugation to U.S. strategic and economic interests, and so on – **were linked to the prospect of** explosive events occurring in the hemisphere. Hence, the Central American imbroglio was viewed as a fuse which could ignite **a cataclysmic process** throughout the region. Analysts at the time worried that in a worst-case scenario, **instability created by a regional war, beginning in Central America and spreading elsewhere** in Latin America, **might preoccupy Washington to the extent that the United States would be unable to perform adequately its important hegemonic role** in the international arena – a concern expressed by the director of research for Canada’s Standing Committee Report on Central America. It was feared that **such a predicament could generate increased global instability and** perhaps even **a hegemonic war**. This is one of the motivations which led Canada to become involved in efforts at regional conflict resolution, such as Contadora, as will be discussed in the next chapter.

**Effective international institutions solve extinction**

Gwynne **Dyer**, Ph.D. in Military History from University of London, 12/30/200**4**, The end of war, Toronto Star, Lexis

War is deeply embedded in our history and our culture, probably since before we were even fully human, but weaning ourselves away from it should not be a bigger mountain to climb than some of the other changes we have already made in the way we live, given the right incentives. And we have certainly been given the right incentives: The holiday from history that we have enjoyed since the early '90s may be drawing to an end, and **another great-power war**, fought next time with **nuclear weapons**, may be lurking in our future.. The "firebreak" against nuclear weapons use that we began building after Hiroshima and Nagasaki has held for well over half a century now. But the proliferation of nuclear weapons to new powers is a major challenge to the stability of the system. So are the **coming crises**, mostly environmental in origin, which will hit some countries much harder than others, and may drive some to desperation. Add in the huge impending shifts in the great-power system as China and India grow to rival the United States in GDP over the next 30 or 40 years and it will be hard to keep things from **spinning out of control**. With good luck and good management, we may be able to ride out the next half-century without the first-magnitude **catastrophe of a global nuclear war**, but the potential certainly exists for a **major die-back** of human population. We cannot command the good luck, but good management is something we can choose to provide. It depends, above all, on preserving and extending the multilateral system that we have been building since the end of World War II. The **rising powers** must be absorbed into a system that emphasizes co-operation and makes room for them, rather than one that deals in confrontation and raw military power. If they are obliged to play the traditional great-power game of winners and losers, then history will repeat itself and everybody loses. Our hopes for mitigating the severity of the coming environmental crises also depend on early and concerted global action of a sort that can only happen in a basically co-operative international system. When the great powers are locked into a military confrontation, there is simply not enough spare attention, let alone enough trust, to make deals on those issues, so the **highest priority** at the moment is to **keep the multilateral approach alive and avoid a drift back into alliance systems and arms races.** And there is no point in dreaming that we can leap straight into some never-land of universal brotherhood; we will have to confront these challenges and solve the problem of war within the context of the existing state system.

**Russia control of Latin America causes US-Russia conflict**

Peter **Zeihan**, Stratfor, 9/18/200**8**, The Russian Resurgence and the New-Old Front, www.stratfor.com/weekly/20080915\_russian\_resurgence\_and\_new\_old\_front

**Russia is attempting to reforge its Cold War-era influence** in its near abroad. **This is not simply an issue of nostalgia**, but a perfectly logical and predictable reaction to the Russian environment. Russia lacks easily definable, easily defendable borders. There is no redoubt to which the Russians can withdraw, and the only security they know comes from establishing buffers -- buffers which tend to be lost in times of crisis. The alternative is for Russia to simply trust other states to leave it alone. Considering Russia's history of occupations, from the Mongol horde to Napoleonic France to Hitler's Germany, it is not difficult to surmise why the Russians tend to choose a more activist set of policies. As such, **the country tends to expand and contract like a beating heart -- gobbling up** nearby **territories** in times of strength, **and** then **contracting** and losing those territories in times of weakness. Rather than what Westerners think of as a traditional nation-state, Russia has always been a multiethnic empire, heavily stocked with non-Russian (and even non-Orthodox) minorities. Keeping those minorities from damaging central control requires a strong internal security and intelligence arm, and hence we get the Cheka, the KGB, and now the FSB. Nature of **the Budding Conflict** **Combine a security policy thoroughly wedded to expansion with an internal stabilization policy that institutionalizes terror, and it is understandable** why most of Russia's neighbors do not like Moscow very much. A fair portion of Western history revolves around the formation and shifting of coalitions to manage Russian insecurities. In the American case specifically, the issue is one of continental control. **The U**nited **S**tates **is the only country in the world that effectively controls an entire continent.** Mexico and Canada have been sufficiently intimidated so that they can operate independently only in a very limited sense. (Technically, Australia controls a continent, but with the some 85 percent of its territory unusable, it is more accurate in geopolitical terms to think of it as a small archipelago with some very long bridges.) **This grants the United States not only a potentially massive internal market**, **but** also the **ability to project power without the fear of facing rearguard security threats**. U.S. forces can be focused almost entirely on offensive operations, whereas potential competitors in Eurasia must constantly be on their guard about the neighbors. The only thing that could threaten U.S. security would be the rise of a Eurasian continental hegemon. For the past 60 years, Russia (or the Soviet Union) has been the only entity that has had a chance of achieving that, largely due to its geographic reach. U.S. strategy for coping with this is simple: containment, or the creation of a network of allies to hedge in Russian political, economic and military expansion. NATO is the most obvious manifestation of this policy imperative, while the Sino-Soviet split is the most dramatic one. Containment requires that United States counter Russian expansionism at every turn, crafting a new coalition wherever Russia attempts to break out of the strategic ring, and if necessary committing direct U.S. forces to the effort. The Korean and Vietnam wars -- both traumatic periods in American history -- were manifestations of this effort, as were the Berlin airlift and the backing of Islamist militants in Afghanistan (who incidentally went on to form al Qaeda). The Georgian war in August was simply the first effort by a resurging Russia to pulse out, expand its security buffer and, ideally, in the Kremlin's plans, break out of the post-Cold War noose that other powers have tied. The Americans (and others) will react as they did during the Cold War: by building coalitions to constrain Russian expansion. In Europe, the challenges will be to keep the Germans on board and to keep NATO cohesive. In the Caucasus, the United States will need to deftly manage its Turkish alliance and find a means of engaging Iran. In China and Japan, economic conflicts will undoubtedly take a backseat to security cooperation. **Russia and the U**nited **S**tates **will struggle in all** of these **areas**, **consisting as they do the Russian borderlands.** Most of the locations will feel familiar, as Russia's near abroad has been Russia's near abroad for nearly 300 years. Those locations -- the Baltics, Austria, Ukraine, Serbia, Turkey, Central Asia and Mongolia -- that defined Russia's conflicts in times gone by will surface again. Such is the tapestry of history: the major powers seeking advantage in the same places over and over again. The New Old-Front **But not all of those fronts are in Eurasia**. **So long as U.S. power projection puts the Russians on the defensive, it is only a matter of time before** something along the cordon cracks and the Russians are either fighting a land war or facing a local insurrection. Russia must keep U.S. efforts dispersed and captured by events as far away from the Russian periphery as possible -- preferably where Russian strengths can exploit American weakness. So where is that? Geography dictates that U.S. strength involves coalition building based on mutual interest and long-range force projection, and internal U.S. harmony is such that America's intelligence and security agencies have no need to shine. Unlike Russia, the United States does not have large, unruly, resentful, conquered populations to keep in line. In contrast, recall that the multiethnic nature of the Russian state requires a powerful security and intelligence apparatus. No place better reflects Russia's intelligence strengths and America's intelligence weakness than Latin America. **The U**nited **S**tates **faces no traditional security threats in its backyard**. South America is in essence a hollow continent, populated only on the edges and thus lacking a deep enough hinterland to ever coalesce into a single hegemonic power. Central America and southern Mexico are similarly fractured, primarily due to rugged terrain. Northern Mexico (like Canada) is too economically dependent upon the United States to seriously consider anything more vibrant than ideological hostility toward Washington. Faced with this kind of local competition, **the U**nited **S**tates **simply does not worry too much about the rest of the Western Hemisphere -- except when someone comes to visit**. **Stretching back to the** time of the **Monroe Doctrine, Washington's Latin American policy has been very simple**. **The U**nited **S**tates does not feel threatened by any local power, but it **feels inordinately threatened by any Eastern Hemispheric power that could ally with a local entity**. **Latin America**n entities cannot greatly harm American interests themselves, but they **can be used as fulcrums by hostile states further abroad to strike at the core of the U**nited **S**tates' **power**: **its undisputed command of North America.** It is a fairly straightforward exercise to predict where Russian activity will reach its deepest. **One only needs to revisit Cold War history**. Future Russian efforts can be broken down into three broad categories: naval interdiction, drug facilitation and direct territorial challenge.

**Extinction**

**Corcoran 9**

(PhD, Senior Fellow @ Global Security, Frmr. Strategic Analyst at the US Army War College where he chaired studies for the Office of the Deputy Chief of Operations and member of the National Advisory Board for the Alsos Digital Library for Nuclear Issues, we win the qualification game, 4/21, http://sitrep.globalsecurity.org/articles/090421301-strategic-nuclear-targets.htm)

That brings us to Russia, our former main adversary, now a competitive partner and still a potential future adversary, particularly as relations have gradually soured in recent years. Russia is the only other nation with a formidable arsenal of some three thousand strategic weapons. Our opposing arsenals were built up in the period when Mutually Assured Destruction (MAD) was the underlying strategic concept -- each side deterred from striking the other by the prospect of assured retaliatory destruction. The situation became even madder as both sides worked to develop a capability to destroy the other's strike force with a crippling first strike. This resulted in further large increases in the sizes of the arsenals, as well as early warning systems and hair-trigger launch-on-warning alert procedures. The final result was an overall system in which each side could destroy the other in a matter of minutes. And it also raised another chilling specter, Nuclear Winter, in which the atmospheric dust raised from a major nuclear exchange would block sunlight for an extended period and essentially destroy human civilization globally. The collapse of the Soviet Union collapsed this threat, but did not eliminate it. US and Russian nuclear forces remained frozen in adversarial positions. The May 2002 Moscow Treaty began to address this legacy and is leading to a reduction in strategic nuclear forces down to levels of about two thousand on each side by 2012. These levels are still sufficient to destroy not only both nations but also human civilization. It is hard to even construct scenarios where the use of even a few strategic nuclear weapons does not risk a total escalation. Strikes on Russian warning facilities or strike forces would almost certainly bring a wave of retaliatory strikes. Strikes on hardened command centers would be of questionable effectiveness and also risk total escalation. In addition, successful elimination of Russian leaders could greatly complicate any efforts to stop escalation short of a total nuclear exchange.

**SMRs solve—**

**Plan results in exports and is cost-competitive**

Ken **Silverstein**, Forbes, **1/15**/13, After Fukushima, U.S. Seeks to Advance Small Nuclear Reactors, www.forbes.com/sites/kensilverstein/2013/01/15/after-fukushima-u-s-seeks-to-advance-small-nuclear-reactors/

“Restarting the nation’s nuclear industry and **advancing small modular reactor technologies will** help **create new jobs and export opportunities for American** workers and **businesses**, and ensure we continue to take an all-of-the-above approach to American energy production,” says Energy Secretary Steven Chu. To that end, the Obama administration is partnering with Babcock & Wilcox and Bechtel to develop those smaller nuclear reactors for the federally-owned utility Tennessee Valley Authority. The Department of Energy is expected to invest about $450 million in the project, which equates to roughly half of the overall cost. Industry will pony up the other half. Babcock builds smaller nuclear units of 100 megawatts, which can also be aggregated together to supply as much power as a base-load nuclear generator, or 1,000 megawatts. The modules are stored underground. Christopher Mowry, president of Babcock, says that TVA should expect to have those units running by 2020. Beyond the federal wholesaler of electricity, he says that other potential clients exist: smaller utilities that can only afford to make “bite size” investments in nuclear energy that include the electric cooperatives and municipalities. “**I’d like to** rebuild the United States first and then **sell oversees**,” says Mowry, who spoke with this reporter. **Smaller nuclear units are** just as **viable in other nations where the transmission grids can’t handle larger generation**. Once the concept is shown to be feasible, the **developers can then build on the smaller facilities to form a larger base-load plant.** Currently, 104 nuclear reactors are located here in the United States. But half of them are nearing their retirement, although regulators will likely extend their lives to meet an expected increase in electricity demand. Southern Co. and Scana Corp. have gotten federal regulatory approval in the last year to expand their existing nuclear campuses. Smaller reactors, though, have a place: They might not only serve niche markets but they could also replace at least some of those bigger and more centralized nuclear generation. The **right-sized reactors are expected to operate at high efficiencies and to have built-in advantages**, ultimately **giving** those **investments a respectable return**. Such units, for example, generally come with a nuclear waste storage containment device. The **facilities** could also be used to **create drinkable water supplies in** those **countries where such a resource is in short supply.** According to the Sandia National Laboratory, these **smaller reactors would be factory built and mass-assembled**, with potential production of 50 a year. They **would** all have the exact same design, **allow**ing for **easier licensing and deployment than large-scale facilities**. **Mass production will keep the costs down** **to** between $**250 million** and $500 million **per unit**. “**This small reactor … could supply energy to remote areas and developing countries at lower costs and with a manufacturing turnaround period of two years as opposed to seven for** its **larger relatives**,” says Tom Sanders, who has been working with Sandia. “**It could** also **be a more practical means to implement nuclear base-load capacity** comparable to natural gas-fired generating stations and **with more manageable financial demands** than a conventional power plant.” In the case of Sandia, the right-sized reactors would generate their own fuel as they operate. They are designed to have an extended operational life and would only need to be refueled a few times during its projected 60-year lifespan. At the same time, **the reactor system would have no need for fuel handling, all of which helps to alleviate proliferation concerns**. Conventional nuclear power plants in the U.S. have their reactors refueled once every 18 to 24 months. **The issue that manufacturers of small reactors have is that they are relying on the venture capital community to back their ideas.** While they may be worthy, **they must** still **endure years of regulatory scrutiny before they would get the permission to be built in this country**. Investors don’t want to tie up their money for that long. That’s why the Energy Department is getting involved. Consider NuScale: It says that by taking its smaller modules and ultimately forming a 540 megawatt plant that it would cost between $2.2 billion and $2.5 billion. That’s marginally less expensive than a traditional plant. At a few billion, the company says that **utilities would not be taking the kind of risks they might otherwise be incurring if they were to build a larger** $10 billion **facility**. For most companies, **the amount of money is too great, especially in the aftermath of** a recession, credit crunch and **Japanese nuclear crisis.** “We saw the economic value of taking virtually the entire nuclear system, including its containment, to a factory where they could be manufactured under more controlled conditions,” says Paul Lorenzini, founder of NuScale, in a previous talk with this writer. He goes on to **say that smaller units are extremely safe** because they are immune from the type of events that occurred in Japan. **Right-sized nuclear reactors face the same financial and regulatory obstacles as do their bigger brothers.** But **if the smaller and scalable technologies prove effective**, **they will establish valuable niche markets for themselves** not just among the TVAs of the world but also **among** those **local utilities and less developed countries** that need a clean and continuous source of power.

**SMRs revitalize the US nuclear industry and overcome their export D**

Fred **McGoldrick**, CSIS, Former Senior Official, U.S. Department of Energy and the U.S. Department of State, negotiated U.S. peaceful nuclear cooperation agreements, served in the U.S. Mission to the International Atomic Energy Agency, Jan **2013**, Nuclear Trade Controls, http://csis.org/files/publication/130122\_McGoldrick\_NuclearTradeControls\_Web.pdf

Some argue that one of these impediments is the stricter conditions that the United States imposes on its nuclear exports compared to other suppliers. This charge may contain a grain of truth. Some foreign utilities and their governments may think twice about purchasing U.S. nuclear equipment and enrichment services because of the extensive nature of U.S. consent rights and the conservative exercise of those controls by the United States in the past. After the Carter administration’s grudging and protracted handling of reprocessing requests, some foreign utilities sought other sources of supply for enrichment services. **Today**, however, the United States is not challenging the fuel-cycle choices of other advanced nuclear states. Moreover, although members of the NSG do not implement the guidelines in a uniform manner, and some have loosely interpreted them, **international nuclear trade rules among the major suppliers have been largely harmonized. Thus, the disparities in nuclear export controls between the U**nited **S**tates and **other suppliers have been greatly reduced**. Whether the remaining existing disparities or new ones that may arise with new suppliers will affect U.S. competitiveness remains to be seen. **The U.S. nuclear industry** has recently **published a report concluding that the U.S. nuclear export control system is** more **complex, inefficient, and restrictive** and places more onerous burdens on U.S. exporters than some of its key competitors in the international market.61 The report concludes that the differences in the U.S. and non-U.S. export control regimes impose a competitive disadvantage on commercial nuclear exporters from the United States**. While there is some validity to the** report’s **argument** that U.S. export laws and regulations may impose unnecessarily burdensome requirements on U.S. companies and that the approval of export applications may take an unreasonably long time, it is not clear that the U.S. system is causing serious damage to the competitiveness of the United States in the international market at the present time. Moreover, although the American regime for controlling nuclear exports should be streamlined and made more efficient, **it is not the main reason for the decline in the U.S. share of the international market**. Other **factors are far more important**: ■ **The emergence of other suppliers** long ago undermined the monopoly of supply that the United States enjoyed in the early days nuclear energy. This was an inevitable development, and the future is likely to see the arrival of even more suppliers. ■ The international playing field is not level. The nuclear export industries of other major suppliers have strong governmental and financial support that the U.S. nuclear export industry does not enjoy. ■ **The U**nited **S**tates **has not built new domestic nuclear power plants in over 30 years**. **Countries** seeking to develop nuclear power are likely to **turn for assistance to those states that have growing domestic nuclear power programs**, offer competitive fuel-cycle services, **and support the development of advanced technologies**. Alt**hough U.S. skills** in operating and regulating nuclear power plants **are highly valued,** manufacturing and construction **effectiveness** (which brings down costs) does **not have the same credibility it once had**. **As a result, the ability of the U**nited **S**tates **to participate competitively in the international nuclear market has been weakened**. **Overcoming these developments and obstacles will not be easy**. Subsidies for U.S. nuclear exports may be one way to put American industry on a more competitive footing with nuclear exporters in other countries. However, financial support for U.S. nuclear exports has long been controversial and is likely to become even more so in the future, particularly in light of severe constraints on the U.S. budget.62 **To retain a role in the international marketplace**, some **U.S. companies have entered into alliances with foreign suppliers**. Toshiba’s purchase of Westinghouse and the creation of General Electric1–Hitachi Nuclear Energy are examples of such ventures. However, it is not clear how the uncertain future of the post-Fukushima Japanese nuclear industry will affect these ventures. In any event, **forging** such **alliances with foreign firms may be one avenue for promoting U.S. nuclear exports.** **Revitalizing and rebuilding the domestic nuclear industry** also **faces significant challenges**. The low price of natural gas plants and the absence of a national nuclear waste policy will significantly slow the nuclear renaissance, and post-Fukushima public concerns and new safety regulations may create additional brakes on nuclear power plant construction. **However, the development of small modular reactors**, if they prove economically competitive and meet safety standards, could not only **rejuvenate the U.S. domestic nuclear industry** but also boost the **competiveness** of the United States in the **international market**, particularly in **developing countries**. Although some have expressed concerns about the proliferation implications of laser isotope separation technology, if the General Electric-Hitachi Global Laser Enrichment Uranium Enrichment Facility, a venture owned by GE, Hitachi, and Cameco Corporation, can satisfy proliferation concerns and meet the economic expectations of its supporters, it could give the United States a strong cost advantage in the global enrichment market. One step the United States could take to strengthen its role in the international market and promote its nonproliferation would be to establish a national nuclear waste program that would allow for taking back at least limited quantitites of spent fuel produced from U.S. nuclear exports. This may ultimately prove too hard to do, but it is well worth the effort.

**Plan**

**The United States federal government should acquire, through alternative financing, electricity from nuclear reactors fewer than 300 megawatts for military bases in the United States.**

**Contention 3- Solvency**

**DoD acquisition of SMR’s ensures rapid military adoption, commercialization, and U.S. leadership**

**Andres 11**

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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 U**nited **S**tates; 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 [FOOTNOTE 29: **There are** numerous **actions that the Federal Government could take**, such as conducting or funding research and development, stimulating private investment, demonstrating technology, mandating adoption, and guaranteeing markets. **Military procurement** is thus only one option, but it has often **played a decisive role in technology development and is likely to be the catalyst for the U.S. small reactor industry.** See Vernon W. Ruttan, Is War Necessary for Economic Growth? (New York: Oxford University Press, 2006); Kira R. Fabrizio and David C. Mowery, “The Federal Role in Financing Major Inventions: Information Technology during the Postwar Period,” in Financing Innovation in the United States, 1870 to the Present, ed. Naomi R. Lamoreaux and Kenneth L. Sokoloff (Cambridge, MA: The MIT Press, 2007), 283–316.] Historically, **nuclear power has been “the most clear-cut example . . . of an importan tgeneral-purpose technology that in the absence of military** and defense related **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, **M**assachusetts **I**nstitute of **T**echnology 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.** Domestic Nuclear Expertise. From the perspective of larger national security issues, **if DOD does not catalyze the small reactor industry, there is a risk that expertise in small reactors could become dominated by foreign companies**. A 2008 Defense Intelligence Agency report warned that the United States will become totally dependent on foreign governments for future commercial nuclear power unless the military acts as the prime mover to reinvigorate this critical energy technology with small, distributed power reactors.38 **Several of the most prominent small reactor concepts rely on technologies perfected at Federally funded laboratories and research programs**, including the Hyperion Power Module (Los Alamos National Laboratory), NuScale (DOE-sponsored research at Oregon State University), IRIS (initiated as a DOE-sponsored project), Small and Transportable Reactor (Lawrence Livermore National Laboratory), and Small, Sealed, Transportable, Autonomous Reactor (developed by a team including the Argonne, Lawrence Livermore, and Los Alamos National Laboratories). **However, there are scores of competing designs under development from over a dozen countries. If DOD does not act early to support the U.S. small reactor industry, there is a chance that the industry could be dominated by foreign companies**. Along with other negative consequences, **the decline of the U.S. nuclear industry decreases the NRC’s influence on the technology that supplies the world’s rapidly expanding demand for nuclear energy. Unless U.S. companies begin to retake global market share, in coming decades France, China, South Korea, and Russia will dictate standards on nuclear reactor reliability, performance, and proliferation resistance**.

**Alternative financing cuts costs and supercharges commercialization**

**Fitzpatrick 11**

Ryan Fitzpatrick, Senior Policy Advisor for Clean Energy at Third Way, Josh Freed, Vice President for Clean Energy at Third Way, and Mieke Eoyan, Director for National Security at Third Way, June 2011, Fighting for Innovation: How DoD Can Advance CleanEnergy Technology... And Why It Has To, content.thirdway.org/publications/414/Third\_Way\_Idea\_Brief\_-\_Fighting\_for\_Innovation.pdf

The DoD has over $400 billion in annual purchasing power, **which means the Pentagon could provide a sizeable market for new technologies**. **This can increase a technology’s scale of production, bringing down costs, and making the product more likely to successfully reach commercial markets**. **Unfortunately**, many potentially significant clean energy **innovations never get to the marketplace, due to a lack of capital during** the development and **demonstration stages. As a result, technologies that could help the military** meet its clean energy security and cost goals **are being abandoned or co-opted by competetors like China** before they are commercially viable here in the U.S. **By focusing its purchasing power on innovative products that will** help **meet its energy goals, DoD can provide** more **secure** and **cost-effective energy to the military—producing tremendous long-term savings**, while also **bringing** potentially **revolutionary technologies to the public**. Currently, many of these **technologies are passed over during** the **procurement** process **because of** higher **upfront costs—even if these technologies can reduce life-cycle costs** to DoD. The Department has only recently begun to consider life-cycle costs and the “fullyburdened cost of fuel” (FBCF) when making acquisition decisions. However, initial reports from within DoD suggest that the methodology for determining the actual FBCF needs to be refined and made more consistent before it can be successfully used in the acquisition process.32 The Department should fast-track this process to better maximize taxpayer dollars. Congressional appropriators— and the Congressional Budget Office—should also recognize the **savings that can be achieved by procuring advanced technologies to promote DoD’s energy goals**, even if these procurements come with higher upfront costs. **Even if the Pentagon makes procurement of emerging clean energy technologies a higher priority, it still faces real roadblocks in developing relationships with the companies that make them. Many clean energy innovations are developed by small businesses or companies that have no previous experience working with military procurement officers. Conversely, many procurement officers do not know the clean energy sector and are not incentivized to develop relationships with emerging clean energy companies**. Given the stakes in developing domestic technologies that would help reduce costs and improve mission success, the Pentagon should develop a program to encourage a better flow of information between procurement officers and clean energy companies—especially small businesses. Leverage Savings From Efficiency and Alternative Financing to Pay for Innovation. **In an age of government-wide austerity and tight** Pentagon **budgets**, current congressional **appropriations are simply not sufficient** to fund clean energy innovation. **Until Congress decides to direct additional resources** for this purpose, the **Defense** Department **must leverage** the money and other **tools it already has** to help develop clean energy. This can take two forms: repurposing money that was saved through energy efficiency programs for innovation and using alternative methods of financing to reduce the cost to the Pentagon of deploying clean energy. For several decades **the military has made** modest **use alternative financing** **mechanisms to fund** clean **energy** and efficiency **projects when appropriated funds were insufficient**. In a 2010 report, GAO found that while only 18% of renewable energy projects on DoD lands used alternative financing, these projects account for 86% of all renewable energy produced on the Department’s property.33 This indicates that **alternative financing can be particularly helpful to DoD in terms of bringing larger and more expensive projects to fruition**. One advanced financing tool available to DoD is **the energy savings performance contract** (ESPC). These agreements **allow DoD to contract a private firm to make upgrades to a building or other facility that result in energy savings, reducing overall energy costs without appropriated funds**. **The firm finances the cost, maintenance and operation of these upgrades and recovers a profit over the life of the contract**. While mobile applications consume 75% of the Department’s energy,34 DoD is only authorized to enter an ESPC for energy improvements done at stationary sites. As such, Congress should allow DoD to conduct pilot programs in which ESPCs are used to enhance mobile components like aircraft and vehicle engines. This could accelerate the needed replacement or updating of aging equipment and a significant reduction of energy with no upfront cost. To maximize the potential benefits of ESPCs, DoD should work with the Department of Energy to develop additional training and best practices to ensure that terms are carefully negotiated and provide benefits for the federal government throughout the term of the contract.35 This effort could possibly be achieved through the existing memorandum of understanding between these two departments.36 The Pentagon should also consider using any long-term savings realized by these contracts for other energy purposes, including the promotion of innovative technologies to further reduce demand or increase general energy security. In addition to ESPCs, **the Pentagon** also **can enter into** extended agreements with utilities to use DoD land to generate electricity, or for the **long-term purchase of energy**. **These** **innovative financing mechanisms**, known respectively as enhanced use leases (EULs) and power purchase agreements (PPAs), **provide a valuable degree of certainty to third party generators**. In exchange, the **Department can leverage its existing resources**—either its land or its purchasing power—**to negotiate lower electricity rates** and dedicated sources of locallyproduced power with its utility partners. **DoD has unique authority among federal agencies to enter extended 30-year PPAs**, **but only for geothermal energy projects and only with direct approval from the Secretary of Defense**. Again, limiting incentives for clean energy generation to just geothermal power inhibits the tremendous potential of other clean energy sources to help meet DoD’s energy goals. **Congress should consider opening this incentive up to other forms of clean energy generation**, including the production of advanced fuels. Also, given procurement officials’ lack of familiarity with these extended agreements and the cumbersome nature of such a high-level approval process, the unique authority to enter into extended 30-year PPAs is very rarely used.37 DoD should provide officials with additional policy guidance for using extended PPAs and Congress should simplify the process by allowing the secretary of each service to approve these contracts. Congress should also investigate options for encouraging regulated utility markets to permit PPA use by DoD. Finally, when entering these agreements, the Department should make every effort to promote the use of innovative and fledgling technologies in the terms of its EULs and PPAs. CON C L U S ION **The Defense Department is in a unique position to foster and deploy innovation in clean energy technologies**. This has two enormous benefits for our military: it will make our troops and our facilities more secure and it will reduce the amount of money the Pentagon spends on energy, freeing it up for other mission critical needs. If the right steps are taken by Congress and the Pentagon, the military will be able to put its resources to work developing technologies that will lead to a stronger fighting force, a safer nation, and a critical emerging sector of the American economy. **The Defense Department has helped give birth to technologies and new economic sectors dozens of times before**. For its own sake and the sake of the economy, **it should make clean energy innovation its newest priority**.

**SMRs are cost-effective, safe, fuel efficient- their defense doesn’t apply**

**Szondy 12**

David, freelance writer based in Monroe, Washington. An award-winning playwright, he has contributed to Charged and iQ magazine and is the author of the website Tales of Future Past, February 16, "Feature: Small modular nuclear reactors - the future of energy?", [www.gizmag.com/small-modular-nuclear-reactors/20860/](http://www.gizmag.com/small-modular-nuclear-reactors/20860/)

Small Modular Reactors¶ **One way of getting around many** of these **problems is through** the **development of small modular reactors** (SMR). **These are reactors capable of generating** about **300 megawatts of power** or less, which is enough to run 45,000 US homes. **Though small, SMRs are proper reactors**. They are quite different from the radio-thermal generators (RTG) used in spacecraft and remote lighthouses in Siberia. **Nuclear reactors such as SMRs use controlled nuclear fission to generate power while RTGs use natural radioactive decay to power a** relatively simple thermoelectric **generator** that can only produce, at most, about two kilowatts.¶ In terms of power, RTGs are the equivalent of batteries while small nuclear reactors are only "small" when compared to conventional reactors. They are hardly the sort that you would keep in the garage. In reality, SMR power plants would cover the area of a small shopping mall. Still, such an installation is not very large as power plants go and a reactor that only produces 300 megawatts may not seem worth the investment, but **the US Department of Energy is offering US$452 million in matching grants to develop SMRs** and private investors like the Bill Gates Foundation and the company of Babcock and Wilcox are putting up money for their own modular reactor projects.¶ The 60-year old breakthrough¶ **One reason for government and private industry to take an interest in SMRs is that they've been successfully employed for** much **longer than** most **people realize**. In fact, **hundreds have been steaming around the world inside the hulls of nuclear submarines and other warships for sixty years**. They've also been used in merchant ships, icebreakers and as research and medical isotope reactors at universities. There was even one installed in the Antarctic at McMurdo Station from 1962 to 1972. **Now they're being considered for domestic use**.¶ The case for SMRs¶ **SMRs have a number of advantages over conventional reactors**. For one thing, **SMRs are cheaper to construct and run**. This makes them very attractive to poorer, energy-starved countries; small, growing communities that don't require a full-scale plant; and remote locations such as mines or desalination plants. Part of the reason for this is simply that the reactors are smaller. Another is that, not needing to be custom designed in each case, **the reactors can be standardized and some types built in factories that are able to employ economies of scale. The factory-built aspect is also important because a factory is more efficient than on-site construction by as much as eight to one in terms of building time. Factory construction also allows SMRs to be built, delivered to the site, and then returned to the factory for dismantling** at the end of their service lives - **eliminating a major problem with old conventional reactors, i.e. how to dispose of them.¶ SMRs** also **enjoy** a good deal of **design flexibility**. **Conventional reactors are usually cooled by water** - a great deal of water - **which means that the reactors need to be situated near rivers or coastlines. SMRs, on the other hand, can be cooled by air, gas, low-melting point metals or salt**. This means that **SMRs can be placed in remote, inland areas where it isn't possible to site conventional reactors**.¶ Safety¶ **This cooling system is** often **passive**. In other words**, it relies more on the natural circulation of the cooling medium within the reactor's containment flask than on pumps. This passive cooling is one of the ways that SMRs can improve safety. Because modular reactors are smaller** than conventional ones, **they contain less fuel**. This means that **there's less of a mass to be affected if an accident occurs**. If one does happen, there's less radioactive material that can be released into the environment and makes it easier to design emergency systems. **Since they are smaller and use less fuel, they are easier to cool effectively, which greatly reduces the likelihood of a catastrophic accident or meltdown in the first place.¶** This also means that **accidents proceed much slower in modular reactors than** in **conventional ones. Where the latter need accident responses in** a matter of hours or **minutes, SMRs can be responded to in** hours or **days, which reduces the chances of an accident resulting in major damage** to the reactor elements.¶ **The SMR designs that reject water cooling** in favor of gas, metal or salt **have their own safety advantages**. Unlike water-cooled reactors, **these media operate at a lower pressure**. One of the hazards of water cooling is that a cracked pipe or a damaged seal can blow radioactive gases out like anti-freeze out of an overheated car radiator. With low-pressure media, there's less force to push gases out and there's less stress placed on the containment vessel. **It also eliminates one of the frightening episodes of the Fukushima accident where the water in the vessel broke down** into hydrogen and oxygen **and** then **exploded**.¶ **Another advantage of modular design is that some SMRs are small enough to be installed below ground. That is cheaper, faster to construct and less invasive** than building a reinforced concrete containment dome. There is also the point that **putting a reactor in the ground makes it less vulnerable to earthquakes. Underground installations make modular reactors easier to secure and install in a much smaller footprint. This makes SMRs particularly attractive to military customers who need to build power plants for bases quickly.** **Underground installation also enhances security with fewer sophisticated systems needed, which** also **helps bring down costs**.¶ **SMRs can help with** proliferation, **nuclear waste and fuel supply issues** because, while some modular reactors are based on conventional pressurized water reactors and burn enhanced uranium, others use less conventional fuels. **Some**, for example, **can generate power from what is now regarded as "waste", burning depleted uranium and plutonium left over from conventional reactors. Depleted uranium is** basically **U-238 from** which the **fissible U-235 has been consumed. It's** also **much more abundant in nature than U-235, which has the potential of providing the world with energy for thousands of years. Other reactor designs don't even use uranium**. Instead, **they use thorium. This fuel is also incredibly abundant, is easy to process for use as fuel and has the added bonus of being utterly useless for making weapons**, so it can provide power even to areas where security concerns have been raised.¶ But there's still the sticking point that modular reactors are, by definition, small. That may be fine for a submarine or the South Pole, but what about places that need more? Is the alternative conventional nuclear plants? It turns out that the answer is no. **Modular reactors don't need to be used singly. They can be set up in batteries of five or six or even more**, providing as much power as an area needs. And **if one unit needs to be taken off line for repairs or even replacement, it needn't interfere with the operation of the others**.

**DoD needs to lead**

**Energy Washington Week 10**

(“DOD STRESSING NEED FOR NRC COLLABORATION ON 'MINI' REACTOR BUILD OUT” July 5, 2010, Vol. 7 No. 27)

The U.S. Army is rejecting arguments by some industry and government officials who say military bases could proceed to build small modular reactors (SMRs) on military bases without Nuclear Regulatory Commission (NRC) certification and license approvals. Instead, the Department of Defense (DOD) believes it must work closely with NRC and that legislation will likely be needed to clearly define the various agency roles before the novel nuclear energy systems are constructed, according to DOD and industry sources. A senior DOD source also says that a collaborative arrangement between DOE, DOD, and NRC will be needed to begin constructing reactors that currently have not been licensed by the NRC -- including all prominent SMR models being examined by the three agencies for potential licensing and deployment. **Small reactor industry and government proponents have been struggling to find ways to accelerate** the **development of small reactors, including through the use of military bases as a test bed for building and demonstrating the reactors ahead of NRC certification of SMR designs**, according to industry sources, who note that NRC approval is required before a utility can apply for a license to build a small reactor. One senior industry consultant says **the NRC does not have authority over military bases and therefore a non-certified reactor could be built there without the technology being vetted by NRC.** **While industry proponents want NRC certification, they see it as slow because of a lack of resources to review the new reactors and certify the designs**, says the industry consultant. **Building the reactors on military bases would help demonstrate SMR functionality that would eventually help accelerate commercial licensing**, says the source.

**Squo SMR incentives trigger the link**

Ken **Silverstein**, Forbes, **1/15**/13, After Fukushima, U.S. Seeks to Advance Small Nuclear Reactors, www.forbes.com/sites/kensilverstein/2013/01/15/after-fukushima-u-s-seeks-to-advance-small-nuclear-reactors/

Two years ago, some thought that the nuclear energy had been leveled. But **the industry today is picking up steam** by getting construction licenses to build four new units and by **getting government funding to develop smaller nuclear reactors** that are less expensive and which may be less problematic when it comes to winning regulatory approval. The creators of those roughly 100-megawatt electric modules want to sell their products first in this country before they would market them overseas to lesser-developed nations that don’t have a huge transmission infrastructure. They would be factory-built before being shipped and fueled to where the energy is needed. To the extent that more electric generation is required, no problem: Just lay the small-scale modules next to each other, making the financial outlays more manageable. “Restarting the nation’s nuclear industry and advancing small modular reactor technologies will help create new jobs and export opportunities for American workers and businesses, and ensure we continue to take an all-of-the-above approach to American energy production,” says Energy Secretary Steven Chu. To that end, the Obama administration is partnering with Babcock & Wilcox and Bechtel to develop those smaller nuclear reactors for the federally-owned utility Tennessee Valley Authority. The **Department** **of** **Energy is expected to invest** about $**450 million in the project**, which equates to roughly half of the overall cost. Industry will pony up the other half.

## RD 2/4

**Contention 1- Grid**

**Domestic DoD bases are vulnerable due to connectivity to the civilian grid–only SMRs solve**

**Robitaille 12**

(George, Department of Army Civilian, United States Army War College, “Small Modular Reactors: The Army’s Secure Source of Energy?” 21-03-2012, Strategy Research Project)

In recent years, **the** U.S Department of Defense (**DoD**) **has identified a security issue at our installations related to the dependence on the civilian electrical grid**. 1 **The DoD depends on a steady source of electricity at military facilities to perform the functions that secure our nation**. The **flow of electricity into military facilities is controlled by a public grid system that is susceptible to being compromised because of the age of the infrastructure, damage from natural disasters and the potential for cyber attacks.** Although most major functions at military installations employ diesel powered generators as temporary backup, **the public grid may not be available to provide electricity when it is needed the most. The U**nited **S**tates **electrical infrastructure system is prone to failures and susceptible to terrorist attacks**. 2 It is critical that the source of electricity for our installations is reliable and secure. In order to ensure that our military facilities possess a secure source of electricity, either the public system of electric generation and distribution is upgraded to increase its reliability as well as reducing its susceptibility to cyber attack or another source of electricity should be pursued. **Although** significant **investments are being made to upgrade the electric grid, the current investment levels are not keeping up with the aging system.** Small modular reactors (SMRs) are nuclear reactors that are about an order of magnitude smaller than traditional commercial reactor used in the United States. SMRs are capable of generating electricity and at the same time, they are not a significant contributor to global warming because of green house gas emissions. The DoD needs to look at small modular nuclear reactors (SMRs) to determine if they can provide a safe and secure source of electricity. Electrical Grid Susceptibility to Disruptions 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.** 3 **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**. 9 **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 U**nited **S**tates **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 U**nited **S**tates 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 U**nited **S**tates, **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 executedthese 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.

**The grid is vulnerable – multiple different threats cause year long blackouts**

**Magnuson 12**

(Stew Magnuson, managing editor of National Defense Magazine, Washington, D.C.-based journalist and the author of The Death of Raymond Yellow Thunder: And Other True Stories from the Nebraska-Pine Ridge Border Towns, the Nebraska Nonfiction Book of the Year for 2009, bronze medal in the regional nonfiction category, September 2012, “Feds Fear Coordinated Physical, Cyber-Attacks on Electrical Grids,” http://www.nationaldefensemagazine.org/archive/2012/september/Pages/FedsFearCoordinatedPhysical,Cyber-AttacksonElectricalGrids.aspx)

Electrical grids in the United States are vulnerable to both cyber-attacks and space weather, federal officials have said. But an assault that combines the skills of a hacker with a physical attack on key parts of a grid’s infrastructure may result in hundreds of millions of U.S. homes and businesses losing electricity. “I am most concerned about coordinated physical and cyber-attacks intended to disable elements of the power grid or deny electricity to specific targets, such as government or business centers, military installations, or other infrastructures,” Gerry Cauley, president and CEO of the North American Electric Reliability Corp., said at a recent Senate hearing. Scott Pugh, of the Department of Homeland Security’s interagency program office, said at an energy conference in April that there are maps — not available for public viewing — that “show you a handful of substations — six or so — [where] you could take out those six substations and black out most of the U.S. east of the Mississippi, if you knew which six [they] were. And in many cases you could do it **with a hunting rifle from a couple hundred yards away**.” There are some 1,500 companies that generate electricity in the United States, and the hodgepodge of federal agencies that oversee them have limited statutory authorities to force them to protect themselves against attacks, the Senate Energy and Natural Resources Committee hearing revealed. “Limitations in federal authority do not fully protect the grid against physical and cyberthreats,” Joseph McClelland, director of the office of reliability at the Federal Energy Regulatory Commission, said. Legislation passed in 2005 gave the agency the authority to impose reliability standards on “bulk,” or large-scale, power systems. That law excludes local distribution facilities, federal installations located inside grids, and major cities such as New York. Hawaii and Alaska also don’t fall under the commission’s jurisdiction. Officials are concerned about two threats: electromagnetic pulses, which come from solar storms or weapons, and cyber-attacks, particularly on “smartgrids,” which it turns out, are not very “smart” when it comes to protecting against hackers. “No single security asset, technique, procedure or standard — even if strictly followed — will protect an entity from all potential cyberthreats,” said Gregory Wilshusen, director of information security issues at the Government Accountability Office. “The cybersecurity threat environment is constantly changing and our defenses must keep up.” However, in the case of smartgrids, utilities continue to employ them without the necessary safeguards, the GAO has found. There is a lack of security features consistently being integrated into smartgrids and the current regulatory environment makes it difficult to ensure that power companies are properly protecting them. Physical attacks against the grid can cause equal or greater destruction than cyber-attacks, McClelland said. An electromagnetic pulse, or EMP event, could seriously degrade or shut down large swaths of the nation. Depending on the attack, **a significant part of the infrastructure could be “out of service for** periods measured in months to **a year or more**,” he said. “The self-reporting requirements, the enforcement provisions under the existing standards are important,” he said. “But at the end of the day, if there’s no enforcement provisions, there’s no teeth behind the provisions.” The National Institute of Standards and Technology has guidelines for utilities to gird themselves from physical and cyber-attacks, but they do not address coordinated attacks, said Wilshusen. NIST “guidelines did not address an important element essential to securing smartgrid systems — the risk of attacks using both cyber and physical means.” Meanwhile, there have been three major studies that looked at the possible effects of a massive solar storm on U.S. electrical grids. They reached different conclusions, Pugh said at the National Defense Industrial Association Environment, Energy Security and Sustainability symposium in New Orleans. Experts are trying to map the grid and figure out what would happen in the event of an attack or solar storm, Pugh said. But there is nothing that requires the 1,500 companies to share proprietary data about their equipment, so coming to firm conclusions is difficult. Transformers — which number about 2,000 nationwide — are a key vulnerability. Strong electrical pulses caused by a weapon or solar storm can irreparably damage them, he said. “If you need a dozen of those tomorrow because somebody attacked the grid, or we had a space weather event that took out a dozen, you might be waiting quite a while,” he said. They weigh about 300 tons, can only be delivered by special rail car, and most are now manufactured overseas.

**Those communication breakdowns go nuclear and decimate military operations**

**Andres 11**

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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 almostentirely 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**.7 **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 blackoutcould 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. **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**.

**Regardless of relative power, military operations solve all conflict.**

**Kagan and O’Hanlon 7**

Frederick Kagan andMichael O’Hanlon, Fred’s a resident scholar at AEI, Michael is a senior fellow in foreign policy at Brookings, “The Case for Larger Ground Forces”, April 24, 2007, <http://www.aei.org/files/2007/04/24/20070424_Kagan20070424.pdf>

We live at a time when **wars not only rage in nearly every region but threaten to erupt in many places where the current relative calm is tenuous**. **To view this as a strategic military challenge for the U**nited **S**tates **is not to espouse a specific theory of America’s role in the world or a certain political philosophy**. Such an assessment flows directly from the basic bipartisan view of American foreign policy makers since World War II that overseas threats must be countered before they can directly threaten this country’s shores, that the basic stability of the international system is essential to American peace and prosperity, and that **no country besides the United States** **is in a position to lead the way in countering major challenges to the global order**. **Let us highlight the threats and their consequences with a few concrete examples, emphasizing** those that involve key strategic regions of the world such as **the Persian Gulf and East Asia, or** key potential threats to American security, such as **the** spread of nuclear weapons **and the strengthening of the global Al Qaeda/jihadist movement**. **The Iranian government has rejected a series of international demands to halt its efforts at enriching uranium and submit to international inspections**. **What will happen if the US—or Israeli—government becomes convinced that Tehran is on the verge of fielding a nuclear weapon? North Korea, of course, has already done so, and the ripple effects are beginning to spread**. **Japan’s** recent **election** to supreme power **of a leader who has promised** to rewrite that country’s constitution **to support increased armed forces—and**, possibly, **even nuclear weapons**— **may** well **alter the delicate balance of fear in Northeast Asia fundamentally and rapidly**. Also, in the background, at least for now, **SinoTaiwanese tensions continue to flare, as do tensions between India and Pakistan, Pakistan and Afghanistan, Venezuela and the U**nited **S**tates, and so on. Meanwhile, **the world’s nonintervention in Darfur** troubles consciences from Europe to America’s Bible Belt to its bastions of liberalism, yet with no serious international forces on offer, the bloodletting **will probably, tragically, continue unabated**. And as bad as things are in Iraq today, they could get worse. What would happen if the key Shiite figure, Ali al Sistani, were to die? If another major attack on the scale of the Golden Mosque bombing hit either side (or, perhaps, both sides at the same time)? Such deterioration might convince many Americans that the war there truly was lost—but the costs of reaching such a conclusion would be enormous. Afghanistan is somewhat more stable for the moment, although a major Taliban offensive appears to be in the offing. Sound US grand strategy must proceed from the recognition that, **over the next few years and decades, the world is going to be a very unsettled and quite dangerous place**, with Al Qaeda and its associated groups as a subset of a much larger set of worries. **The only serious response to this international environment is to develop armed forces capable of protecting America’s vital interests throughout this dangerous time. Doing so requires a military capable of a wide range of missions—including not only deterrence of great power conflict in dealing with potential hotspots in Korea, the Taiwan Strait, and the Persian Gulf but also associated with a variety of Special Forces activities and stabilization operations**. For today’s US military, which already excels at high technology and is increasingly focused on re-learning the lost art of counterinsurgency, this is first and foremost a question of finding the resources to field a large-enough standing Army and Marine Corps to handle personnel intensive missions such as the ones now under way in Iraq and Afghanistan.

**And it makes the military ineffective–collapses hegemony.**

**CNA 9**

Center for Naval Analyses Military Adviser Board, Chaired by General Charles Wald, USAF (Ret.) Former Deputy Commander, Headquarters U.S. European Command (USEUCOM), May 2009, Powering America’s Defense: Energy and the Risks to National Security, https://www.cna.org/sites/default/files/Powering%20Americas%20Defense.pdf

Our **vulnerabilities from energy use** are not limited to battlefields and forward operating bases; they also **exist at home. The biggest impacts** may be local, but can **extend to locations and operations around the world.** In August 2003, 50 million people living in the Northeast, Midwest, and Ontario were suddenly left in the dark when their electric power failed. More than 500 generating units at 265 power plants shut down—a quiet collapse cascading across the landscape. Most homes and businesses regained power within a day (though some plants took two weeks to regain full capacity), a quick restoration that was possible primarily because no significant equipment was damaged. Still, critical national security systems failed. U.S. border check systems were not fully operational, causing a severe backup of truck traffic on our northern boundary. There were related effects from the outage as well. Water and sewage plants shut down. Gas stations stopped working, and rail service was curtailed. Many cellular phone providers, radio stations, and television stations lost service—their backup power systems were insufficient. The blackout is estimated to have caused economic losses of $7 to $10 billion [55]. The trigger for this massive blackout was tragically simple: An Ohio utility had failed to properly trim trees near a power line. American utilities have experience responding to interruptions caused by extreme weather. Even after severe ice storms and hurricanes, power is most often restored within a few days. But the effects of a long-term power outage are unknown. Our ability to recover from a dedicated attack is also not known—except to say that a deliberate attack would require a different response. There have been numerous attacks on the operating systems of major critical infrastructure facilities, including power grids, around the world in recent years: • In one instance outside the U.S., a power outage was triggered that affected multiple cities; in other instances, hackers have extorted hundreds of millions of dollars out of their victims [57, 58]. • Foreign cyber spies are also a serious concern: U.S. Homeland Security and Intelligence officials revealed that Chinese and Russian spies have “penetrated the U.S. electrical grid” and left behind dormant but malicious software [59]. • In 2007, the discovery of what is now known as the “Aurora threat” revealed the possibility that sophisticated hackers could seriously dam age the grid by destroying mechanisms downstream from the initial point of attack. Aurora involves opening and quickly closing a high voltage circuit breaker, which can result in an out-of-synchronism condition that can physically damage rotating equipment connected to the power grid [60-63]. At military installations across the country, a myriad of **critical systems** **must be operational 24 hours a day**, 365 days a year. They receive and analyze data to keep us safe from threats, they provide direction and support to combat troops, and stay ready to provide relief and recovery services when natural disasters strike or when someone attempts to attack our homeland. These installations are almost completely dependent on commercial electrical power delivered through the national electrical grid. When the DSB studied the 2003 blackout and the condition of the grid, they concluded it is “fragile and vulnerable... placing critical military and homeland defense missions at unacceptable risk of extended outage”. As the resiliency of the grid continues to decline, it increases the potential for an expanded and/ or longer duration outage from natural events as well as deliberate attack. The DSB noted that the military’s backup power is inadequately sized for its missions and military bases cannot easily store sufficient fuel supplies to cope with a lengthy or widespread outage. An extended **outage could jeopardize ongoing missions in far-flung battle spaces** for a variety of reasons: • The American military’s logistics chains operate a just-in-time delivery system familiar to many global businesses. If an aircraft breaks down in Iraq, parts may be immediately shipped from a supply depot in the U.S. If the depot loses power, personnel there may not fill the order for days, increasing the risk to the troops in harm’s way. • Data collected in combat zones are often analyzed at data centers in the U.S. In many cases, the information helps battlefield commanders plan their next moves. If the data centers lose power, the next military move can be delayed, or taken without essential information. • The loss of electrical power affects refineries, ports, repair depots, and other commercial or military centers that help assure the readiness of American armed forces. When power is lost for lengthy periods, vulnerability to attack increases. President Obama, Congress, and major utilities, among others, are discussing an upgrade of the national electrical grid for a variety of reasons. We add our voice to this discussion with a singular perspective: we see that our **national security is directly linked to the security and reliability of our system of energy production and delivery.**

**Hegemonic decline causes nuclear war**

**Barnett ‘11**

Thomas, American military geostrategist and Chief Analyst at Wikistrat, “The New Rules: Leadership Fatigue Puts U.S., and Globalization, at Crossroads,” <http://www.worldpoliticsreview.com/articles/8099/the-new-rules-leadership-fatigue-puts-u-s-and-globalization-at-crossroads>, AM

Let me be more blunt: As the guardian of globalization, **the U.S. military has been the greatest force for peace the world has ever known**. Had America been removed from the global dynamics that governed the 20th century, the mass murder never would have ended. Indeed**, it's entirely conceivable** **there would** now **be no** identifiable **human civilization left**, **once nuclear weapons entered the** killing **equation**. But the world did not keep sliding down that path of perpetual war. Instead, America stepped up and changed everything by ushering in our now-**perpetual great-power peace**. **We introduced the** international **liberal trade** **order** known as globalization **and played loyal Leviathan over its spread**. **What resulted was the collapse of empires, an explosion of democracy, the persistent spread of human rights, the liberation of women, the doubling of life expectancy, a roughly 10-fold increase in adjusted global GDP and a profound and persistent reduction in battle deaths from state-based conflicts.** That is what American "hubris" actually delivered.

**DoD procurement of SMR’s solves security and islands military bases.**

**Loudermilk 11**

Micah J. Loudermilk, Research Associate for the Energy & Environmental Security Policy program with the Institute for National Strategic Studies at National Defense University, 5/31/11, Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs, [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](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)

Path forward: Department of Defense as first-mover 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 U**nited **S**tates. **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**.

**Contention 2- Hydrogen**

**SMR development results in military hydrogen**

**AET 12** Alternative Energy Today, “Alternative Energy The Ways that the Military is Using,” 10/25, http://www.alternative-energy-today.com/the-ways-that-the-military-is-using-alternative-energy/

One thing that the **military leaders stress** is **the desire for the forces deployed in the theater to be able to be more alternative energy-independent**. Currently the **US military has policies and procedures in place to interact with allies or sympathetic local populaces to help its forces in the field get their needed energy and clean water when engaged in a foreign military campaign. However, this is not wholly reliable, as the US might well find itself facing unilateral military activities, or have itself in a situation where its allies cannot help it with the resources it needs to conduct its military actions successfully**. **The US military is very interested in** certain alternative **energy that, with the right** research and **development technologically, can make it energy independent**, or at least a great deal more so, **on the battlefield.** One of the things that greatly interests the military along these lines is **the development of small nuclear reactors,** which could be portable, for producing theater-local electricity. The military is impressed with how clean-burning nuclear reactors are and how energy efficient they are. Making them portable for the typical warfare of today’s highly mobile, small-scaled military operations is something they are researching. The most prominent thing that the US military thinks these small nuclear reactors **would be useful for** involves **the removal of hydrogen (for fuel cell) from seawater.** It also thinks that converting seawater to hydrogen fuel in this way would have less negative impact on the environment than its current practices of remaining supplied out in the field. **Seawater is, in fact, the military’s highest interest when it comes to the matter of alternative energy supply. Seawater can be endlessly “mined” for hydrogen, which in turn powers advanced fuel cells.** Using OTEC, seawater can also be endlessly converted into desalinated, potable water. **Potable water and hydrogen for power are two of the things that a near-future deployed military force will need most of all. In the cores of nuclear reactors**—which as stated above are devices highly interesting, **in portable form, to the US military—we encounter temperatures greater than 1000 degrees Celsius. When this level of temperature is mixed with a thermo-chemical water-splitting procedure, we have on our hands the most efficient means of breaking down water into its component parts, which are molecular hydrogen and oxygen**. The minerals and salts that are contained in seawater would have to be extracted via a desalination process in order to make the way clear for the water-splitting process. These could then be utilized, such as in vitamins or in salt shakers, or simply sent back to the ocean (recycling). **Using the power of nuclear reactors to extract this hydrogen from the sea, in order to then input that into fuel cells to power advanced airplanes, tanks, ground vehicles**, and the like, **is clearly high on the R & D priority list of the military.**

**SMRs make hydrogen feasible and economical**

**Science 12**, quoting Dr. Ibrahim Khamis of the International Atomic Energy Agency (IAEA), 3/26, “One Day, You May Thank Nuclear Power For The Hydrogen Economy”, www.science20.com/news\_articles/one\_day\_you\_may\_thank\_nuclear\_power\_hydrogen\_economy-88334

**The hydrogen economy has been ready to start for decades and could begin commercial production of hydrogen in this decade** **but**, says Dr. Ibrahim Khamis of the International Atomic Energy Agency (IAEA) in Vienna, Austria, **it will take heat from** existing **nuclear plants to make hydrogen economical.¶** Khamis said **scientists and economists at IAEA and elsewhere are working intensively to determine how** current nuclear power reactors — 435 are operational worldwide — and **future nuclear power reactors could be enlisted in hydrogen production**.¶ Most hydrogen production at present comes from natural gas or coal and results in releases of the greenhouse gas carbon dioxide. On a much smaller scale, some production comes from a cleaner process called electrolysis, in which an electric current flowing through water splits the H2O molecules into hydrogen and oxygen. This process, termed electrolysis, is more efficient and less expensive if water is first heated to form steam, with the electric current passed through the steam.¶ **"There is rapidly growing interest around the world in hydrogen production using nuclear power plants as heat sources**," Khamis said. "Hydrogen production using nuclear energy could reduce dependence on oil for fueling motor vehicles and the use of coal for generating electricity. In doing so, hydrogen could have a beneficial impact on global warming, since burning hydrogen releases only water vapor and no carbon dioxide, the main greenhouse gas. There is a dramatic reduction in pollution."¶ Khamis said that **nuclear power plants are ideal for hydrogen production because they already produce the heat for changing water into steam and the electricity for breaking the steam down into hydrogen and oxygen**. Experts envision the current generation of **nuclear power** plants using a low-temperature electrolysis which **can take advantage of low electricity prices during the plant's off-peak hours to produce hydrogen. Future plants**, **designed** specifically **for hydrogen production, would use a more efficient high-temperature electrolysis process or be coupled to thermochemical processes,** which are currently under research and development.¶ "**Nuclear hydrogen** from electrolysis of water or steam **is a reality** now, yet the economics need to be improved," said Khamis. He noted that some countries are considering construction of new nuclear plants coupled with high-temperature steam electrolysis (HTSE) stations that would allow them to generate hydrogen gas on a large scale in anticipation of growing economic opportunities.

**Tech is viable—just need hydrogen fuel**

**Squatriglia 11** Chuck, Wired, 4/22, Discovery Could Make Fuel Cells Much Cheaper, www.wired.com/autopia/2011/04/discovery-makes-fuel-cells-orders-of-magnitude-cheaper/

One of **the biggest issues with hydrogen fuel cells**, **aside from the lack of fueling infrastructure**, **is the high cost** of the technology. Fuel cells use a lot of platinum, which is frightfully expensive and one reason we’ll pay $50,000 or so for the hydrogen cars automakers say we’ll see in 2015. **That might soon change**. **Researchers** at Los Alamos National Laboratory have **developed a platinum-free catalyst in the cathode of a hydrogen fuel cell** that uses carbon, iron and cobalt. **That could make the catalysts** “two to **three orders of magnitude cheaper**,” the lab says, **thereby significantly reducing the cost of fuel cells.** Although the discovery means we **could see hydrogen fuel cells in a wide variety of applications**, it could have the biggest implications for automobiles. Despite the auto industry’s focus on hybrids, plug-in hybrids and battery-electric vehicles — driven in part by the Obama administration’s love of cars with cords — several automakers remain convinced hydrogen fuel cells are the best alternative to internal combustion. Hydrogen offers the benefits of battery-electric vehicles — namely zero tailpipe emissions — without the drawbacks of short range and long recharge times. Hydrogen fuel cell vehicles are electric vehicles; they use a fuel cell instead of a battery to provide juice. You can fill a car with hydrogen in minutes, it’ll go about 250 miles or so and the technology is easily adapted to everything from forklifts to automobiles to buses. Toyota, Mercedes-Benz and Honda are among the automakers promising to deliver hydrogen fuel cell vehicles in 2015. Toyota has said it has cut the cost of fuel cell vehicles more than 90 percent by using less platinum — which currently goes for around $1,800 an ounce — and other expensive materials. It plans to sell its first hydrogen vehicle for around $50,000, a figure Daimler has cited as a viable price for the Mercedes-Benz F-Cell (pictured above in Australia). Fifty grand is a lot of money, especially something like the F-Cell — which is based on the B-Class compact — or the Honda FCX Clarity. Zelenay and Wu in the lab. In a paper published Friday in Science, Los Alamos researchers Gang Wu, Christina Johnston and Piotr Zelenay, joined by Karren More of Oak Ridge National Laboratory, outline their platinum-free cathode catalyst. The catalysts use carbon, iron and cobalt. The researchers say **the fuel cell provided high power** **with** reasonable **efficiency and promising durability**. It provided currents comparable to conventional fuel cells, and showed favorable durability when cycled on and off — a condition that quickly damages inferior catalysts. The researchers say the carbon-iron-cobalt catalyst completed the conversion of hydrogen and oxygen into water, rather than producing large amounts of hydrogen peroxide. They claim the catalyst created minimal amounts of hydrogen peroxide — a substance that cuts power output and can damage the fuel cell — even when compared to the best platinum-based fuel cells. In fact, the fuel cell works so well the researchers have filed a patent for it. The researchers did not directly quantify the cost savings their cathode catalyst offers, which would be difficult because platinum surely would become more expensive if fuel cells became more prevalent. But the lab notes that iron and cobalt are cheap and abundant, and so the cost of fuel cell catalysts is “definitely two to three orders of magnitude cheaper.” “The encouraging point is that **we have found a catalyst with a good durability and life cycle relative to platinum-based catalysts**,” Zelenay said in a statement. “For all intents and purposes, **this is a zero-cost catalyst** in comparison to platinum, so **it directly addresses** one of the main **barriers to hydrogen fuel cells**.”

**Key to UAV effectiveness**

**NRL 10** Naval Research Laboratory, Fall, Fuel Cell Power Soar on Fuel Cell Power, http://www.nrl.navy.mil/content\_images/SPECTRA\_Fall2010.pdf

Piloted remotely or autonomously, **unmanned aerial vehicles** have **long provided extra “eyes in the sky,” especially for missions that are too dangerous for manned aircraft**. At the Naval Research Laboratory (NRL), **scientists are merging UAV technology and alternative energy research to develop advanced, fuel-cell-powered UAVs that can fly longer, lower, quieter, and farther than** their **traditionally powered counterparts**, **offering significant tactical advantages**.¶ Building on its extensive experience developing battery-powered electric UAVs, NRL began research into fuel cell UAVs in 2003. Starting with a small, 100-watt fuel cell from Protonex Technology Corporation, an NRL team assembled a power system from off-the-shelf parts such as tubing and aluminum foil to make the radiator, and a tank from a paintball gun to hold high-pressure hydrogen for¶ fuel. They retrofitted the system into a sailplane kit and called the vehicle the “Spider Lion.” In its November 2005 demonstration flight, the 6-pound Spider Lion flew for 3.3 hours with only a half-ounce of hydrogen in its tank. Although the Spider Lion was far from a useful military vehicle — it had no payload and was not very durable — it showed that fuel-cell-powered flight was possible for UAVs.¶ Why Fuel Cells?¶ **Fuel cells offer clean, quiet, high-efficiency electric power for UAVs**. Proton exchange membrane (PEM) fuel cells, also called polymer fuel cells, are electrochemical devices that create an electric current when they combine hydrogen and oxygen to make water. **They consume only hydrogen and air**, and their only emissions are water and heat.¶ **Fuel cells are** two to **three times more efficient than internal combustion engines, and have much greater endurance than batteries.** While **batteries** provide quiet and reliable electrical energy, and are used to power many of he small UAVs on the battlefield today, their low **endurance translates into less time collecting intelligence and more time spent on “refueling” and turnaround. Fuel cell systems overcome these limitations.¶ The Navy is interested in harnessing fuel cell technology to increase power potential and energy efficiency across its operational spectrum** — **from air** vehicles **to** **ground** vehicles **to undersea vehicles; to** man-portable power generation for Marine **expeditionary missions**; to meeting power needs afloat.¶ The Office of **Naval Research** (ONR), a major sponsor of NRL’s fuel cell research, **has been supporting the development of innovative power and energy technologies for decades**. “Pursuing energy efficiency and energy independence are core to ONR’s Power and Energy Focus Area,” said Rear Admiral Nevin Carr, Chief of Naval Research. “**ONR’s investments in alternative energy sources, like fuel cell research, have application to t**he Navy and Marine Corps **mission in future UAVs and vehicles. These investments also contribute directly to solving** some of the same **technology challenges** faced at the national level.”¶ Lightweight, Durable, and Stealthy: XFC In 2006, through sponsorship of ONR and the Office of the Secretary of Defense’s Rapid Reaction Technology Office and Office of Technology Transition, NRL partnered with Protonex Technology Corporation to design and build a hydrogen fuel cell power plant for a battlefield-capable, payload-carrying UAV. They aimed to put the most power they could into the smallest and lightest package possible. The team first tested a new 2.2-pound, 300-watt fuel cell system onboard the eXperimental Fuel Cell unmanned aerial system, or XFC UAS. NRL’s Chemistry and Tactical Electronic Warfare divisions developed the XFC UAS as an affordably expendable surveillance platform. It is a folding-wing UAV that ejects from an 18” diameter transport tube and unfolds to its X-shaped flight configuration after launch. XFC is fully autonomous and weighs 19 pounds with a 2.5-pound payload. The hydro a vehicle called the Ion Tiger. For the Ion Tiger UAV, the mission goal was to fly for 24 hours and carry a 5-pound payload — the approximate weight of common payloads such as a day/night camera or a communication relay. NRL again teamed with Protonex Technology Corporation to improve the fuel cell system, along with the University of Hawaii for systems testing and modeling, HyperComp Engineering to build the hydrogen tanks, and Arcturus UAV to build the airframe. The team designed a 37-pound vehicle with a 17-foot wingspan, allowing 13 pounds (0.75 horsepower) fuel cell system still weighed only 2.2 pounds, but now was more efficient, converting 99 percent of the hydrogen fuel to electricity at 40 to 55 percent efficiency. NRL developed thermal and systems models and new methods to make custom hydrogen fuel tanks, making the entire fuel cell system design modular so it can be adapted to a variety of military and commercial platforms. In October 2009, at the U.S. Army’s Aberdeen Proving Ground on the northwestern shore of Maryland’s Chesapeake Bay, the Ion Tiger was launched for its much-anticipated test flight. The UAV stayed aloft for23 hours and 17 minutes to set an unofficial endurance record for fuelcell-powered flight, despite stormy and windy weather conditions. The Ion Tiger was flown again in November 2009 for an unprecedented 26 hours and 1 minute, beating its previous record and exceeding program goals. Through these demonstrations, NRL proved that polymer fuel cell technology can meet or surpass the performance of traditional power systems. In fact, the Ion Tiger fuel cell system provided seven times the endurance of the equivalent weight in batteries. “This is something that, until now, has not been achieved by anyone,” said ONR Program Manager Dr. Michele Anderson. “The Ion Tiger successfully demonstrates ONR’s vision to show how efficient, clean technology can be used to improve the warfighter’s capabilities.” NRL has come a long way since that first Spider Lion flight. “Today,” says NRL’s principal investigator for alternative energy research, Dr. Karen Swider-Lyons, “these long-endurance flights are made possible by the team’s sustained research on high-power fuel cell systems, lightweight hydrogen-gas storage tanks, improved thermal management, and the effective integration of these systems.” ¶ The Sky’s the Limit¶ NRL **scientists and engineers are already working on the next generation of fuel cell UAVs.** They are focusing on **tripling the flight endurance** of the present power system by using cryogenic liquid hydrogen, which can be stored at about a third the weight of the compressed hydrogen gas. They are also exploring a larger system with a 1.5-kilowatt (2-horsepower) fuel cell capable of carrying a 15to 30-pound payload.¶ **Military planners want these stealthy, more capable, fuel-cell-powered UAVs**. These **aircraft will be able to stay on station for long periods of time, supplying commanders with continuous surveillance. Their long endurance will enable them to serve as communication relays. Their quiet propulsion will allow them to fly undetected at low altitudes,** and thus **perform high-quality surveillance with low-resolution imaging systems. The hydrogen fuel can be electrolyzed directly from seawater onboard Navy ships, so** these **UAVs** **could reduce** some of the **logistics burdens associated with traditional fuels.¶ The ultimate benefit will be to replace large, manned aircraft** with smaller, less expensive fuel cell UAVs — keeping more personnel out of harm’s way and **improving tactical capabilities**, all by using a “green,” quiet, efficient, and affordable fuel system.

**UAVs key to force projection, application, and battlefield awareness—fuel cells key**

**Gross et al 11** Thomas, Albert Poche, Kevin Ennis, DOD Defense Logistics Agency Research & Development, 10/19, Beyond Demonstration: The Role of Fuel Cells in DoD's Energy Strategy, http://www.chfcc.org/publications/reports/dod-fuel-cell\_10-19-11\_dlafuelcells.pdf

**Future uses for unmanned vehicles may extend well beyond their current missions**. The Integrated Roadmap maps projected unmanned systems against JCAs to determine how **unmanned systems can contribute to DoD missions in the future**. Its conclusions indicate that **future unmanned systems could be key contributors to:**¶ Battlefield awareness. **Unmanned systems in all domains** can **significantly contribute to future battlefield awareness. Missions will include expeditionary runway evaluation, nuclear forensics, and special forces beach reconnaissance**. **Future applications will require longer mission endurance to conduct persistent reconnaissance and surveillance**.¶ Force application. **Unmanned systems are projected to have a large presence** in this JCA. **Future missions for UAVs include air-to-air combat and suppression and defeat of enemy air defense.** **UGVs are expected to conduct missions such as** non-lethal and lethal crowd control, dismounted **offensive operations, and armed reconnaissance and assault operations**. **UUV and unmanned surface vehicle missions are projected to include** mine laying as well as **mine neutralization**.¶ Protection. **Unmanned systems are projected to perform** tasks such as **firefighting**, **decontamination**, **forward operating base security**, installation security, obstacle construction and breaching, vehicle and personnel search and inspection, **mine clearance and neutralization**, more **sophisticated explosive ordnance disposal**, casualty extraction and evacuation, and maritime interdiction.¶ Logistics. **Unmanned systems are expected to transport supplies and perform maintenance tasks** such as inspection, decontamination, and refueling. Future safety-related tasks will include munitions and material handling and combat engineering.¶ Force support. **The capabilities of unmanned systems may allow them to have a significant impact on medical sup port.** **They** also could **contribute to nuclear and bio-weapon forensics** **and contaminated remains recovery**.¶ In March 2011, ONR issued a BAA seeking proposals on longendurance unmanned undersea vehicle propulsion. The BAA states, “**Greater breadth of mission profiles for current and future Naval UUVs require longer endurance stealthy propulsion systems that extend the current capability of 10–40 hours to several days or weeks.”¶** VALUE PROPOSITION FOR DoD BENEFITS¶ **For the unmanned vehicle application, mission accomplishment is** generally **the highest priority** consideration in making vehicle design and systems decisions. Compared to other power options, **fuel cells** can **provide improved mission capability**.¶ Increased mission endurance. **Fuel cell systems** can **increase flight duration for UAVs; time on station for UAVs and UUVs; and range for all unmanned vehicles** (“DoD Fuel Cell Activities” and “Other Fuel Cell Activities,” above.) **Current power sources limit** the ability of unmanned vehicles to support long-duration **missions**.¶ Reduced noise and heat signatures. **The sound and heat that conventional power systems produce sometimes limit how well unmanned vehicles can accomplish their missions. Fuel cells can be an attractive option for vehicles where sound or operating temperature are considerations**.¶ Increased efficiency. **Fuel cells are significantly more energy efficient** than internal combustion engines, which improves mission duration.[70]

**Key to ISR—solves crisis management**

**Trefz 3** John L, Jr., LCDR, US Navy, From Persistent ISR to Precision Strikes: The Expanding Role of UAVs, http://www.dtic.mil/dtic/tr/fulltext/u2/a420264.pdf

“Operational intelligence is directed at collection, analysis, and evaluation of information dealing with all aspects of the situation in a given theater of operation plus adjacent areas of interest.”21 **The ability to gather timely, relevant intelligence is critical to the success of any major operation** or campaign. **The capability to provide adequate coverage** of the operational commander’s Area of Responsibility (AOR) or Area of Interest (AOI) **depends on the integration of** both manned and **unmanned assets**. The level of effort will vary with the size (factor space) of the AOR/AOI and the time available (factor time) for intelligence collection.¶ During the pre-hostility stage of a conflict, **UAVs can assist manned assets** in the Intelligence Preparation of the Theater (IPT). **Easily transportable and rapidly deployable**, both the Global Hawk and Predator systems **can quickly respond to an emerging crisis**. **Their smaller “footprint” in a given theater allows the operational commander to gather intelligence with less** diplomatic and political **interference**. The deployment of manned platforms such as the JSTARS or Rivet Joint aircraft to monitor a given crisis results in a very large support package to sustain operations. Once these aircraft are in theater, Operational Security (OPSEC) becomes more challenging and Military Deception (MILDEC) may be lost.¶ **During the monitoring of adversary activity, the presence of easily identifiable, radar significant intelligence platforms makes easier the enemy’s job of hiding his activities**. **UAVs’ smaller size, combined with long endurance and unlimited sustainability, makes them the optimal platform during the pre-hostility phase of operations**.¶ Once hostilities commence, the **UAV remains the premier intelligence-gathering platform**. **The reduced ris**k to coalition aircraft and personnel in high-threat environments **makes UAV employment ideal**. Although systems such as the Global Hawk at $10 million per unit are not considered expendable, **the cost of losing one of these assets is insignificant when compared to the loss of a manned asset and its aircrew**. **The ability of UAVs to provide real-time BDA to the operational commander will allow more efficient allocation of follow-on strike assets to maximize their effects on the enemy’s ability to continue to resist**.¶ Command and Control Warfare (C2W)¶ Information Warfare (IW) is the “actions aimed at achieving information superiority by denying, exploiting, corrupting, or destroying the enemy’s information and information functions while protecting one’s own from enemy attack.”23 C2W uses OPSEC, MILDEC, PSYOPS, Electronic Warfare (EW) and Physical Destruction to defeat the enemy’s Command and Control (C2) functions while protecting one’s own.24 The UAV has the ability to accomplish all of these functions effectively.¶ As mentioned before, **the employment of UAVs for monitoring** and IPT **missions improves** both OPSEC and MILDEC **activities**. Additionally, the **psychological impact to the enemy of constant monitoring and surveillance cannot be overlooked. The ability of the UAV to maintain 24/7 coverage** of selected portions of the AOR **will make it virtually impossible for the enemy to determine if or when he is being watched**. The “CNN Factor” of **constant coverage will make him think that all his movements are under scrutiny**. **When you add a limited strike capability to the UAV,** such as armed Predators, **the adversary commander would have to assume that all UAVs are armed.¶** Another subset of C2W is Electronic Warfare (EW). This is an area where the UAV can tackle the “dull” and the “dangerous” missions presently performed by manned aircraft. The three parts of EW are Electronic Attack (EA), Electronic Protect (EP), and Electronic Support (ES).25 EA serves to deny the enemy’s operational commander the use of the electromagnetic spectrum while EP serves to safeguard the use of the same spectrum for our operational commander. ES involves those activities which serve to identify our enemy’s activities and help locate the threats (SIGINT is a by-product). ES also helps to provide Indications and Warnings (I&W) to our forces of immediate threats or potential future threats enhancing overall Force Protection. The Global Hawk **UAV is ideally suited for the mission of monitoring enemy electronic emissions and providing timely threat warnings to the operational commander**. **As UAV technology advances, they will prepare the battlefield by leading the way into high threat envelopes and neutralizing enemy air defense systems.** As mentioned before, they are not expendable, but their loss would be more acceptable than that of a manned aircraft.

**Key to de-escalate crises—the alternative is US deterrence collapse and regional instability**

**Alcazar 12** Vincent, Colonel, USAF, Winter, Crisis Management and the Anti-Access/Area Denial Problem, http://www.au.af.mil/au/ssq/2012/winter/alcazar.pdf

America’s political and military **leaders rely on unimpeded US force movements across strategic distances to stabilize regions and deter threatening regimes**. **That reliance depends on assured** air and naval **superiority as a precondition**. US leaders assume that with air and naval superiority during wartime, **the U**nited **S**tates **can secure its interests and attain its objectives through robust military intelligence, logistics, maneuver, and firepower**. **But the rise of** anti-access (**A2**) and area denial (**AD**) **strategies** and capabilities **poses a problem for US foreign policy: A2/AD thwarts US ability to project power and force on its own terms**. By using an A2/ AD strategy, **regional adversaries are able to contest US power projection** and presence. **This strategy and capability allows adversaries to oppose the U**nited **S**tates across its operational and strategic depth.¶ When Pres. Barack Obama and Secretary of Defense Leon Panetta unveiled the new DoD strategic guidance, Sustaining US Global Leadership: Priorities For The 21st Century Defense, on 3 January 2012, Secretary Panetta wrote in his introduction, “this country is at a strategic turning point after a decade of war and, therefore, we are shaping a Joint Force for the future that will be smaller and leaner, but will be agile, flexible, ready, and technologically advanced.”1 Additionally, “it [joint force] will have cutting edge capabilities, exploiting our technological, joint, and networked advantage.” The document referenced the challenges to US power projection by A2/AD and identified competitors to US power projection. Specifically, **China and Iran were cited as “[pursuing] asymmetric means to counter our power projection capabilities, while the proliferation of sophisticated weapons and technology will extend to nonstate actors** as well.”2 The A2/AD verbiage in the document indicates what must be done: **the U**nited **S**tates **must have assured methods of projecting military force where presence of that force will be contested**.3 The DoD strategic guidance document also discussed the recently completed Joint Operational Access Concept (JOAC).4 While the JOAC addresses how **US forces must be able to enter highly contested places**, it is not a conceptual design that promotes strategic theories for shaping and deterring A2/AD adversaries.5¶ Without a better understanding of the A2/AD problem and new ideas to assure its power and force projection, the United States will gradually lose its ability to shape regions and deter A2/AD adversaries. The A2/ AD challenge demands an offsetting strategy, a retooling of US power and force projection concepts, and an examination of the ways US power projection can shape A2/AD crisis management. This article presents the concept of A2/AD, including the nature of the problem, and amplifies the A2/AD strategy. It then offers a new crisis management design framework, followed by planning considerations for the future of A2/AD.¶ The terms in figure 1 make the case for an applied design concept to better manage crises in A2/AD settings. They imply the notion of the “A2/AD portfolio”—**an adversary’s** all-of-their-government **method of undermining regional stabilization** that also **blunts US projection of power and force.** The US “offsetting strategy” refers to a multilinear whole-of-government method geared to overcome the resistance and effects of a rival’s A2/AD strategy. ¶ The primary benefit of this design concept for crisis management is to ensure the United States can continue to use assured military presence and whole-of-government synchronized effort to strengthen its influence in key regions. Other benefits include improved understanding and specified design that allow the United States to better shape a crisis with an A2/AD adversary; or alternatively, better position its entry into conflict against an A2/AD threat. There are three premises which underlie this concept for crisis management: (1) the nature of war does not change, but the character of war does change from era to era,6 (2) the United States will need fresh theories and concepts of shaping, deterring, and war fighting less tethered to its traditions of annihilation warfare, and (3) **A2/AD will multiply US force attrition, erode its conventional deterrence, and undercut its ability to manage escalation and deescalation**.

**Nuclear War**

**Ferguson 04** professor of history at New York University's Stern School of Business and senior fellow at the Hoover Institution at Stanford University (Niall, “A World without Power”, Foreign Policy )

Could an apolar world today produce an era reminiscent of the age of Alfred? It could, though with some important and troubling differences. **Certainly, one can imagine the world's established powers—the United States, Europe, and China—retreating into their own regional spheres of influence**. But what of the growing pretensions to autonomy of the supranational bodies created under U.S. leadership after the Second World War? The United Nations, the International Monetary Fund, the World Bank, and the World Trade Organization (formerly the General Agreement on Tariffs and Trade) each considers itself in some way representative of the “international community.” Surely their aspirations to global governance are fundamentally different from the spirit of the Dark Ages? Yet universal claims were also an integral part of the rhetoric of that era. All the empires claimed to rule the world; some, unaware of the existence of other civilizations, maybe even believed that they did. The reality, however, was not a global Christendom, nor an all-embracing Empire of Heaven. **The reality was political fragmentation. And that is also true today. The defining characteristic of our age is not a shift of power upward to supranational institutions, but downward. With the end of states' monopoly on the means of violence and the collapse of their control over channels of communication, humanity has entered an era characterized as much by disintegration as integration. If free flows of information and of means of production empower multinational corporations and nongovernmental organizations (as well as evangelistic religious cults of all denominations), the free flow of destructive technology empowers both criminal organizations and terrorist cells.** These groups can operate, it seems, wherever they choose, from Hamburg to Gaza. By contrast, the writ of the international community is not global at all. It is, in fact, increasingly confined to a few Page 5 strategic cities such as Kabul and Pristina. In short, it is the nonstate actors who truly wield global power—including both the monks and the Vikings of our time. So **what is left? Waning empires. Religious revivals. Incipient anarchy. A coming retreat into fortified cities. These are the Dark Age experiences that a world without a hyperpower might quickly find itself reliving. The trouble is, of course, that this Dark Age would be an altogether more dangerous one than the Dark Age of the ninth century. For the world is much more populous—roughly 20 times more—so friction between the world's disparate “tribes” is bound to be more frequent. Technology has transformed production; now human societies depend not merely on freshwater and the harvest but also on supplies of fossil fuels that are known to be finite. Technology has upgraded destruction, too, so it is now possible not just to sack a city but to obliterate it. For more than two decades, globalization—the integration of world markets for commodities, labor, and capital—has raised living standards throughout the world, except where countries have shut themselves off from the process through tyranny or civil war. The reversal of globalization—which a new Dark Age would produce—would certainly lead to economic stagnation and even depression.** As the United States sought to protect itself after a second September 11 devastates, say, Houston or Chicago, it would inevitably become a less open society, less hospitable for foreigners seeking to work, visit, or do business. Meanwhile, as Europe's Muslim enclaves grew, Islamist extremists' infiltration of the EU would become irreversible, increasing trans-Atlantic tensions over the Middle East to the breaking point. An economic meltdown in China would plunge the Communist system into crisis, unleashing the centrifugal forces that undermined previous Chinese empires. Western investors would lose out and conclude that lower returns at home are preferable to the risks of default abroad. **The worst effects of the new Dark Age would be felt on the edges of the waning great powers. The wealthiest ports of the global economy—from New York to Rotterdam to Shanghai—would become the targets of plunderers and pirates. With ease, terrorists could disrupt the freedom of the seas, targeting oil tankers, aircraft carriers, and cruise liners,** while Western nations frantically concentrated on making their airports secure. Meanwhile**, limited nuclear wars could devastate numerous regions, beginning in the Korean peninsula and Kashmir, perhaps ending catastrophically in the Middle East.** In Latin America, wretchedly poor citizens would seek solace in Evangelical Christianity imported by U.S. religious orders**. In Africa, the great plagues of AIDS and malaria would continue their deadly work.** The few remaining solvent airlines would simply suspend services to many cities in these continents; who would wish to leave their privately guarded safe havens to go there? For all these reasons, the prospect of an apolar world should frighten us today a great deal more than it frightened the heirs of Charlemagne. **If the United States retreats from global hegemony**— its fragile self-image dented by minor setbacks on the imperial frontier—its critics at home and abroad must not pretend that they are ushering in a new era of multipolar harmony, or even a return to the good old balance of power. Be careful what you wish for**. The alternative to unipolarity would not be multipolarity at all. It would be apolarity—a global vacuum of power. And far more dangerous forces than rival great powers would benefit from such a not-so-new world disorder**

**UAVs key to interdictions in the Caribbean---solves the drug trade**

**Purdy 8** Ellen, director, Joint Ground Robotics Enterprise, within the Office of the Deputy Under Secretary of Defense for Acquisition and Technology, and is responsible for oversight and funding of ground robotics technology development, “The Increasing Role of Robots in National Security” May-June 2008, Defense AT&L, page 27

In U.S. Southern Command’s area of responsibility **in Central and South America and the Caribbean, one of the most significant threats to national security is the drug trade and narco-terrorism**. **Drug revenues finance and equip terrorists** and insurgents, **so if the movement of drugs can be interdicted, then funding** for insurgents **dries up.** **A significant challenge** for SOUTHCOM **is the immense variety of mountainous and jungle terrain that is difficult to see and maneuver through**, for which reasons, it is a haven for drug traffickers and insurgents. **Since so much of the drug trade operates in jungle conditions, and transport is largely conducted by river**, SOUTHCOM is exploring whether different **robotic systems could operate together to conduct reconnaissance and interdiction missions**.¶ Reduced Risk of Casualty¶ **Unmanned aerial vehicles equipped with foliage-penetrating radar could** potentially **scout areas of interest. If suspicious activity is detected, the aerial vehicle would then send g**lobal **p**ositioning **s**ystem **coordinates to unmanned vehicles on the ground** or on a river, **enabling the vehicles to conduct reconnaissance closer** to the area of interest. **Vast areas could be covered by the unmanned systems, and personnel would be sent in only after confirmation** that interdiction is warranted. **This is an idea that capitalizes on the advantages of robotics. Robots can operate for long periods without becoming fatigued and losing their sharp perception**—they don’t get tired or hungry—**and they keep personnel from being detected and harmed by insurgents**.

**That’s key to prevent Latin American instability, bioterror, and LNG attacks**

**Flynn and Bryan 1** Stephen, Senior Fellow @ CFR and Commander in US Coast Guard, and Anthony, Dir. North-South Center’s Caribbean Program, “Terrorism, Porous Borders, and Homeland Security: The Case for U.S.-Caribbean Cooperation”, October 21

**Terrorist acts can take place anywhere. The Caribbean is no exception**. Already the linkages between drug trafficking and terrorism are clear in countries like Colombia and Peru, and such connections have similar potential in the Caribbean. **The security of major industrial complexes in** some **Caribbean countries is vital. Petroleum refineries and major industrial estates in Trinidad, which host** more than 100 companies that produce the majority of the world’s methanol, ammonium sulphate, and **40 percent of U.S.** imports of liquefied natural gas (**LNG), are vulnerable targets**. Unfortunately, as experience has shown in Africa, the Middle East, and Latin America, **terrorists are likely to strike at U.S. and European interests in Caribbean countries**.¶ **Security issues become** even **more critical when one considers the** possible **use of Caribbean countries by terrorists as bases from which to attack the U**nited **S**tates. **An airliner hijacked** after departure **from** an airport in **the** northern **Caribbean** or the Bahamas **can be flying over South Florida in less than an hour. Terrorists can sabotage or seize control of a cruise ship after the vessel leaves a** Caribbean **port**. Moreover, terrorists with false passports and visas issued in the Caribbean may be able to move easily through passport controls in Canada or the United States. (To help counter this possibility, some countries have suspended "economic citizenship" programs to ensure that known terrorists have not been inadvertently granted such citizenship.) Again, **Caribbean countries are** as **vulnerable** as anywhere else **to** the clandestine **manufacture and deployment of bio**logical **weapons within national borders**.

**Bioterror causes extinction**

**Ochs 2** | Past president of the Aberdeen Proving Ground Superfund Citizens Coalition, Member of the Depleted Uranium Task force of the Military Toxics Project, and M of the Chemical Weapons Working Group [Richard Ochs, , June 9, 2002, “Biological Weapons Must Be Abolished Immediately,” <http://www.freefromterror.net/other_articles/abolish.html>]

Of all the weapons of mass destruction, the **genetically engineered biological weapons, many without a known cure or vaccine, are an extreme danger to the continued survival of life on earth**. Any perceived military value or deterrence pales in comparison to the great risk these weapons pose just sitting in vials in laboratories. While a “**nuclear** winter,” resulting from a massive exchange of nuclear weapons, could also kill off most of life on earth and severely compromise the health of future generations, they **are easier to control. Biological weapons, on the other hand, can get out of control very easily**, as the recent anthrax attacks has demonstrated. There is no way to guarantee the security of these doomsday weapons because very **tiny amounts** can be stolen or accidentally released and then **grow or be grown to horrendous proportions**. The Black Death of the Middle Ages would be small in comparison to the potential damage bioweapons could cause. Abolition of chemical weapons is less of a priority because, while they can also kill millions of people outright, their persistence in the environment would be less than nuclear or biological agents or more localized. Hence, chemical weapons would have a lesser effect on future generations of innocent people and the natural environment. Like the Holocaust, once a localized chemical extermination is over, it is over. With nuclear and biological weapons, the killing will probably never end. Radioactive elements last tens of thousands of years and will keep causing cancers virtually forever. Potentially worse than that, bio-engineered **agents by the hundreds with no known cure could wreck even greater calamity on the human race** than could persistent radiation. AIDS and ebola viruses are just a small example of recently emerging plagues with no known cure or vaccine. Can we imagine hundreds of such plagues? HUMAN **EXTINCTION IS NOW POSSIBLE**. Ironically, the Bush administration has just changed the U.S. nuclear doctrine to allow nuclear retaliation against threats upon allies by conventional weapons. The past doctrine allowed such use only as a last resort when our nation’s survival was at stake. Will the new policy also allow easier use of US bioweapons? How slippery is this slope?

**Latin American instability causes nuke war**

**Rochlin 94** James Francis, Professor of Political Science at Okanagan University College, “Discovering the Americas: the evolution of Canadian foreign policy towards Latin America,” p. 130-131.

While there were economic motivations for Canadian policy in Central America, security considerations were perhaps more important. Canada possessed an interest in promoting stability in the face of a potential decline of U.S. hegemony in the Americas. Perceptions of declining U.S. influence in the region – which had some credibility in 1979-1984 due to the wildly inequitable divisions of wealth in some U.S. client states in Latin America, in addition to political repression, under-development, mounting external debt, anti-American sentiment produced by decades of subjugation to U.S. strategic and economic interests, and so on – were linked to the prospect of explosive events occurring in the hemisphere. Hence, the Central American imbroglio was viewed as a fuse which could ignite a cataclysmic process throughout the region. Analysts at the time worried that in a worst case scenario**, instability created by a regional war**, beginning in Central America and spreading elsewhere **in Latin America**, **might preoccupy Washington to the extent that the United States would be unable to perform adequately its important hegemonic role in the international arena** – a concern expressed by the director of research for Canada’s Standing Committee Report on Central America. It was feared that **such a predicament could generate increased global instability and** perhaps even **a hegemonic war**. This is one of the motivations which led Canada to become involved in efforts at regional conflict resolution, such as Contadora, as will be discussed in the next chapter.

**LNG accidents cause extinction**

**Lovins 1** Hunter and Amory Lovins work together as analysts, lecturers and consultants on energy, resource and security policy in over 30 countries. Hunter Lovins has degrees in Law, Political Studies and Sociology and an honorary doctorate, and is a member of the California Bar. For six years she was assistant Director of the California Conservation project. Amory Lovins is a consultant experimental physicist, educated at Harvard and Oxford, who has published 23 books (many co-authored with Hunter) and several hundred papers. He has held various academic chairs, received six honorary doctorates, served on the US Department of Energy's senior advisory board, and consulted (often with Hunter) for scores of energy companies, manufacturing firms, governments and international organisations. The Lovineses have received numerous awards for their work. Brittle Power : Energy Strategy for National Security – Rocky Mountain Institute -- http://www.rmi.org/images/other/S-BrPwr-Parts123.pdf -- also available @ http://www.transitcommerce.com/Harpswell/weeks.asp

LNG is less than half as dense as water, so a cubic meter of LNG (the usual unit of measure) weighs just over half a ton. **LNG contains about thirty per-cent less energy per cubic meter than oil, but is potentially far more hazardous**. Burning oil cannot spread very far on land or water, but a cubic meter of spilled LNG rapidly boils into about six hundred twenty cubic meters of pure natural gas, which in turn mixes with surrounding air. Mixtures of between about five and fourteen percent natural gas in air are flammable. Thus **a single cubic meter of spilled LNG can make up to twelve thousand four hundred cubic meters of flammable gas-air mixture**. **A single modern LNG tanker typically holds** one hundred twenty-five thousand cubic meters of LNG, **equivalent to** twenty-seven hundred million cubic feet of natural gas. That gas can form **between about twenty and fifty billion cubic feet of flammable gas-air mixture**—several hundred times the volume of the Great Pyramid of Cheops. About nine percent of such a tankerload of LNG will probably, if spilled onto water, boil to gas in about five minutes. (It does not matter how cold the water is; it will be at least two hundred twenty-eight Fahrenheit degrees hotter than the LNG, which it will therefore cause to boil violently.) **The resulting gas**, however, **will be so cold that it will still be denser than air**. **It will** therefore **flow in a cloud or plume along the surface until it reaches an ignition source**. Such a plume might extend at least three miles downwind from a large tanker spill within ten to twenty minutes. It might ultimately reach much farther—perhaps six to twelve miles. **If not ignited, the gas is asphyxiating. If ignited, it will burn to completion with a turbulent diffusion flame reminiscent of the 1937 Hindenberg disaster but about a hundred times as big**. **Such a fireball would burn everything within it, and by its radiant heat would cause third-degree burns and start fires a mile or two away**. **An LNG fireball can blow through a city**, creating “a very large number of ignitions and explosions across a wide area. **No present or foreseeable equipment can put out avery large [LNG]... fire**.” **The energy content of a single standard LNG tanker** (one hundred twenty-five thousand cubic meters) **is equivalent to** seven-tenths of a megaton of TNT, or about **fifty-five Hiroshima bombs.**

**Plan**

**The Department of Defense should acquire, through alternative financing, electricity from nuclear reactors fewer than 300 megawatts for military bases in the United States.**

**Contention 3- Solvency**

**DoD acquisition of SMR’s ensures rapid military adoption**

**Andres 11**

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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 U**nited **S**tates; 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 [FOOTNOTE 29: **There are** numerous **actions that the Federal Government could take**, such as conducting or funding research and development, stimulating private investment, demonstrating technology, mandating adoption, and guaranteeing markets. **Military procurement** is thus only one option, but it has often **played a decisive role in technology development and is likely to be the catalyst for the U.S. small reactor industry.** See Vernon W. Ruttan, Is War Necessary for Economic Growth? (New York: Oxford University Press, 2006); Kira R. Fabrizio and David C. Mowery, “The Federal Role in Financing Major Inventions: Information Technology during the Postwar Period,” in Financing Innovation in the United States, 1870 to the Present, ed. Naomi R. Lamoreaux and Kenneth L. Sokoloff (Cambridge, MA: The MIT Press, 2007), 283–316.] Historically, **nuclear power has been “the most clear-cut example . . . of an importan tgeneral-purpose technology that in the absence of military** and defense related **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, **M**assachusetts **I**nstitute of **T**echnology 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.** Domestic Nuclear Expertise. From the perspective of larger national security issues, **if DOD does not catalyze the small reactor industry, there is a risk that expertise in small reactors could become dominated by foreign companies**. A 2008 Defense Intelligence Agency report warned that the United States will become totally dependent on foreign governments for future commercial nuclear power unless the military acts as the prime mover to reinvigorate this critical energy technology with small, distributed power reactors.38 **Several of the most prominent small reactor concepts rely on technologies perfected at Federally funded laboratories and research programs**, including the Hyperion Power Module (Los Alamos National Laboratory), NuScale (DOE-sponsored research at Oregon State University), IRIS (initiated as a DOE-sponsored project), Small and Transportable Reactor (Lawrence Livermore National Laboratory), and Small, Sealed, Transportable, Autonomous Reactor (developed by a team including the Argonne, Lawrence Livermore, and Los Alamos National Laboratories). **However, there are scores of competing designs under development from over a dozen countries. If DOD does not act early to support the U.S. small reactor industry, there is a chance that the industry could be dominated by foreign companies**. Along with other negative consequences, **the decline of the U.S. nuclear industry decreases the NRC’s influence on the technology that supplies the world’s rapidly expanding demand for nuclear energy. Unless U.S. companies begin to retake global market share, in coming decades France, China, South Korea, and Russia will dictate standards on nuclear reactor reliability, performance, and proliferation resistance**.

**Alternative financing cuts costs**

**Fitzpatrick 11**

Ryan Fitzpatrick, Senior Policy Advisor for Clean Energy at Third Way, Josh Freed, Vice President for Clean Energy at Third Way, and Mieke Eoyan, Director for National Security at Third Way, June 2011, Fighting for Innovation: How DoD Can Advance CleanEnergy Technology... And Why It Has To, content.thirdway.org/publications/414/Third\_Way\_Idea\_Brief\_-\_Fighting\_for\_Innovation.pdf

The DoD has over $400 billion in annual purchasing power, **which means the Pentagon could provide a sizeable market for new technologies**. **This can increase a technology’s scale of production, bringing down costs, and making the product more likely to successfully reach commercial markets**. **Unfortunately**, many potentially significant clean energy **innovations never get to the marketplace, due to a lack of capital during** the development and **demonstration stages. As a result, technologies that could help the military** meet its clean energy security and cost goals **are being abandoned or co-opted by competetors like China** before they are commercially viable here in the U.S. **By focusing its purchasing power on innovative products that will** help **meet its energy goals, DoD can provide** more **secure** and **cost-effective energy to the military—producing tremendous long-term savings**, while also **bringing** potentially **revolutionary technologies to the public**. Currently, many of these **technologies are passed over during** the **procurement** process **because of** higher **upfront costs—even if these technologies can reduce life-cycle costs** to DoD. The Department has only recently begun to consider life-cycle costs and the “fullyburdened cost of fuel” (FBCF) when making acquisition decisions. However, initial reports from within DoD suggest that the methodology for determining the actual FBCF needs to be refined and made more consistent before it can be successfully used in the acquisition process.32 The Department should fast-track this process to better maximize taxpayer dollars. Congressional appropriators— and the Congressional Budget Office—should also recognize the **savings that can be achieved by procuring advanced technologies to promote DoD’s energy goals**, even if these procurements come with higher upfront costs. **Even if the Pentagon makes procurement of emerging clean energy technologies a higher priority, it still faces real roadblocks in developing relationships with the companies that make them. Many clean energy innovations are developed by small businesses or companies that have no previous experience working with military procurement officers. Conversely, many procurement officers do not know the clean energy sector and are not incentivized to develop relationships with emerging clean energy companies**. Given the stakes in developing domestic technologies that would help reduce costs and improve mission success, the Pentagon should develop a program to encourage a better flow of information between procurement officers and clean energy companies—especially small businesses. Leverage Savings From Efficiency and Alternative Financing to Pay for Innovation. **In an age of government-wide austerity and tight** Pentagon **budgets**, current congressional **appropriations are simply not sufficient** to fund clean energy innovation. **Until Congress decides to direct additional resources** for this purpose, the **Defense** Department **must leverage** the money and other **tools it already has** to help develop clean energy. This can take two forms: repurposing money that was saved through energy efficiency programs for innovation and using alternative methods of financing to reduce the cost to the Pentagon of deploying clean energy. For several decades **the military has made** modest **use alternative financing** **mechanisms to fund** clean **energy** and efficiency **projects when appropriated funds were insufficient**. In a 2010 report, GAO found that while only 18% of renewable energy projects on DoD lands used alternative financing, these projects account for 86% of all renewable energy produced on the Department’s property.33 This indicates that **alternative financing can be particularly helpful to DoD in terms of bringing larger and more expensive projects to fruition**. One advanced financing tool available to DoD is **the energy savings performance contract** (ESPC). These agreements **allow DoD to contract a private firm to make upgrades to a building or other facility that result in energy savings, reducing overall energy costs without appropriated funds**. **The firm finances the cost, maintenance and operation of these upgrades and recovers a profit over the life of the contract**. While mobile applications consume 75% of the Department’s energy,34 DoD is only authorized to enter an ESPC for energy improvements done at stationary sites. As such, Congress should allow DoD to conduct pilot programs in which ESPCs are used to enhance mobile components like aircraft and vehicle engines. This could accelerate the needed replacement or updating of aging equipment and a significant reduction of energy with no upfront cost. To maximize the potential benefits of ESPCs, DoD should work with the Department of Energy to develop additional training and best practices to ensure that terms are carefully negotiated and provide benefits for the federal government throughout the term of the contract.35 This effort could possibly be achieved through the existing memorandum of understanding between these two departments.36 The Pentagon should also consider using any long-term savings realized by these contracts for other energy purposes, including the promotion of innovative technologies to further reduce demand or increase general energy security. In addition to ESPCs, **the Pentagon** also **can enter into** extended agreements with utilities to use DoD land to generate electricity, or for the **long-term purchase of energy**. **These** **innovative financing mechanisms**, known respectively as enhanced use leases (EULs) and power purchase agreements (PPAs), **provide a valuable degree of certainty to third party generators**. In exchange, the **Department can leverage its existing resources**—either its land or its purchasing power—**to negotiate lower electricity rates** and dedicated sources of locallyproduced power with its utility partners. **DoD has unique authority among federal agencies to enter extended 30-year PPAs**, **but only for geothermal energy projects and only with direct approval from the Secretary of Defense**. Again, limiting incentives for clean energy generation to just geothermal power inhibits the tremendous potential of other clean energy sources to help meet DoD’s energy goals. **Congress should consider opening this incentive up to other forms of clean energy generation**, including the production of advanced fuels. Also, given procurement officials’ lack of familiarity with these extended agreements and the cumbersome nature of such a high-level approval process, the unique authority to enter into extended 30-year PPAs is very rarely used.37 DoD should provide officials with additional policy guidance for using extended PPAs and Congress should simplify the process by allowing the secretary of each service to approve these contracts. Congress should also investigate options for encouraging regulated utility markets to permit PPA use by DoD. Finally, when entering these agreements, the Department should make every effort to promote the use of innovative and fledgling technologies in the terms of its EULs and PPAs. CON C L U S ION **The Defense Department is in a unique position to foster and deploy innovation in clean energy technologies**. This has two enormous benefits for our military: it will make our troops and our facilities more secure and it will reduce the amount of money the Pentagon spends on energy, freeing it up for other mission critical needs. If the right steps are taken by Congress and the Pentagon, the military will be able to put its resources to work developing technologies that will lead to a stronger fighting force, a safer nation, and a critical emerging sector of the American economy. **The Defense Department has helped give birth to technologies and new economic sectors dozens of times before**. For its own sake and the sake of the economy, **it should make clean energy innovation its newest priority**.

**SMRs are cost-effective, safe, fuel efficient- their defense doesn’t apply**

**Szondy 12**

David, freelance writer based in Monroe, Washington. An award-winning playwright, he has contributed to Charged and iQ magazine and is the author of the website Tales of Future Past, February 16, "Feature: Small modular nuclear reactors - the future of energy?", [www.gizmag.com/small-modular-nuclear-reactors/20860/](http://www.gizmag.com/small-modular-nuclear-reactors/20860/)

Small Modular Reactors¶ **One way of getting around many** of these **problems is through** the **development of small modular reactors** (SMR). **These are reactors capable of generating** about **300 megawatts of power** or less, which is enough to run 45,000 US homes. **Though small, SMRs are proper reactors**. They are quite different from the radio-thermal generators (RTG) used in spacecraft and remote lighthouses in Siberia. **Nuclear reactors such as SMRs use controlled nuclear fission to generate power while RTGs use natural radioactive decay to power a** relatively simple thermoelectric **generator** that can only produce, at most, about two kilowatts.¶ In terms of power, RTGs are the equivalent of batteries while small nuclear reactors are only "small" when compared to conventional reactors. They are hardly the sort that you would keep in the garage. In reality, SMR power plants would cover the area of a small shopping mall. Still, such an installation is not very large as power plants go and a reactor that only produces 300 megawatts may not seem worth the investment, but **the US Department of Energy is offering US$452 million in matching grants to develop SMRs** and private investors like the Bill Gates Foundation and the company of Babcock and Wilcox are putting up money for their own modular reactor projects.¶ The 60-year old breakthrough¶ **One reason for government and private industry to take an interest in SMRs is that they've been successfully employed for** much **longer than** most **people realize**. In fact, **hundreds have been steaming around the world inside the hulls of nuclear submarines and other warships for sixty years**. They've also been used in merchant ships, icebreakers and as research and medical isotope reactors at universities. There was even one installed in the Antarctic at McMurdo Station from 1962 to 1972. **Now they're being considered for domestic use**.¶ The case for SMRs¶ **SMRs have a number of advantages over conventional reactors**. For one thing, **SMRs are cheaper to construct and run**. This makes them very attractive to poorer, energy-starved countries; small, growing communities that don't require a full-scale plant; and remote locations such as mines or desalination plants. Part of the reason for this is simply that the reactors are smaller. Another is that, not needing to be custom designed in each case, **the reactors can be standardized and some types built in factories that are able to employ economies of scale. The factory-built aspect is also important because a factory is more efficient than on-site construction by as much as eight to one in terms of building time. Factory construction also allows SMRs to be built, delivered to the site, and then returned to the factory for dismantling** at the end of their service lives - **eliminating a major problem with old conventional reactors, i.e. how to dispose of them.¶ SMRs** also **enjoy** a good deal of **design flexibility**. **Conventional reactors are usually cooled by water** - a great deal of water - **which means that the reactors need to be situated near rivers or coastlines. SMRs, on the other hand, can be cooled by air, gas, low-melting point metals or salt**. This means that **SMRs can be placed in remote, inland areas where it isn't possible to site conventional reactors**.¶ Safety¶ **This cooling system is** often **passive**. In other words**, it relies more on the natural circulation of the cooling medium within the reactor's containment flask than on pumps. This passive cooling is one of the ways that SMRs can improve safety. Because modular reactors are smaller** than conventional ones, **they contain less fuel**. This means that **there's less of a mass to be affected if an accident occurs**. If one does happen, there's less radioactive material that can be released into the environment and makes it easier to design emergency systems. **Since they are smaller and use less fuel, they are easier to cool effectively, which greatly reduces the likelihood of a catastrophic accident or meltdown in the first place.¶** This also means that **accidents proceed much slower in modular reactors than** in **conventional ones. Where the latter need accident responses in** a matter of hours or **minutes, SMRs can be responded to in** hours or **days, which reduces the chances of an accident resulting in major damage** to the reactor elements.¶ **The SMR designs that reject water cooling** in favor of gas, metal or salt **have their own safety advantages**. Unlike water-cooled reactors, **these media operate at a lower pressure**. One of the hazards of water cooling is that a cracked pipe or a damaged seal can blow radioactive gases out like anti-freeze out of an overheated car radiator. With low-pressure media, there's less force to push gases out and there's less stress placed on the containment vessel. **It also eliminates one of the frightening episodes of the Fukushima accident where the water in the vessel broke down** into hydrogen and oxygen **and** then **exploded**.¶ **Another advantage of modular design is that some SMRs are small enough to be installed below ground. That is cheaper, faster to construct and less invasive** than building a reinforced concrete containment dome. There is also the point that **putting a reactor in the ground makes it less vulnerable to earthquakes. Underground installations make modular reactors easier to secure and install in a much smaller footprint. This makes SMRs particularly attractive to military customers who need to build power plants for bases quickly.** **Underground installation also enhances security with fewer sophisticated systems needed, which** also **helps bring down costs**.¶ **SMRs can help with** proliferation, **nuclear waste and fuel supply issues** because, while some modular reactors are based on conventional pressurized water reactors and burn enhanced uranium, others use less conventional fuels. **Some**, for example, **can generate power from what is now regarded as "waste", burning depleted uranium and plutonium left over from conventional reactors. Depleted uranium is** basically **U-238 from** which the **fissible U-235 has been consumed. It's** also **much more abundant in nature than U-235, which has the potential of providing the world with energy for thousands of years. Other reactor designs don't even use uranium**. Instead, **they use thorium. This fuel is also incredibly abundant, is easy to process for use as fuel and has the added bonus of being utterly useless for making weapons**, so it can provide power even to areas where security concerns have been raised.¶ But there's still the sticking point that modular reactors are, by definition, small. That may be fine for a submarine or the South Pole, but what about places that need more? Is the alternative conventional nuclear plants? It turns out that the answer is no. **Modular reactors don't need to be used singly. They can be set up in batteries of five or six or even more**, providing as much power as an area needs. And **if one unit needs to be taken off line for repairs or even replacement, it needn't interfere with the operation of the others**.

**DoD needs to lead**

**Energy Washington Week 10**

(“DOD STRESSING NEED FOR NRC COLLABORATION ON 'MINI' REACTOR BUILD OUT” July 5, 2010, Vol. 7 No. 27)

The U.S. Army is rejecting arguments by some industry and government officials who say military bases could proceed to build small modular reactors (SMRs) on military bases without Nuclear Regulatory Commission (NRC) certification and license approvals. Instead, the Department of Defense (DOD) believes it must work closely with NRC and that legislation will likely be needed to clearly define the various agency roles before the novel nuclear energy systems are constructed, according to DOD and industry sources. A senior DOD source also says that a collaborative arrangement between DOE, DOD, and NRC will be needed to begin constructing reactors that currently have not been licensed by the NRC -- including all prominent SMR models being examined by the three agencies for potential licensing and deployment. **Small reactor industry and government proponents have been struggling to find ways to accelerate** the **development of small reactors, including through the use of military bases as a test bed for building and demonstrating the reactors ahead of NRC certification of SMR designs**, according to industry sources, who note that NRC approval is required before a utility can apply for a license to build a small reactor. One senior industry consultant says **the NRC does not have authority over military bases and therefore a non-certified reactor could be built there without the technology being vetted by NRC.** **While industry proponents want NRC certification, they see it as slow because of a lack of resources to review the new reactors and certify the designs**, says the industry consultant. **Building the reactors on military bases would help demonstrate SMR functionality that would eventually help accelerate commercial licensing**, says the source.

**Squo SMR incentives trigger the link**

Ken **Silverstein**, Forbes, **1/15**/13, After Fukushima, U.S. Seeks to Advance Small Nuclear Reactors, www.forbes.com/sites/kensilverstein/2013/01/15/after-fukushima-u-s-seeks-to-advance-small-nuclear-reactors/

Two years ago, some thought that the nuclear energy had been leveled. But **the industry today is picking up steam** by getting construction licenses to build four new units and by **getting government funding to develop smaller nuclear reactors** that are less expensive and which may be less problematic when it comes to winning regulatory approval. The creators of those roughly 100-megawatt electric modules want to sell their products first in this country before they would market them overseas to lesser-developed nations that don’t have a huge transmission infrastructure. They would be factory-built before being shipped and fueled to where the energy is needed. To the extent that more electric generation is required, no problem: Just lay the small-scale modules next to each other, making the financial outlays more manageable. “Restarting the nation’s nuclear industry and advancing small modular reactor technologies will help create new jobs and export opportunities for American workers and businesses, and ensure we continue to take an all-of-the-above approach to American energy production,” says Energy Secretary Steven Chu. To that end, the Obama administration is partnering with Babcock & Wilcox and Bechtel to develop those smaller nuclear reactors for the federally-owned utility Tennessee Valley Authority. The **Department** **of** **Energy is expected to invest** about $**450 million in the project**, which equates to roughly half of the overall cost. Industry will pony up the other half.

## Rd 5

### Contention 1- Grid

#### Domestic DoD bases are vulnerable due to connectivity to the civilian grid–only SMRs solve

Robitaille 12

(George, Department of Army Civilian, United States Army War College, “Small Modular Reactors: The Army’s Secure Source of Energy?” 21-03-2012, Strategy Research Project)

In recent years, the U.S Department of Defense (DoD) has identified a security issue at our installations related to the dependence on the civilian electrical grid. 1 The DoD depends on a steady source of electricity at military facilities to perform the functions that secure our nation. The flow of electricity into military facilities is controlled by a public grid system that is susceptible to being compromised because of the age of the infrastructure, damage from natural disasters and the potential for cyber attacks. Although most major functions at military installations employ diesel powered generators as temporary backup, the public grid may not be available to provide electricity when it is needed the most. The United States electrical infrastructure system is prone to failures and susceptible to terrorist attacks. 2 It is critical that the source of electricity for our installations is reliable and secure. In order to ensure that our military facilities possess a secure source of electricity, either the public system of electric generation and distribution is upgraded to increase its reliability as well as reducing its susceptibility to cyber attack or another source of electricity should be pursued. Although significant investments are being made to upgrade the electric grid, the current investment levels are not keeping up with the aging system. Small modular reactors (SMRs) are nuclear reactors that are about an order of magnitude smaller than traditional commercial reactor used in the United States. SMRs are capable of generating electricity and at the same time, they are not a significant contributor to global warming because of green house gas emissions. The DoD needs to look at small modular nuclear reactors (SMRs) to determine if they can provide a safe and secure source of electricity. Electrical Grid Susceptibility to Disruptions 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. 3 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. 9 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.

#### The grid is vulnerable – multiple different threats cause year long blackouts

Magnuson 12

(Stew Magnuson, managing editor of National Defense Magazine, Washington, D.C.-based journalist and the author of The Death of Raymond Yellow Thunder: And Other True Stories from the Nebraska-Pine Ridge Border Towns, the Nebraska Nonfiction Book of the Year for 2009, bronze medal in the regional nonfiction category, September 2012, “Feds Fear Coordinated Physical, Cyber-Attacks on Electrical Grids,” http://www.nationaldefensemagazine.org/archive/2012/september/Pages/FedsFearCoordinatedPhysical,Cyber-AttacksonElectricalGrids.aspx)

Electrical grids in the United States are vulnerable to both cyber-attacks and space weather, federal officials have said. But an assault that combines the skills of a hacker with a physical attack on key parts of a grid’s infrastructure may result in hundreds of millions of U.S. homes and businesses losing electricity. “I am most concerned about coordinated physical and cyber-attacks intended to disable elements of the power grid or deny electricity to specific targets, such as government or business centers, military installations, or other infrastructures,” Gerry Cauley, president and CEO of the North American Electric Reliability Corp., said at a recent Senate hearing. Scott Pugh, of the Department of Homeland Security’s interagency program office, said at an energy conference in April that there are maps — not available for public viewing — that “show you a handful of substations — six or so — [where] you could take out those six substations and black out most of the U.S. east of the Mississippi, if you knew which six [they] were. And in many cases you could do it **with a hunting rifle from a couple hundred yards away**.” There are some 1,500 companies that generate electricity in the United States, and the hodgepodge of federal agencies that oversee them have limited statutory authorities to force them to protect themselves against attacks, the Senate Energy and Natural Resources Committee hearing revealed. “Limitations in federal authority do not fully protect the grid against physical and cyberthreats,” Joseph McClelland, director of the office of reliability at the Federal Energy Regulatory Commission, said. Legislation passed in 2005 gave the agency the authority to impose reliability standards on “bulk,” or large-scale, power systems. That law excludes local distribution facilities, federal installations located inside grids, and major cities such as New York. Hawaii and Alaska also don’t fall under the commission’s jurisdiction. Officials are concerned about two threats: electromagnetic pulses, which come from solar storms or weapons, and cyber-attacks, particularly on “smartgrids,” which it turns out, are not very “smart” when it comes to protecting against hackers. “No single security asset, technique, procedure or standard — even if strictly followed — will protect an entity from all potential cyberthreats,” said Gregory Wilshusen, director of information security issues at the Government Accountability Office. “The cybersecurity threat environment is constantly changing and our defenses must keep up.” However, in the case of smartgrids, utilities continue to employ them without the necessary safeguards, the GAO has found. There is a lack of security features consistently being integrated into smartgrids and the current regulatory environment makes it difficult to ensure that power companies are properly protecting them. Physical attacks against the grid can cause equal or greater destruction than cyber-attacks, McClelland said. An electromagnetic pulse, or EMP event, could seriously degrade or shut down large swaths of the nation. Depending on the attack, **a significant part of the infrastructure could be “out of service for** periods measured in months to **a year or more**,” he said. “The self-reporting requirements, the enforcement provisions under the existing standards are important,” he said. “But at the end of the day, if there’s no enforcement provisions, there’s no teeth behind the provisions.” The National Institute of Standards and Technology has guidelines for utilities to gird themselves from physical and cyber-attacks, but they do not address coordinated attacks, said Wilshusen. NIST “guidelines did not address an important element essential to securing smartgrid systems — the risk of attacks using both cyber and physical means.” Meanwhile, there have been three major studies that looked at the possible effects of a massive solar storm on U.S. electrical grids. They reached different conclusions, Pugh said at the National Defense Industrial Association Environment, Energy Security and Sustainability symposium in New Orleans. Experts are trying to map the grid and figure out what would happen in the event of an attack or solar storm, Pugh said. But there is nothing that requires the 1,500 companies to share proprietary data about their equipment, so coming to firm conclusions is difficult. Transformers — which number about 2,000 nationwide — are a key vulnerability. Strong electrical pulses caused by a weapon or solar storm can irreparably damage them, he said. “If you need a dozen of those tomorrow because somebody attacked the grid, or we had a space weather event that took out a dozen, you might be waiting quite a while,” he said. They weigh about 300 tons, can only be delivered by special rail car, and most are now manufactured overseas.

#### Those communication breakdowns go nuclear and decimate military operations

Andres 11

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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.7 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. 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.

#### Regardless of relative power, military operations solve all conflict.

Kagan and O’Hanlon 7

Frederick Kagan and Michael O’Hanlon, Fred’s a resident scholar at AEI, Michael is a senior fellow in foreign policy at Brookings, “The Case for Larger Ground Forces”, April 24, 2007, <http://www.aei.org/files/2007/04/24/20070424_Kagan20070424.pdf>

We live at a time when wars not only rage in nearly every region but threaten to erupt in many places where the current relative calm is tenuous. To view this as a strategic military challenge for the United States is not to espouse a specific theory of America’s role in the world or a certain political philosophy. Such an assessment flows directly from the basic bipartisan view of American foreign policy makers since World War II that overseas threats must be countered before they can directly threaten this country’s shores, that the basic stability of the international system is essential to American peace and prosperity, and that no country besides the United States is in a position to lead the way in countering major challenges to the global order. Let us highlight the threats and their consequences with a few concrete examples, emphasizing those that involve key strategic regions of the world such as the Persian Gulf and East Asia, or key potential threats to American security, such as the spread of nuclear weapons and the strengthening of the global Al Qaeda/jihadist movement. The Iranian government has rejected a series of international demands to halt its efforts at enriching uranium and submit to international inspections. What will happen if the US—or Israeli—government becomes convinced that Tehran is on the verge of fielding a nuclear weapon? North Korea, of course, has already done so, and the ripple effects are beginning to spread. Japan’s recent election to supreme power of a leader who has promised to rewrite that country’s constitution to support increased armed forces—and, possibly, even nuclear weapons— may well alter the delicate balance of fear in Northeast Asia fundamentally and rapidly. Also, in the background, at least for now, SinoTaiwanese tensions continue to flare, as do tensions between India and Pakistan, Pakistan and Afghanistan, Venezuela and the United States, and so on. Meanwhile, the world’s nonintervention in Darfur troubles consciences from Europe to America’s Bible Belt to its bastions of liberalism, yet with no serious international forces on offer, the bloodletting will probably, tragically, continue unabated. And as bad as things are in Iraq today, they could get worse. What would happen if the key Shiite figure, Ali al Sistani, were to die? If another major attack on the scale of the Golden Mosque bombing hit either side (or, perhaps, both sides at the same time)? Such deterioration might convince many Americans that the war there truly was lost—but the costs of reaching such a conclusion would be enormous. Afghanistan is somewhat more stable for the moment, although a major Taliban offensive appears to be in the offing. Sound US grand strategy must proceed from the recognition that, over the next few years and decades, the world is going to be a very unsettled and quite dangerous place, with Al Qaeda and its associated groups as a subset of a much larger set of worries. The only serious response to this international environment is to develop armed forces capable of protecting America’s vital interests throughout this dangerous time. Doing so requires a military capable of a wide range of missions—including not only deterrence of great power conflict in dealing with potential hotspots in Korea, the Taiwan Strait, and the Persian Gulf but also associated with a variety of Special Forces activities and stabilization operations. For today’s US military, which already excels at high technology and is increasingly focused on re-learning the lost art of counterinsurgency, this is first and foremost a question of finding the resources to field a large-enough standing Army and Marine Corps to handle personnel intensive missions such as the ones now under way in Iraq and Afghanistan.

#### And it makes the military ineffective–collapses hegemony.

CNA 9

Center for Naval Analyses Military Adviser Board, Chaired by General Charles Wald, USAF (Ret.) Former Deputy Commander, Headquarters U.S. European Command (USEUCOM), May 2009, Powering America’s Defense: Energy and the Risks to National Security, https://www.cna.org/sites/default/files/Powering%20Americas%20Defense.pdf

Our **vulnerabilities from energy use** are not limited to battlefields and forward operating bases; they also **exist at home**. The **biggest impacts** may be local, but can **extend to locations and operations around the world.** In August 2003, 50 million people living in the Northeast, Midwest, and Ontario were suddenly left in the dark when their electric power failed. More than 500 generating units at 265 power plants shut down—a quiet collapse cascading across the landscape. Most homes and businesses regained power within a day (though some plants took two weeks to regain full capacity), a quick restoration that was possible primarily because no significant equipment was damaged. Still, critical national security systems failed. U.S. border check systems were not fully operational, causing a severe backup of truck traffic on our northern boundary. There were related effects from the outage as well. Water and sewage plants shut down. Gas stations stopped working, and rail service was curtailed. Many cellular phone providers, radio stations, and television stations lost service—their backup power systems were insufficient. The blackout is estimated to have caused economic losses of $7 to $10 billion [55]. The trigger for this massive blackout was tragically simple: An Ohio utility had failed to properly trim trees near a power line. American utilities have experience responding to interruptions caused by extreme weather. Even after severe ice storms and hurricanes, power is most often restored within a few days. But the effects of a long-term power outage are unknown. Our ability to recover from a dedicated attack is also not known—except to say that a deliberate attack would require a different response. There have been numerous attacks on the operating systems of major critical infrastructure facilities, including power grids, around the world in recent years: • In one instance outside the U.S., a power outage was triggered that affected multiple cities; in other instances, hackers have extorted hundreds of millions of dollars out of their victims [57, 58]. • Foreign cyber spies are also a serious concern: U.S. Homeland Security and Intelligence officials revealed that Chinese and Russian spies have “penetrated the U.S. electrical grid” and left behind dormant but malicious software [59]. • In 2007, the discovery of what is now known as the “Aurora threat” revealed the possibility that sophisticated hackers could seriously dam age the grid by destroying mechanisms downstream from the initial point of attack. Aurora involves opening and quickly closing a high voltage circuit breaker, which can result in an out-of-synchronism condition that can physically damage rotating equipment connected to the power grid [60-63]. At military installations across the country, a myriad of **critical systems** **must be operational 24 hours a day**, 365 days a year. They receive and analyze data to keep us safe from threats, they provide direction and support to combat troops, and stay ready to provide relief and recovery services when natural disasters strike or when someone attempts to attack our homeland. These installations are almost completely dependent on commercial electrical power delivered through the national electrical grid. When the DSB studied the 2003 blackout and the condition of the grid, they concluded it is “fragile and vulnerable... placing critical military and homeland defense missions at unacceptable risk of extended outage”. As the resiliency of the grid continues to decline, it increases the potential for an expanded and/ or longer duration outage from natural events as well as deliberate attack. The DSB noted that the military’s backup power is inadequately sized for its missions and military bases cannot easily store sufficient fuel supplies to cope with a lengthy or widespread outage. An extended **outage could jeopardize ongoing missions in far-flung battle spaces** for a variety of reasons: • The American military’s logistics chains operate a just-in-time delivery system familiar to many global businesses. If an aircraft breaks down in Iraq, parts may be immediately shipped from a supply depot in the U.S. If the depot loses power, personnel there may not fill the order for days, increasing the risk to the troops in harm’s way. • Data collected in combat zones are often analyzed at data centers in the U.S. In many cases, the information helps battlefield commanders plan their next moves. If the data centers lose power, the next military move can be delayed, or taken without essential information. • The loss of electrical power affects refineries, ports, repair depots, and other commercial or military centers that help assure the readiness of American armed forces. When power is lost for lengthy periods, vulnerability to attack increases. President Obama, Congress, and major utilities, among others, are discussing an upgrade of the national electrical grid for a variety of reasons. We add our voice to this discussion with a singular perspective: we see that our **national security is directly linked to the security and reliability of our system of energy production and delivery.**

#### Hegemonic decline causes nuclear war

Barnett ‘11

Thomas, American military geostrategist and Chief Analyst at Wikistrat, “The New Rules: Leadership Fatigue Puts U.S., and Globalization, at Crossroads,” <http://www.worldpoliticsreview.com/articles/8099/the-new-rules-leadership-fatigue-puts-u-s-and-globalization-at-crossroads>, AM

Let me be more blunt: As the guardian of globalization, **the U.S. military has been the greatest force for peace the world has ever known**. Had America been removed from the global dynamics that governed the 20th century, the mass murder never would have ended. Indeed, it's entirely conceivable **there would** now **be no** identifiable **human civilization left**, **once nuclear weapons entered the** killing **equation**. But the world did not keep sliding down that path of perpetual war. Instead, America stepped up and changed everything by ushering in our now-**perpetual great-power peace**. We introduced the international liberal trade order known as globalization and played loyal Leviathan over its spread. What resulted was the collapse of empires, an explosion of democracy, the persistent spread of human rights, the liberation of women, the doubling of life expectancy, a roughly 10-fold increase in adjusted global GDP and a profound and persistent reduction in battle deaths from state-based conflicts. That is what American "hubris" actually delivered.

#### DoD procurement of SMR’s solves security and islands military bases.

Loudermilk 11

Micah J. Loudermilk, Research Associate for the Energy & Environmental Security Policy program with the Institute for National Strategic Studies at National Defense University, 5/31/11, Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs, [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](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)

Path forward: Department of Defense as first-mover 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.

### Contention 2- Space Radar

**Space radar is infeasible due to power limitations --- nuclear’s key**

**McCall 6** Chair, USAF Scientific Advisory Board, “Spacecraft Bus Technoligies,” http://www.au.af.mil/au/awc/awcgate/vistas/stechch3.pdf

All current spacecraft are either power limited or restricted in some measure by inadequate electrical power. Power limitations impose restrictions on the communications and propulsion subsystems and currently **make** large **space-based radars** and space-based weapons **relatively unfeasible**. A revolutionary change in capabilities will result from power technologies capable of providing large amounts of power onboard satellites. Large amounts of power will be enabling on spacecraft in the same sense that large amounts of random access memory have been enabling in personal computers. If power is not an issue, then previously hard applications become easy and new applications become possible. Evolutionary development of solar-array-based power technologies will see improvements to tens of kilowatts on satellites over the next decades. However, all solar collection systems in Earth orbit are limited by the solar constant of 1.4 kiloWatts per square meter. Large powers from solar collectors require large collection areas. For substantially larger powers (> 100 kW), several different types of technologies will have to be explored. Powers of this level will **make large space-based radars,** space-based directed energy weapons, and the use of high-performance electrically driven maneuvering technologies possible. **A natural technology to enable high power is nuclear power in space**; however, this technology has to date been considered unacceptable due to political and environmental limitations. Thus it is desirable to develop other technologies that may provide large power levels in space. In addition to continued development of safe **nuclear** systems, two other sources of continuous power in space that should be explored are the concepts of electrodynamic power-generating tethers and power beaming from one location to another (e.g., from space to space). The development of these and other technologies for high continuous power **will have a revolutionary effect** and the Air Force should invest in these areas as well as continuing to invest in solar collection technologies. Over the years, there have been several programs in nuclear powered spacecraft. NASA has been using Radioisotope Thermoelectric Generators (RTGs) for the interplanetary missions that generate a few tens of watts of power. Russia has flown nuclear reactors in space and BMDO has a joint program with the Russians (TOPAZ), under which the Defense department bought three of the reactors to do laboratory experiments. DoE had a program (SP 100) to use nuclear power in space and the Air Force had a nuclear propulsion program; these **programs have been canceled.** Nuclear power, however, remains one of the attractive alternatives in generating large amounts of power in space. To build a reactor for space applications has many challenging technical aspects including development of high-temperature lightweight materials, active cooling technologies, extremely radiation-hard and high-temperature electronics, and fail-safe system architectures. Setting the emotional issues of nuclear power aside, this technology offers a viable alternative for large amount of power in space. The Air Force should continue efforts towards making a safe nuclear reactor in space a viable option. Existing joint programs with Russia offer a low cost alternative and should be pursued. To build a reactor for space applications has many challenging technical aspects including development of high-temperature lightweight materials, active cooling technologies, extremely radiation-hard and high-temperature electronics, and fail-safe system architectures. Setting the emotional issues of nuclear power aside, this technology offers a viable alternative for large amount of power in space. The Air Force should continue efforts towards **making a safe nuclear reactor in space a viable option**. Existing joint programs with Russia offer a low cost alternative and should be pursued.

**SMR development solves---allows the Air Force to deploy space radar**

**Maybury 12** Dr. Mark T, Chief Scientist, United States Air Force, 1/31/12, “Energy Horizons: United States Air Force Energy S&T Vision 2011-2026,” <http://www.fas.org/irp/doddir/usaf/energy.pdf>

**There are** other **breakthrough space energy generation component technologies with the potential of achieving up to 70% efficiency. Examples include** quantum dots and dilute nitrides in solar cells. But there are also entirely new technologies such as tethers to attempt to harvest energy from the geomagnetic field, and energy harvesting from system heat waste. These ideas, as well as **new developments in nuclear energy**, **including small modular reactors**, can potentially fuel local facilities. ¶ Recently, there has been progress in developing large systems for energy generation, including very large deployable panels as developed by the Air Force Research Lab (AFRL), DARPA, and industry. For example, **we are currently limited to 27 kW arrays for satellite power, whereas more power is required for some future space missions by the AF**, National Security Space (NSS), and NASA. **Employing larger and more efficient arrays will enable missions that** **require very high power**, **such as** **s**pace-**b**ased **r**adar or space-based laser missions. An example of a system that is almost ready for a flight demonstration is the AFRL-Boeing 30 kW Integrated Blanket Interconnect System (IBIS). Figure 3.2 shows the technology and implementation concept for such a High Power Solar Array (HPSA). In the long term, increased solar cell efficiencies and revolutionary materials foreshadow the potential of 500 kW on-orbit power generation technologies, which would be transformational for performing missions from spacebased systems. ¶ In addition to improving photovoltaic efficiencies, other potential energy production is possible in the mid- to far-term. **In addition to modern designs for** autosafing, **small modular nuclear reactors for ground operations energy,** **nuclear energy has been demonstrated on several sat**ellite **systems** (e.g., Radioisotope Thermoelectric Generators (RTG)). **This** source **provides** **consistent power** **regardless of harvestable resources** (i.e. solar) **at** a **much higher energy and power density than current technologies**. While the implementation of such a technology should be weighed heavily against potential catastrophic outcomes, many **investments into small modular reactors can be leveraged for space based systems**. **As these nuclear power plants decrease in size**, **their utility on** board **space based assets increases**.

**It will be deployed---Air Force wants to, they just need the tech**

**Puiu 12** Tibi Puiu – Studies Mechanical Engineering, Feb 23, 2012 “Air Force plans buildings a solar power station in space and nuclear-powered spacecraft”

http://billionyearplan.blogspot.com/2012/08/air-force-plans-buildings-solar-power.html

Last week, the U.S. Air Force released a report in which it outlines its technological and energy plans for the forthcoming 15 years. Among others, the Air Force means to deploy a space-based solar power station, which would serve energy wirelessly to both Earth and space satellites, as well as a new generation of **spacecraft powered by sm**all nuclear **r**eactor**s.**¶ This solar power satellite design features sets of lightweight, inflatable fresnel reflectors to focus the Sun's energy on small arrays of high-efficiency photovoltaic cells. (c) NASA¶ The 72-page long report, titled “Energy Horizons: United States Air Force Energy S&T Vision 2011-2026″, can be read in its entirety for thus curious enough here. It discusses measures the institution plans to meet in order to reach its energy goals, reduce demand and **change military culture** in sight of rapidly developing missions.¶ “Energy is a center of gravity in war and an assured energy advantage can enable victory,” said Mark Maybury, chief scientist for the United States Air Force. He spearheaded the report.¶ “While energy is already an essential enabler,” Maybury said. “Global competition, environmental objectives and economic imperatives will only increase its importance.”¶ Of great interest, is a solar-based power station, which would harness solar energy and then beam it to Earth using lasers. **The tech**nology **necessary to effectively transfer energy between space and Earth isn’t available** at the moment, however, **so** my guess is **the Air Force has in mind distributing it towards satellites**, **whether they belong to the Air Force,** NASA **or other national security agencies**. Air Force is currently limited to 27 kilowatt (kW) arrays for satellite power. In the future**, it intends to massively increase its space energy array**, **which would also allow them to build smaller spacecraft**, as they wouldn’t need to generate power for themselves. Also, **sensors, communications equipment and on-board processing devices generally require a lot of energy,** **and if you want to have a very powerful sat**ellite, **destined for space-based radar** or space-based laser missions, **you need to provide it somehow. It would** all **be** wireless **transmitted from the neighboring space power station.¶** Nuclear-powered spacecraft¶ When nuclear energy is concerned, there are already some satellites powered by Radioisotope Thermoelectric Generators (RTG), which provide steady and reliable power, at a much greater output than other technologies currently in place. However, **the** Air **Force wants to take it up a notch and employ** **satellites powered by small nuclear reactors**. We’ve discussed about nuclear fission power plants, small enough to fit in a briefcase, in one of our past posts – I’m guessing the Air Force is going for something similar. Of course, safety is a major concern, as outlined in the report.

**Space radar is the key internal link to maintaining nuclear primacy**

**Li & Nie 9** – Li Bin, director of Arms Control Program at the Institute of International Studies, Tsinghua University; and Nie Hongyi, officer in the People’s Liberation Army with an MA from China’s National Defense University and a Ph.D. in International Studies from Tsinghua University, 5/22/9, “An Investigation of China – U.S. Strategic Stability,” <http://www.ucsusa.org/assets/documents/nwgs/Li-and-Nie-translation-final-5-22-09.pdf>

**The mobility of China’s nuclear weapons raises the survivability of Chinese nuclear weapons** and thereby sustains China-U.S. strategic stability. If the United States cannot accept a condition of strategic stability between China and the United States, then **a simple increase in the number of nuclear weapons targeting China** (for example, moving nuclear subs) **cannot achieve that objective, but requires an increase in the ability to sense, discriminate and track mobile targets**. The visible light and the infrared sensors on U.S. satellites can partially serve this objective. But **in clouds and rain the light seen by infrared and visible light sensors have no way to penetrate the cloud layer to see targets** on the ground. **For this reason the U**nited **S**tates **hopes to develop an all-weather capability** to observe the ground. **The specified plan is to develop a satellite-based radar system utilizing** the Doppler reflection to follow moving targets on the ground. According to this plan the United States will begin to deploy a **space-based radar** network in 2008. If the **U.S. space-based radar** can effectively realize the functions of this idea then they **will be able to** detect, recognize and **track** the large body of **Chinese strategic mobile missiles**. **This will greatly discount the effort of China to mobilize its strategic weapons**, and a new strategic imbalance will appear between China and the United States. Analysis makes it clear that if China selects an appropriate countermeasure to space-based radar it would be difficult to track Chinese mobile missiles in all weather, making it unable to realistically lower China’s nuclear retaliatory capability. The problem is that the ability of space-based radar to track mobile objects on the ground is a product of adjustments in the movement that are sensitive to the environment (such as terrain), the path followed by mobile objects on the ground and other factors. Consequently, once the United States deploys a space-based radar system, it will not be easy for China to know if its mobile missiles are being tracked; it will also not be easy for the United States to know if the Chinese mobile missiles they’re tracking already escaped tracking. This increases difficulties for decision-makers on both sides.

**It enables effective reconnaissance to ensure primacy over mobile targets**

**Li 7** Bin, director of Arms Control Program at the Institute of International Studies, Tsinghua University, “Tracking Chinese Strategic Mobile Missiles,” Science and Global Security, Vol. 15, p. 1-30

Long-range weapons can be divided into two categories: nuclear and nonnuclear. ICBMs and SLBMs are two main long-range nuclear weapons. The United States has deployed ICBMs and SLBMs for several decades and these weapons, in principle, are able to attack mobile targets if the targets are located, although the costs may be high. **The question is whether** or not **conventional weapons are able to attack mobile targets from long distances.** As conventional weapons have a much smaller lethal radius, **they must be very precise to hit the target**.¶ To attack mobile or re-locatable targets, **real-time intelligence systems are also required as an adjunct to weapons** in order **to locate and track mobile targets**.¶ **For many years, the United States has employed satellite-based optical and infrared sensors** that observe ground targets with a resolution of sub-meters. The optical and infrared observation capabilities from space have been applied in recent warfare and proved to be strategically important. **However,** the **detection of optical and infrared signals is not always possible. Darkness** precludes the use of optical signals **and heavy clouds can shield** both optical and infrared **signals. To ensure persistent monitoring all-weather systems are needed.** One idea is to detect the targets on the ground by **satellite based radar. Radar can penetrate clouds and rain, and space radar is** an **ideal** alternative. The main question is whether space radar can provide persistent tracking. This study uses the DF-31 as the example and assumes that it can move on standard roads at 20 km/h (5.6 m/s), the limit set by the Chinese government for transportation vehicles on level IV roads in uneven areas. 36 In the ﬁrst mobility mode analyzed in the previous section, the survivability of DF-31 increases when its speed increases. In that analysis the author examined the DF-31 TELs at speeds of 20 km/h and higher to see if a higher speed helps China saturate a U.S. preemptive strike. In the mode analyzed next, **higher speeds of DF-31 TELs make them more visible to space radar when the radar monitors moving ground targets.** Therefore the author examines a case in which the DF-31 TELs are at low speed (20 km/h). ¶ Research in the United States has explored the roles of using space radar to track Chinese mobile missiles. 37 **Space radar detects targets on the ground or in the air by sending radar waves to targets and picking up reﬂected signals**. To reach the same level of resolution, the size of the radar antenna needs to be much larger than the size of the telescope that picks up infrared and optical signals as the radar wavelength (e.g., several centimeters for X-band) is much larger than optical and infrared signals (10−4 to 10−5 centimeters). Satellites in space cannot carry large radar antenna to achieve such a high resolution. An alternative is to pick up a reﬂected radar wave at different positions when the satellite is traveling and piece the picture together from coherent signals. Radar working in this mode is called a Synthetic Aperture Radar (SAR). Spacebased SAR is good for taking pictures of nearly stationary targets, for example, mapping the terrain. To highlight moving targets, the Doppler effects of radar waves are utilized. If a beam of a radar wave is projected to a moving target with radial speed (speed in the direction of the radar beam), the frequency of the radar wave reﬂected from the moving target changes slightly. A larger radial speed creates larger frequency shift. Space radar can pick up only the signals from moving targets whose frequency is slightly different from that from stationary targets. This mode of detection is called Ground Moving Target Indicator (GMTI) or Surface Moving Target Indicator (SMTI). When space radar is operated in SMTI mode, all stationary objects in the ﬁeld become dark and only moving targets with appropriate radial speed are bright. **Space radar in SMTI mode is the primary available tool to monitor mobile targets and therefore is the main candidate for tracking Chinese strategic mobile missiles**. This analysis will focus mainly on space radar in SMTI mode.

**Nuke primacy prevents nuclear war over Taiwan**

**Lieber and Press 7** - Keir A. Lieber, Assistant Professor of Political Science at the University of Notre Dame, and Daryl G. Press, Associate Professor of Political Science at the University of Pennsylvania, Winter 2007, “U.S. Nuclear Primacy and the Future of the Chinese Deterrent,” China Security, Issue No. 5, online: http://www.wsichina.org/cs5\_5.pdf

Ironically, one of the clearest explanations for how the United States may use nuclear primacy in a crisis or war with China appears in an earlier article by Blair. His recent article with Chen labels our suggestion that the United States might use nuclear threats “the zenith of provocation” and “unthinkable.”23 However, in the autumn 2005 issue of China Security, Blair describes exactly the crisis dynamics we envision leading to U.S. nuclear threats and perhaps even a preemptive nuclear attack. He notes that if China were to alert its strategic nuclear forces during a war with the United States over Taiwan, “the United States would likely act to beat China to the punch.” He continues, “Given constant U.S. surveillance of Chinese nuclear launch sites, any major Chinese preparations to fire peremptorily would be detected and countered by a rapid U.S. preemptive strike against the sites by U.S. conventional or nuclear forces… The United States could easily detect and react inside of the lengthy launch cycle time of Chinese forces.”24¶ Blair’s words mirror our argument and suggest the two ways that nuclear primacy may benefit the United States. First, if the Chinese were to threaten nuclear escalation in the context of a Taiwan war, the U.S. could strike first and likely destroy the Chinese force on the ground – “beat China to the punch,” as Blair puts it. Second, **China’s knowledge of its vulnerability to nuclear preemption might prevent China from alerting its nuclear force – or even attacking Taiwan – in the first place**.

**War over Taiwan is inevitable---U.S. conventional superiority ensures China will escalate**

**Zhang 8** - Baohui Zhang, Associate Professor of Political Science, Lingnan University, Hong Kong, March 2008, “The Taiwan Strait and the Future of China's No-First-Use Nuclear Policy,” Comparative Strategy, Vol. 27, No. 2, p. 164-182

For the above reasons the **n**o-**f**irst-**u**se principle remained unchallenged until the 1990s, when a series of new issues began to force some in China to rethink its nuclear principles. These include the ascendance of the Taiwan issue as the central security challenge for China (and, as a result, the increased likelihood of American military intervention in the Taiwan Strait), and the revolution in military affairs (RMA) that has given the **U**nited **S**tates vast **conventional advantage over China.** ¶ According to John Wilson Lewis and Xue Litai, during the 1990s Taiwan's tendency to move toward de jure independence led to an increasingly pessimistic view inside China that the Taiwan issue could not be peacefully resolved. More and more Chinese analysts believed that, due to the internal political dynamics of a democratic Taiwan and the rise of Taiwanese identity among its people, peaceful reunification between Taiwan and the mainland has become increasingly hopeless.13 In fact, Jiang Zemin made the famous remark that “a **war across the** Taiwan **Strait is unavoidable**.”14 As a result, Taiwan has become the number-one security issue for China, and preparing for a war to prevent Taiwan's independence has become an obsession of the Chinese leadership and military.¶ The problem for China is that it also increasingly believes that American military intervention can be expected in the event of war in the Taiwan Strait. Inside the Chinese military, due to “America's proclaimed geostrategic interests and recent military actions the **prevailing opinion was that U.S. forces would undoubtedly intervene**.”15 This scenario presents an extremely daunting challenge: how to defeat the world's most powerful military. This task is particularly daunting since the Chinese military recognizes that the revolution in military affairs has given the United States vast advantages over China. According to military observers, the 1991 Gulf War and the 1999 NATO war against Serbia demonstrated the revolutionary change in warfare through the use of precision-guided weapons linked to information technologies in areas such as intelligence, command and control, and weapon guidance. The Chinese military was keenly aware of the new trend and organized systematic studies of how the American military conducted its operations in this new kind of war.16¶ In fact, **the Chinese military was awed by the American dominance in conventional warfare**. As observed by General Wang Baocun, a prominent strategist at the PLA Academy of Military Sciences, the U.S. revolution in military affairs has resulted in a new kind of gap with other countries. Previously, the gap was merely generational. This time, there is a “time gap” in that the U.S. military and others are fighting as if they were from different historical periods. According to Wang, “The time gap in military technologies allows the superior side to possess an absolute advantage while leaving the other side in a position of absolute disadvantage. … The time gap makes it impossible for developing countries to overcome their military disadvantage in confrontations with the United States.” Wang thus reaches a gloomy conclusion: “The military time gap results in serious threats to the national and military security of developing countries. In fact, they are almost in a defenseless situation.”17¶ Major General Xu Hezhen, who is the Commandant of PLA Army Command Academy in Shijiazhuang, suggests that the RMA allows the U.S. to conduct “no-contact combat” against other militaries through beyond visual range sensor technologies and precision-strike weapons. This revolution in combat “creates a battlefield situation where 'I can see you and hit you but you can't see me and hit back. The situation leaves the weaker side in a position of perpetual disadvantage until it loses the will of resistance.”18¶ The RMA thus presents a serious problem for China's military planners: how to defeat a technologically far superior enemy such as the United States. In fact, **China is no longer confident** it can defeat such an enemy due to the **vast gap** with the United States **in conventional military technologies**. As Lewis and Xue observe, “As senior PLA planners dissected the American strategy from the Gulf War of 1991 to the lightening war against Iraq in 2003, it was to become painfully evident that no war with the United States could be won or even brought to a reasonable draw.”19¶ This bleak assessment by Chinese officers of the U.S. conventional dominance in the Taiwan Strait is echoed by American analysis. In a research project for the U.S. Department of Defense, the Rand Corporation analyzed how China may choose to conduct a war against the American military. According to Rand, in the coming decades the U.S. will possess “even greater military advantages over Chinese forces than it currently enjoys.”20 Therefore, if the China intends to fight the U.S. through conventional military modernization, “this option, taken alone, potentially condemns the PLA to evolving relative obsolescence.”21¶ How to prevent a disastrous defeat in the Taiwan Strait led some in China to **question the separation of conventional and nuclear doctrines** in Chinese military thinking. While the no-first-use policy can prevent a nuclear attack against China, it cannot deter a large-scale conventional war by a technologically superior enemy. Some believe that the policy can no **longer protect China's core national interests**, such as preventing de jure independence of Taiwan. According to Alastair Iain Johnston, who was the first Western analyst to notice this trend in the 1990s, some Chinese strategists began to argue that China should develop a nuclear doctrine “suitable for economically and technologically weak states.”22

**Nuclear war**

**Glaser 11** Professor of Political Science and International Affairs – George Washington University, “Will China’s Rise Lead to War?” *Foreign Affairs* Vol. 9 Iss. 2, March/April

THE PROSPECTS for avoiding intense military competition and war may be good, but growth in China's power may nevertheless require some changes in U.S. foreign policy that Washington will find disagreeable--particularly regarding Taiwan. Although it lost control of Taiwan during the Chinese Civil War more than six decades ago, **China** still **considers Taiwan to be part of its homeland, and unification remains a key political goal** for Beijing. **China** has made clear that it **will use force if Taiwan declares independence, and** much of **China's** conventional **military buildup has been dedicated to increasing its ability to coerce Taiwan** and reducing the United States' ability to intervene. **Because China places such high value on Taiwan** and because the United States and China--whatever they might formally agree to--have such different attitudes regarding the legitimacy of the status quo, **the issue poses special dangers and challenges for the U.S.-Chinese relationship**, placing it in a different category than Japan or South Korea. A crisis over Taiwan **could** fairly **easily escalate to nuc**lear **war, because each step** along the way **might** well **seem rational to the actors involved.** Current U.S. policy is designed to reduce the probability that Taiwan will declare independence and to make clear that the United States will not come to Taiwan's aid if it does. Nevertheless, **the U**nited **S**tates **would find itself under pressure to protect Taiwan against any sort of attack, no matter how it originated. Given the different** interests and **perceptions of the various parties and the limited control** Washington has **over Taipei's behavior, a crisis could unfold in which** **the U**nited **S**tates **found itself following events** rather than leading them. Such dangers have been around for decades, but ongoing **improvements in China's military capabilities** may **make Beijing more willing to escalate a Taiwan crisis.** In addition to its improved conventional capabilities, **China is modernizing** its **nuclear forces to increase their ability to survive and retaliate** **following** a large-scale **U.S. attack**. Standard deterrence theory holds that Washington's current ability to destroy most or all of China's nuclear force enhances its bargaining position. China's nuclear **modernization might** remove that check on Chinese action, **lead**ing **Beijing to behave more boldly** in future crises than it has in past ones. **A U.S. attempt to** preserve its ability to **defend Taiwan**, meanwhile, **could fuel a conventional and nuclear arms race.** **Enhancements to U.S.** offensive targeting **capabilities** and strategic ballistic missile defenses **might be interpreted by China as a signal of malign U.S. motives**, leading to further Chinese military efforts and a general poisoning of U.S.-Chinese relations.

**Space radar solves Pakistan loose nukes, Mediterranean oil safety and bioterror**

**Sersun 3** Douglas K, Major of USAF, Air Command and Staff College, "Eyes of the Nation: Does the United States Need Space Radar?", April, dtlweb.au.af.mil///exlibris/dtl/d3\_1/apache\_media/L2V4bGlicmlzL2R0bC9kM18xL2FwYWNoZV9tZWRpYS8zNzMzMA==.pdf

**Space Radar is specifically designed to operate within** a **complementary** system-of systems (SoS) **architecture to address these requirements**, wisely benefiting from investment in existing ISR platforms. This horizontal integration is one of the great legacies of the former Undersecretary of the Air Force (USECAF), Mr. Peter B. Teets, who drove the National Security Space community to embrace the concept. **Because of the inherent day/night, all-weather, global persistence of Space Radar**, Mr. Teets notes that **we could use Space Radar “as a tripwire between…Iran and Iraq, or Pakistan and Afghanistan, so that anything that moves across those borders would set off alarms**.” 3 With this information, **we could then cue more locally** persistent and **responsive assets to go in for a closer look, dramatically increasing the efficiency of the entire network of sensors, and** thus, **denying the enemy sanctuary**. ¶ **U.S. forces require this timely flow of actionable intelligence to maintain full spectrum domain awareness** whether engaged against hard target sets, conducting battle damage assessment, monitoring sea commerce routes, or augmenting disaster relief operations. **Space Radar is the only sensor that can provide it globally, non-provocatively, in all-weather, day or night**. Fully deployed, a **Space Radar** constellation **will allow U.S. forces** and coalition/allied partners **to understand enemy actions and harness decision superiority to defeat him**. ¶ Finally, **Space Radar will enable** many of the **QDR’s transformation goals**. We need to think well beyond OEF and OIF, continuing progress to deal with asymmetric, non-traditional threats, from non-state actors, with non-western cultural values, and potential access to WMD. This includes operational integration in interagency scenarios supporting the State Department, the Department of Commerce and justice/law enforcement. **Space Radar can** be harnessed to **monitor nuclear storage facilities and** the **connecting transportation routes in Pakistan**, to **keep an eye on** the **oil infrastructure in the Mediterranean** region, **or** to **watch developments in the** evolving **Iranian nuclear stalemate. Space Radar can play a key role in homeland security matters such as monitoring** a metropolitan **containment** area **following an outbreak from a bio**logical **weapon** during a bad weather period **or for catastrophe planning in the event of another huge hurricane** and the resultant evacuation. Space Radar is poised to deliver in scenarios well beyond those that resonate with French Maginot Line thinking prior to WWII.

**Pakistan loose nukes cause global nuclear conflict**

**Pitt 9** William, a New York Times and internationally bestselling author of two books: "War on Iraq: What Team Bush Doesn't Want You to Know" and "The Greatest Sedition Is Silence”, 5/8/09, “Unstable Pakistan Threatens the World,” http://www.arabamericannews.com/news/index.php?mod=article&cat=commentary&article=2183

But a suicide bomber in Pakistan rammed a car packed with explosives into a jeep filled with troops today, killing five and wounding as many as 21, including several children who were waiting for a ride to school. Residents of the region where the attack took place are fleeing in terror as gunfire rings out around them, and government forces have been unable to quell the violence. Two regional government officials were beheaded by militants in retaliation for the killing of other militants by government forces. As familiar as this sounds, it did not take place where we have come to expect such terrible events. This, unfortunately, is a whole new ballgame. It is part of another conflict that is brewing, one which puts what is happening in Iraq and Afghanistan in deep shade, and which represents a grave and growing threat to us all. Pakistan is now trembling on the edge of violent chaos, and is doing so with nuclear weapons in its hip pocket, right in the middle of one of the most dangerous neighborhoods in the world.The situation in brief: Pakistan for years has been a nation in turmoil, run by a shaky government supported by a corrupted system, dominated by a blatantly criminal security service, and threatened by a large fundamentalist Islamic population with deep ties to the Taliban in Afghanistan. All this is piled atop an ongoing standoff with neighboring India that has been the center of political gravity in the region for more than half a century. The fact that Pakistan, and India, and Russia, and China all possess nuclear weapons and share the same space means any ongoing or escalating violence over there has the real potential to crack open the very gates of Hell itself. Recently, the Taliban made a military push into the northwest Pakistani region around the Swat Valley. According to a recent Reuters report: The (Pakistani) army deployed troops in Swat in October 2007 and used artillery and gunship helicopters to reassert control. But insecurity mounted after a civilian government came to power last year and tried to reach a negotiated settlement. A peace accord fell apart in May 2008. After that, hundreds — including soldiers, militants and civilians — died in battles. Militants unleashed a reign of terror, killing and beheading politicians, singers, soldiers and opponents. They banned female education and destroyed nearly 200 girls' schools. About 1,200 people were killed since late 2007 and 250,000 to 500,000 fled, leaving the militants in virtual control. Pakistan offered on February 16 to introduce Islamic law in the Swat valley and neighboring areas in a bid to take the steam out of the insurgency. The militants announced an indefinite cease-fire after the army said it was halting operations in the region. President Asif Ali Zardari signed a regulation imposing sharia in the area last month. But the Taliban refused to give up their guns and pushed into Buner and another district adjacent to Swat, intent on spreading their rule. The United States, already embroiled in a war against Taliban forces in Afghanistan, must now face the possibility that Pakistan could collapse under the mounting threat of Taliban forces there. Military and diplomatic advisers to President Obama, uncertain how best to proceed, now face one of the great nightmare scenarios of our time. "Recent militant gains in Pakistan," reported The New York Times on Monday, "have so alarmed the White House that the national security adviser, Gen. James L. Jones, described the situation as 'one of the very most serious problems we face.'" "Security was deteriorating rapidly," reported The Washington Post on Monday, "particularly in the mountains along the Afghan border that harbor al-Qaeda and the Taliban, intelligence chiefs reported, and there were signs that those groups were working with indigenous extremists in Pakistan's populous Punjabi heartland. The Pakistani government was mired in political bickering. The army, still fixated on its historical adversary India, remained ill-equipped and unwilling to throw its full weight into the counterinsurgency fight. But despite the threat the intelligence conveyed, Obama has only limited options for dealing with it. Anti-American feeling in Pakistan is high, and a U.S. combat presence is prohibited. The United States is fighting Pakistan-based extremists by proxy, through an army over which it has little control, in alliance with a government in which it has little confidence." It is believed Pakistan is currently in possession of between 60 and 100 nuclear weapons. Because Pakistan's stability is threatened by the wide swath of its population that shares ethnic, cultural and religious connections to the fundamentalist Islamic populace of Afghanistan, fears over what could happen to those nuclear weapons if the Pakistani government collapses are very real. "As the insurgency of the Taliban and Al Qaeda spreads in Pakistan," reported the Times last week, "senior American officials say they are increasingly concerned about new vulnerabilities for Pakistan's nuclear arsenal, including the potential for militants to snatch a weapon in transport or to insert sympathizers into laboratories or fuel-production facilities. In public, the administration has only hinted at those concerns, repeating the formulation that the Bush administration used: that it has faith in the Pakistani Army. But that cooperation, according to officials who would not speak for attribution because of the sensitivity surrounding the exchanges between Washington and Islamabad, has been sharply limited when the subject has turned to the vulnerabilities in the Pakistani nuclear infrastructure." "The prospect of turmoil in Pakistan sends shivers up the spinesof those U.S. officials charged with keeping tabs on foreign nuclear weapons," reported Time Magazine last month. "Pakistan is thought to possess about 100 — the U.S. isn't sure of the total, and may not know where all of them are. Still, if Pakistan collapses, the U.S. military is primed to enter the country and secure as many of those weapons as it can, according to U.S. officials. Pakistani officials insist their personnel safeguards are stringent, but a sleeper cell could cause big trouble, U.S. officials say." In other words, a shaky Pakistan spells trouble for everyone, especially if America loses the footrace to secure those weapons in the event of the worst-case scenario. If Pakistani militants ever succeed in toppling the government, several very dangerous events could happen at once. Nuclear-armed **India could be galvanized into military action of some kind, as could nuclear-armed China or nuclear-armed Russia.** If the Pakistani government does fall, and all those Pakistani nukes are not immediately accounted for and secured, the specter (or reality) of **loose nukes falling into the hands of terrorist organizations could place the entire world on a collision course with unimaginable disaster.** We have all been paying a great deal of attention to Iraq and Afghanistan, and rightly so. The developing situation in Pakistan, however, needs to be placed immediately on the front burner. The Obama administration appears to be gravely serious about addressing the situation. So should we all.

**Bioterror causes extinction**

**Ochs 2** Richard, Past president of the Aberdeen Proving Ground Superfund Citizens Coalition, Member of the Depleted Uranium Task force of the Military Toxics Project, and M of the Chemical Weapons Working Group, June 9, 2002, “Biological Weapons Must Be Abolished Immediately,” <http://www.freefromterror.net/other_articles/abolish.html>

Of all the weapons of mass destruction, the **genetically engineered biological weapons, many without a known cure or vaccine, are an extreme danger to the continued survival of life on earth**. Any perceived military value or deterrence pales in comparison to the great risk these weapons pose just sitting in vials in laboratories. While a “**nuclear** winter,” resulting from a massive exchange of nuclear weapons, could also kill off most of life on earth and severely compromise the health of future generations, they **are easier to control. Biological weapons, on the other hand, can get out of control very easily**, as the recent anthrax attacks has demonstrated. There is no way to guarantee the security of these doomsday weapons because very **tiny amounts** can be stolen or accidentally released and then **grow or be grown to horrendous proportions**. The Black Death of the Middle Ages would be small in comparison to the potential damage bioweapons could cause. Abolition of chemical weapons is less of a priority because, while they can also kill millions of people outright, their persistence in the environment would be less than nuclear or biological agents or more localized. Hence, chemical weapons would have a lesser effect on future generations of innocent people and the natural environment. Like the Holocaust, once a localized chemical extermination is over, it is over. With nuclear and biological weapons, the killing will probably never end. Radioactive elements last tens of thousands of years and will keep causing cancers virtually forever. Potentially worse than that, bio-engineered **agents by the hundreds with no known cure could wreck even greater calamity on the human race** than could persistent radiation. AIDS and ebola viruses are just a small example of recently emerging plagues with no known cure or vaccine. Can we imagine hundreds of such plagues? HUMAN **EXTINCTION IS NOW POSSIBLE**. Ironically, the Bush administration has just changed the U.S. nuclear doctrine to allow nuclear retaliation against threats upon allies by conventional weapons. The past doctrine allowed such use only as a last resort when our nation’s survival was at stake. Will the new policy also allow easier use of US bioweapons? How slippery is this slope?

**[ ] Independently, radar solves debris**

**Marques 5** Marta Marti-Marques, Technical University of Valencia, Spain, "SPACE-BASED RADAR SYSTEM FOR GEOSTATIONARY DEBRIS DETECTION AND TRACKING AT MEO", 2005, www.iafastro.net/iac/archive/browse/IAC-05/B6/1/1965/

Since the first known satellite fragmentation occurred just four years after Sputnik 1 was successfully put into orbit around our planet, **it is believed that a total of 173 satellites have broken up, making the scientific community aware of the potential risks that space debris poses. In order to decrease the threat** of operational spacecraft colliding with non-functional objects and to assess current and future population of space debris, cost-effective **measurement techniques and devices** capable of supplying us with the data required to conduct collision avoidance manoeuvres **should be developed**.¶ Our research aims to design a space-based detection and tracking radar system, which would provide much more accurate measurements of debris size and orbital parameters from densely populated GEO (Geostationary Earth Orbit). The orbiting device should be placed at MEO (Medium Earth Orbit), so that it allows full tracking of the geostationary arc in order to search GEO for non-functional spacecraft as well as for debris fragments and thereby update the current database of catalogued on-orbit debris population.¶ **The detection and tracking radar system** operating at Ka-band **would supply us with valuable information for the characterisation of** the **near-Earth debris** environment and the validation of space debris models. A directive large antenna would be required to generate short wavelengths and achieve high frequencies, as well as to provide a narrow beamwidth (high gain) capable of searching for non-operational spacecraft and debris clouds. Recent advances on microstrip patch antennas nevertheless prove that the building of such high performance radar would be cost-effective using planar technology.¶ Debris data would be collected by means of an electronically steerable phased array antenna, which could have its beam electronically steered in angle by changing the phase of the current at each radiating element, so that the region of constructive interference could be swept from side to side and look for targets. **Despite the fact that attenuation of electromagnetic signals when propagating through the atmosphere or in adverse weather conditions can seriously degrade radar performance** at high microwave frequencies, our **in situ radar** system **does not have to face this challenge as it is a space-based device**. Now then, on-board signal and data processing should be conducted before transmission by radio link to an Earth-based receiving station.¶ **As it is not technically feasible to provide accurate enough ground-based measurements of targets located 36,000 km above** the **Earth** surface, **a** MEO **space-based radar would be the perfect solution** due to the potential decrease of the distance between the observer and the object. The database built up from ground-based optical and radar facilities by means of traditional measurement techniques would be definitely improved if we update it with the accurate data our space-based radar will acquire. Functional **spacecraft could use this database for advance warning of collisions with debris in order to manoeuvre out of the collision path**.¶ In the final analysis, we believe that **the proposed orbiting radar system would make a significant contribution to achieve a better understanding of the threats posed by the debris environment so that its impact** on future space missions **is minimised**. For this reason, international cooperation is needed to evolve both technically and economically feasible alternatives to debris threats so that future space activities develop in a debris-free orbital environment. In this paper our space-based radar system will be described in detail and its operating parameters will be calculated to prove the feasibility of this new proposal and demonstrate its effectiveness in preserving the orbital environment for future generations.

**[ ] Debris will knock out satellites and cause extinction**

**Dunstan 9** – James, JD, Space and Technology Lawyer – Garvey Schubert Barer, and Berin Szoka, Senior Feelow – Progress and Freedom Foundation, Director – Space Frontier Foundation, and Member of the Commerical Space Transportation Advisory Committee – Federal Aviation Administration, “Beware Of Space Junk: Global Warming Isn’t the Only Major Environmental Problem”, http://techliberation.com/2009/1t2/18/beware-of-space-junk-global-warming-isnt-the-only-major-environmental-problem/

As world leaders meet in Copenhagen to consider drastic carbon emission restrictions that could require large-scale de-industrialization, experts gathered last week just outside Washington, D.C. to discuss another environmental problem: **Space junk**.[1] **Unlike** with **climate change, there’s no difference of scientific opinion about this problem—orbital debris counts increased 13% in 2009 alone**, with the catalog of tracked objects swelling to 20,000, and estimates of over 300,000 objects in total; most too small to see and all racing around the Earth at over 17,500 miles per hour. **Those are speeding bullets**, some the size of school buses, and **all capable of knocking out a sat**ellite or manned vehicle. **At stake are much more than the** $200 billion a year **satellite and launch industries and jobs that depend on them. Satellites connect the remot**est **locations in the world; guide us down unfamiliar roads; allow Internet users to view their homes from space; discourage war by making it impossible to hide armies on another country’s borders; are utterly indispensable to American troops in the field; and play a critical role in monitoring climate change and other environmental problems. Orbital debris could block all these benefits for centuries, and prevent us from developing** clean energy sources like **space solar power satellites, exploring** our Solar System **and** some day **making humanity a** multi-planetary **civilization capable of surviving true climatic catastrophes**. The engineering wizards who have fueled the Information Revolution through the use of satellites as communications and information-gathering tools also overlooked the pollution they were causing. They operated under the “Big Sky” theory: Space is so vast, you don’t have to worry about cleaning up after yourself. They were wrong. Just last February, two satellites collided for the first time, creating over 1,500 new pieces of junk. Many experts believe **we are nearing the “tipping point” where** these **collisions will cascade, making** many **orbits unusable. But the problem can be solved. Thus far, governments have simply tried to mandate “mitigation” of debris-creation. But** just as some warn about “runaway warming,” we know that mitigation alone will not solve the debris problem. Theanswer lies in “remediation”: removing just five large objects per year could prevent a chain reaction. If governments attempt to clean up this mess themselves, the cost could run into the trillions—rivaling even some proposed climate change solutions.

**Plan**

#### The United States federal government should acquire, through alternative financing, electricity from nuclear reactors fewer than 300 megawatts for military bases in the United States.

### Contention 3- Solvency

#### DoD acquisition of SMR’s ensures rapid military adoption

**Andres 11**

Richard Andres, Professor of National Security Strategy at the National War College and a 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, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactorsfor Military Installations:Capabilities, Costs, andTechnological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)

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 [FOOTNOTE 29: **There are** numerous **actions that the Federal Government could take**, such as conducting or funding research and development, stimulating private investment, demonstrating technology, mandating adoption, and guaranteeing markets. **Military procurement** is thus only one option, but it has often **played a decisive role in technology development and is likely to be the catalyst for the U.S. small reactor industry.** See Vernon W. Ruttan, Is War Necessary for Economic Growth? (New York: Oxford University Press, 2006); Kira R. Fabrizio and David C. Mowery, “The Federal Role in Financing Major Inventions: Information Technology during the Postwar Period,” in Financing Innovation in the United States, 1870 to the Present, ed. Naomi R. Lamoreaux and Kenneth L. Sokoloff (Cambridge, MA: The MIT Press, 2007), 283–316.] Historically, nuclear power has been “the most clear-cut example . . . of an importan tgeneral-purpose technology that in the absence of military and defense related 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.** Domestic Nuclear Expertise. From the perspective of larger national security issues, if DOD does not catalyze the small reactor industry, there is a risk that expertise in small reactors could become dominated by foreign companies. A 2008 Defense Intelligence Agency report warned that the United States will become totally dependent on foreign governments for future commercial nuclear power unless the military acts as the prime mover to reinvigorate this critical energy technology with small, distributed power reactors.38 Several of the most prominent small reactor concepts rely on technologies perfected at Federally funded laboratories and research programs, including the Hyperion Power Module (Los Alamos National Laboratory), NuScale (DOE-sponsored research at Oregon State University), IRIS (initiated as a DOE-sponsored project), Small and Transportable Reactor (Lawrence Livermore National Laboratory), and Small, Sealed, Transportable, Autonomous Reactor (developed by a team including the Argonne, Lawrence Livermore, and Los Alamos National Laboratories). However, there are scores of competing designs under development from over a dozen countries. If DOD does not act early to support the U.S. small reactor industry, there is a chance that the industry could be dominated by foreign companies. Along with other negative consequences, the decline of the U.S. nuclear industry decreases the NRC’s influence on the technology that supplies the world’s rapidly expanding demand for nuclear energy. Unless U.S. companies begin to retake global market share, in coming decades France, China, South Korea, and Russia will dictate standards on nuclear reactor reliability, performance, and **proliferation resistance**.

**Alternative financing cuts costs**

**Fitzpatrick 11**

Ryan Fitzpatrick, Senior Policy Advisor for Clean Energy at Third Way, Josh Freed, Vice President for Clean Energy at Third Way, and Mieke Eoyan, Director for National Security at Third Way, June 2011, Fighting for Innovation: How DoD Can Advance CleanEnergy Technology... And Why It Has To, content.thirdway.org/publications/414/Third\_Way\_Idea\_Brief\_-\_Fighting\_for\_Innovation.pdf

The DoD has over $400 billion in annual purchasing power, **which means the Pentagon could provide a sizeable market for new technologies**. **This can increase a technology’s scale of production, bringing down costs, and making the product more likely to successfully reach commercial markets**. **Unfortunately**, many potentially significant clean energy **innovations never get to the marketplace, due to a lack of capital during** the development and **demonstration stages. As a result, technologies that could help the military** meet its clean energy security and cost goals **are being abandoned or co-opted by competetors like China** before they are commercially viable here in the U.S. **By focusing its purchasing power on innovative products that will** help **meet its energy goals, DoD can provide** more **secure** and **cost-effective energy to the military—producing tremendous long-term savings**, while also **bringing** potentially **revolutionary technologies to the public**. Currently, many of these **technologies are passed over during** the **procurement** process **because of** higher **upfront costs—even if these technologies can reduce life-cycle costs** to DoD. The Department has only recently begun to consider life-cycle costs and the “fullyburdened cost of fuel” (FBCF) when making acquisition decisions. However, initial reports from within DoD suggest that the methodology for determining the actual FBCF needs to be refined and made more consistent before it can be successfully used in the acquisition process.32 The Department should fast-track this process to better maximize taxpayer dollars. Congressional appropriators— and the Congressional Budget Office—should also recognize the **savings that can be achieved by procuring advanced technologies to promote DoD’s energy goals**, even if these procurements come with higher upfront costs. **Even if the Pentagon makes procurement of emerging clean energy technologies a higher priority, it still faces real roadblocks in developing relationships with the companies that make them. Many clean energy innovations are developed by small businesses or companies that have no previous experience working with military procurement officers. Conversely, many procurement officers do not know the clean energy sector and are not incentivized to develop relationships with emerging clean energy companies**. Given the stakes in developing domestic technologies that would help reduce costs and improve mission success, the Pentagon should develop a program to encourage a better flow of information between procurement officers and clean energy companies—especially small businesses. Leverage Savings From Efficiency and Alternative Financing to Pay for Innovation. **In an age of government-wide austerity and tight** Pentagon **budgets**, current congressional **appropriations are simply not sufficient** to fund clean energy innovation. **Until Congress decides to direct additional resources** for this purpose, the **Defense** Department **must leverage** the money and other **tools it already has** to help develop clean energy. This can take two forms: repurposing money that was saved through energy efficiency programs for innovation and using alternative methods of financing to reduce the cost to the Pentagon of deploying clean energy. For several decades **the military has made** modest **use alternative financing** **mechanisms to fund** clean **energy** and efficiency **projects when appropriated funds were insufficient**. In a 2010 report, GAO found that while only 18% of renewable energy projects on DoD lands used alternative financing, these projects account for 86% of all renewable energy produced on the Department’s property.33 This indicates that **alternative financing can be particularly helpful to DoD in terms of bringing larger and more expensive projects to fruition**. One advanced financing tool available to DoD is **the energy savings performance contract** (ESPC). These agreements **allow DoD to contract a private firm to make upgrades to a building or other facility that result in energy savings, reducing overall energy costs without appropriated funds**. **The firm finances the cost, maintenance and operation of these upgrades and recovers a profit over the life of the contract**. While mobile applications consume 75% of the Department’s energy,34 DoD is only authorized to enter an ESPC for energy improvements done at stationary sites. As such, Congress should allow DoD to conduct pilot programs in which ESPCs are used to enhance mobile components like aircraft and vehicle engines. This could accelerate the needed replacement or updating of aging equipment and a significant reduction of energy with no upfront cost. To maximize the potential benefits of ESPCs, DoD should work with the Department of Energy to develop additional training and best practices to ensure that terms are carefully negotiated and provide benefits for the federal government throughout the term of the contract.35 This effort could possibly be achieved through the existing memorandum of understanding between these two departments.36 The Pentagon should also consider using any long-term savings realized by these contracts for other energy purposes, including the promotion of innovative technologies to further reduce demand or increase general energy security. In addition to ESPCs, **the Pentagon** also **can enter into** extended agreements with utilities to use DoD land to generate electricity, or for the **long-term purchase of energy**. **These** **innovative financing mechanisms**, known respectively as enhanced use leases (EULs) and power purchase agreements (PPAs), **provide a valuable degree of certainty to third party generators**. In exchange, the **Department can leverage its existing resources**—either its land or its purchasing power—**to negotiate lower electricity rates** and dedicated sources of locallyproduced power with its utility partners. **DoD has unique authority among federal agencies to enter extended 30-year PPAs**, **but only for geothermal energy projects and only with direct approval from the Secretary of Defense**. Again, limiting incentives for clean energy generation to just geothermal power inhibits the tremendous potential of other clean energy sources to help meet DoD’s energy goals. **Congress should consider opening this incentive up to other forms of clean energy generation**, including the production of advanced fuels. Also, given procurement officials’ lack of familiarity with these extended agreements and the cumbersome nature of such a high-level approval process, the unique authority to enter into extended 30-year PPAs is very rarely used.37 DoD should provide officials with additional policy guidance for using extended PPAs and Congress should simplify the process by allowing the secretary of each service to approve these contracts. Congress should also investigate options for encouraging regulated utility markets to permit PPA use by DoD. Finally, when entering these agreements, the Department should make every effort to promote the use of innovative and fledgling technologies in the terms of its EULs and PPAs. CON C L U S ION **The Defense Department is in a unique position to foster and deploy innovation in clean energy technologies**. This has two enormous benefits for our military: it will make our troops and our facilities more secure and it will reduce the amount of money the Pentagon spends on energy, freeing it up for other mission critical needs. If the right steps are taken by Congress and the Pentagon, the military will be able to put its resources to work developing technologies that will lead to a stronger fighting force, a safer nation, and a critical emerging sector of the American economy. **The Defense Department has helped give birth to technologies and new economic sectors dozens of times before**. For its own sake and the sake of the economy, **it should make clean energy innovation its newest priority**.

#### SMRs are cost-effective, safe, fuel efficient- their defense doesn’t apply

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David, freelance writer based in Monroe, Washington. An award-winning playwright, he has contributed to Charged and iQ magazine and is the author of the website Tales of Future Past, February 16, "Feature: Small modular nuclear reactors - the future of energy?", [www.gizmag.com/small-modular-nuclear-reactors/20860/](http://www.gizmag.com/small-modular-nuclear-reactors/20860/)

Small Modular Reactors¶ **One way of getting around many** of these **problems is through** the **development of small modular reactors** (SMR). **These are reactors capable of generating** about **300 megawatts of power** or less, which is enough to run 45,000 US homes. **Though small, SMRs are proper reactors**. They are quite different from the radio-thermal generators (RTG) used in spacecraft and remote lighthouses in Siberia. **Nuclear reactors such as SMRs use controlled nuclear fission to generate power while RTGs use natural radioactive decay to power a** relatively simple thermoelectric **generator** that can only produce, at most, about two kilowatts.¶ In terms of power, RTGs are the equivalent of batteries while small nuclear reactors are only "small" when compared to conventional reactors. They are hardly the sort that you would keep in the garage. In reality, SMR power plants would cover the area of a small shopping mall. Still, such an installation is not very large as power plants go and a reactor that only produces 300 megawatts may not seem worth the investment, but **the US Department of Energy is offering US$452 million in matching grants to develop SMRs** and private investors like the Bill Gates Foundation and the company of Babcock and Wilcox are putting up money for their own modular reactor projects.¶ The 60-year old breakthrough¶ **One reason for government and private industry to take an interest in SMRs is that they've been successfully employed for** much **longer than** most **people realize**. In fact, **hundreds have been steaming around the world inside the hulls of nuclear submarines and other warships for sixty years**. They've also been used in merchant ships, icebreakers and as research and medical isotope reactors at universities. There was even one installed in the Antarctic at McMurdo Station from 1962 to 1972. **Now they're being considered for domestic use**.¶ The case for SMRs¶ **SMRs have a number of advantages over conventional reactors**. For one thing, **SMRs are cheaper to construct and run**. This makes them very attractive to poorer, energy-starved countries; small, growing communities that don't require a full-scale plant; and remote locations such as mines or desalination plants. Part of the reason for this is simply that the reactors are smaller. Another is that, not needing to be custom designed in each case, **the reactors can be standardized and some types built in factories that are able to employ economies of scale. The factory-built aspect is also important because a factory is more efficient than on-site construction by as much as eight to one in terms of building time. Factory construction also allows SMRs to be built, delivered to the site, and then returned to the factory for dismantling** at the end of their service lives - **eliminating a major problem with old conventional reactors, i.e. how to dispose of them.¶ SMRs** also **enjoy** a good deal of **design flexibility**. **Conventional reactors are usually cooled by water** - a great deal of water - **which means that the reactors need to be situated near rivers or coastlines. SMRs, on the other hand, can be cooled by air, gas, low-melting point metals or salt**. This means that **SMRs can be placed in remote, inland areas where it isn't possible to site conventional reactors**.¶ Safety¶ **This cooling system is** often **passive**. In other words**, it relies more on the natural circulation of the cooling medium within the reactor's containment flask than on pumps. This passive cooling is one of the ways that SMRs can improve safety. Because modular reactors are smaller** than conventional ones, **they contain less fuel**. This means that **there's less of a mass to be affected if an accident occurs**. If one does happen, there's less radioactive material that can be released into the environment and makes it easier to design emergency systems. **Since they are smaller and use less fuel, they are easier to cool effectively, which greatly reduces the likelihood of a catastrophic accident or meltdown in the first place.¶** This also means that **accidents proceed much slower in modular reactors than** in **conventional ones. Where the latter need accident responses in** a matter of hours or **minutes, SMRs can be responded to in** hours or **days, which reduces the chances of an accident resulting in major damage** to the reactor elements.¶ **The SMR designs that reject water cooling** in favor of gas, metal or salt **have their own safety advantages**. Unlike water-cooled reactors, **these media operate at a lower pressure**. One of the hazards of water cooling is that a cracked pipe or a damaged seal can blow radioactive gases out like anti-freeze out of an overheated car radiator. With low-pressure media, there's less force to push gases out and there's less stress placed on the containment vessel. **It also eliminates one of the frightening episodes of the Fukushima accident where the water in the vessel broke down** into hydrogen and oxygen **and** then **exploded**.¶ **Another advantage of modular design is that some SMRs are small enough to be installed below ground. That is cheaper, faster to construct and less invasive** than building a reinforced concrete containment dome. There is also the point that **putting a reactor in the ground makes it less vulnerable to earthquakes. Underground installations make modular reactors easier to secure and install in a much smaller footprint. This makes SMRs particularly attractive to military customers who need to build power plants for bases quickly.** **Underground installation also enhances security with fewer sophisticated systems needed, which** also **helps bring down costs**.¶ **SMRs can help with** proliferation, **nuclear waste and fuel supply issues** because, while some modular reactors are based on conventional pressurized water reactors and burn enhanced uranium, others use less conventional fuels. **Some**, for example, **can generate power from what is now regarded as "waste", burning depleted uranium and plutonium left over from conventional reactors. Depleted uranium is** basically **U-238 from** which the **fissible U-235 has been consumed. It's** also **much more abundant in nature than U-235, which has the potential of providing the world with energy for thousands of years. Other reactor designs don't even use uranium**. Instead, **they use thorium. This fuel is also incredibly abundant, is easy to process for use as fuel and has the added bonus of being utterly useless for making weapons**, so it can provide power even to areas where security concerns have been raised.¶ But there's still the sticking point that modular reactors are, by definition, small. That may be fine for a submarine or the South Pole, but what about places that need more? Is the alternative conventional nuclear plants? It turns out that the answer is no. **Modular reactors don't need to be used singly. They can be set up in batteries of five or six or even more**, providing as much power as an area needs. And **if one unit needs to be taken off line for repairs or even replacement, it needn't interfere with the operation of the others**.

**DoD needs to lead**

**Energy Washington Week 10**

(“DOD STRESSING NEED FOR NRC COLLABORATION ON 'MINI' REACTOR BUILD OUT” July 5, 2010, Vol. 7 No. 27)

The U.S. Army is rejecting arguments by some industry and government officials who say military bases could proceed to build small modular reactors (SMRs) on military bases without Nuclear Regulatory Commission (NRC) certification and license approvals. Instead, the Department of Defense (DOD) believes it must work closely with NRC and that legislation will likely be needed to clearly define the various agency roles before the novel nuclear energy systems are constructed, according to DOD and industry sources. A senior DOD source also says that a collaborative arrangement between DOE, DOD, and NRC will be needed to begin constructing reactors that currently have not been licensed by the NRC -- including all prominent SMR models being examined by the three agencies for potential licensing and deployment. **Sm**all **r**eactor industry and government proponents have been struggling to find ways to accelerate the development of small reactors, including through the use of military bases as a test bed for building and demonstrating the reactors **ahead of NRC certification** of SMR designs, according to industry sources, who note that NRC approval is required before a utility can apply for a license to build a small reactor. One senior industry consultant says **the NRC does not have authority over military bases and therefore a non-certified reactor could be built there without the technology being vetted by NRC.** While industry proponents want NRC certification, they see it as slow because of a lack of resources to review the new reactors and certify the designs, says the industry consultant. **Building the reactors on military bases would help demonstrate SMR functionality that would eventually help accelerate commercial licensing**, says the source.

**Squo SMR incentives trigger the link**

Ken **Silverstein**, Forbes, **1/15**/13, After Fukushima, U.S. Seeks to Advance Small Nuclear Reactors, www.forbes.com/sites/kensilverstein/2013/01/15/after-fukushima-u-s-seeks-to-advance-small-nuclear-reactors/

Two years ago, some thought that the nuclear energy had been leveled. But **the industry today is picking up steam** by getting construction licenses to build four new units and by **getting government funding to develop smaller nuclear reactors** that are less expensive and which may be less problematic when it comes to winning regulatory approval. The creators of those roughly 100-megawatt electric modules want to sell their products first in this country before they would market them overseas to lesser-developed nations that don’t have a huge transmission infrastructure. They would be factory-built before being shipped and fueled to where the energy is needed. To the extent that more electric generation is required, no problem: Just lay the small-scale modules next to each other, making the financial outlays more manageable. “Restarting the nation’s nuclear industry and advancing small modular reactor technologies will help create new jobs and export opportunities for American workers and businesses, and ensure we continue to take an all-of-the-above approach to American energy production,” says Energy Secretary Steven Chu. To that end, the Obama administration is partnering with Babcock & Wilcox and Bechtel to develop those smaller nuclear reactors for the federally-owned utility Tennessee Valley Authority. The **Department** **of** **Energy is expected to invest** about $**450 million in the project**, which equates to roughly half of the overall cost. Industry will pony up the other half.