## plan

#### The United States Federal Government should acquire, through Other Transactions authority, electricity from small modular reactors for its military installations in the United States.

## solvency

#### Other Transactions authority leads to effective and quick acquisition

Dix et al 3

Nancy Dix, and Fernard Lavallee, partners in the San Diego and Washington, D.C., offices of Gray Cary, and Kimberly Welch, senior associate, specialize in specialize in government contracts, government contracts litigation, and intellectual property, Fall 2003, FEAR AND LOATHING OF FEDERAL CONTRACTING: ARE COMMERCIAL COMPANIES REALLY AFRAID TO DO BUSINESS WITH THE FEDERAL GOVERNMENT? SHOULD THEY BE?, 33 Pub. Cont. L.J. 5

DARPA has taken the position that OT authority permits tremendous flexibility in the terms and conditions that can be negotiated under such agreements, and, consequently, that there are a great variety of uses for the OT instrument. For example, DARPA has pioneered the use of OTs for research and technology development projects performed as multiparty cooperative arrangements involving cost sharing and advancing dual-use technologies. While the principal purpose of these transactions frequently is like traditional federal assistance, that is, other than to acquire goods and services for the direct benefit and use of the Government, DARPA does take the view that some OTs can be used for acquisition. n62

Proponents of OTs coined the phrase "freedom of contract" to describe the flexibility offered by OTs. Other Transactions are meant to present the Government and contractor with a "blank page" from which to begin when negotiating such instruments. Generally speaking, the terms and conditions of an OT are negotiable; however, DARPA has a well-defined "opening position." DARPA's opening position usually includes, for example, restrictions on foreign access to technology and a Bayh-Dole treatment for patents, without a requirement for the flow-down of the Bayh-Dole provisions.

The "freedom of contract" aspect also acknowledges that OTs are subject to even fewer laws and regulations than Cooperative Agreements or CRADAs. In December 1996, Under Secretary of Defense Paul Kaminski published a memorandum to the secretaries of the military departments and directors of defense agencies that identifies statutes that "are not necessarily applicable to 'other transactions.'" n63

The OT provides both the Government and contractors with unparalleled opportunities to negotiate terms and conditions designed to maintain a contractor's competitive advantage in the commercial marketplace while providing the Government with timely and affordable access to cutting-edge technologies and services. n64 In many respects, the OT is the ultimate in streamlined federal acquisition, allowing the Government to "do business the way business does business." The latitude afforded to the Government by OTs enables the sovereign to attract contractors that traditionally would not, or could not, do business with the Government.

#### Incentives inevitable

Jeffrey Tomich 11-2, energy reporter for the St Louis Dispatch, “Ameren, Westinghouse still waiting for decision on nuclear grant”, <http://www.stltoday.com/business/local/ameren-westinghouse-still-waiting-for-decision-on-nuclear-grant/article_1b46d35b-eda4-5c15-9b08-b0ed80caf2bf.html>

It was six months ago that Ameren Missouri and Westinghouse officials joined Gov. Jay Nixon on the lawn of the governor’s mansion to announce plans to pursue a first-of-its-kind mini nuclear reactor that would be built next to the utility’s Callaway plant.

The effort had bipartisan political support. Other Missouri electricity suppliers were on board, as well as the state’s university system. Everything seemed in place — almost.

The whole plan hinged on getting at least a share of a $452 million federal grant to advance commercialization of next-generation nuclear technology.

Today, a month after the Department of Energy was supposed to announce who would share the federal money, Ameren and Westinghouse are still waiting. And with the presidential election just days away, heightened scrutiny of energy technology subsidies, a growing budget deficit and a potential change in administrations are looming.

An Energy Department spokeswoman said applications are still under review. She didn’t say when a decision would be made.

The companies have reason to be anxious. The government has laid out an ambitious timetable for those who share the award. The winning teams are expected to have the next-generation reactors running by 2022, leaving a decade to design, license and build a new breed of nuclear plant.

“The team is kind of counting on that (grant) right now,” Joe Zwetolitz, president of Westinghouse Americas, said Tuesday at a conference for potential suppliers at the Renaissance Grand Hotel in downtown St. Louis. “It’s really necessary to help spur development.”

President Barack Obama announced the availability of grant funding for so-called small nuclear reactors in March during a stop in Columbus, Ohio, as part of his all-of-the-above energy strategy. Two projects will share the $452 million over a five-year span.

The small-scale reactors, generally less than a third the size of today’s plants, have been touted by the nuclear industry as carbon-free sources of around-the-clock electric generation that offer safety benefits and would be easier for utilities to finance and deploy.

That’s only part of the reason the federal government is willing to throw almost half a billion dollars at developing the technology. The Obama administration also sees modular nuclear plants as another piece of an American manufacturing revival — one with potential to generate thousands of jobs building components that can be shipped overseas.

The possibility for jobs is also a big draw for Nixon and other local politicians, especially because Westinghouse has said it would build a manufacturing plant in Missouri if it wins the grant and a market for the mini reactors develops.

The Ameren-Westinghouse team is one of four that applied for the federal grant in May. Other competing ventures include established names, such as Babcock & Wilcox Co., as well as NuScale Power LLC and Holtec International Inc., both relative newcomers.

Nick Cunningham, a policy analyst for the American Security Project, a nonprofit research group, believes the upcoming election may have temporarily derailed an announcement, but he believes it will come eventually since both candidates are on record as supporting advances of nuclear power.

“I think it will move forward next year,” he said.

Westinghouse officials say they’re ready to submit design certification for the small reactor to the Nuclear Regulatory Commission next year. And while Ameren’s timing is less certain, the utility could apply for a construction and operating license as early as 2014.

## adv 1

#### Adv 1 DOD

#### DoD bases are vulnerable to grid disruptions which destroys command infrastructure – only SMR’s can 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.

#### Those communication breakdowns go nuclear

Andres and Breetz 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.

#### DoD bypasses regulatory hurdles and safety hazards

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.

## adv 2

#### Adv 2 hydrogen

#### SMR development allows hydrogen fuel cell transition—spills over to military transportation

Alt Energy Today, 10/25

(“Alternative Energy The Ways that the Military is Using,” 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.

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

Chuck Squatriglia, Wired, 4/22/11, 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.”

#### Navy developing new underwater capabilities now

Paul Szoldra, Business Insider, 1/17/13, The Pentagon Wants To Scatter Weapons Under The World's Oceans To Activate On Demand, www.businessinsider.com/navy-darpa-develop-underwater-weapon-upward-falling-payloads-ufp-2013-1

The U.S. Navy is attempting to develop a stealth underwater system capable of providing worldwide "operational support and situational awareness," according to a Jan. 11 release from the Defense Advanced Research Projects Agency (DARPA).

The announcement, called "Falling Up", cites cost and complexity that limits the Navy from operating over vast areas.

That makes a lot of sense, considering the cost of ships, which are expensive and limited in scope -keep going up.

And as the technology of unmanned systems has been realized in Iraq & Afghanistan with the use of drones, the Navy wants to get in on the action.

The concept of DARPA's Upward Falling Payloads (UFP) would be "deployable, unmanned, distributed systems that lie on the deep-ocean floor in special containers for years at a time." They can then be woken up remotely and recalled to the surface to send back data.

#### Hydrogen fuel cell critical to effectiveness

Cai et al 7

Cai, Browning, Brett, Brandona, Department of Earth Science and Engineering, Imperial College London, 2007, Hybrid Fuel Cell / Battery Power Systems for Underwater Vehicles, http://www.seasdtc.com/events/2008\_conference/downloads/pdf/propulsion\_power\_generation\_and\_energy\_management/PPEM003\_paper.pdf

A system-level design and analysis of the power system for a lightweight unmanned underwater vehicle (UUV) is presented with recommendations of viable technologies that can meet the UUV mission requirements. A hybrid fuel cell / battery system is designed to power the UUV as it has advantages over a pure fuel cell or battery system. The power system is designed to use a lithium-ion battery hybridised with a polymer electrolyte fuel cell. The analysis is focused on the mass, size, and the energy balance of the system components. It is shown that hydrogen and oxygen storage systems dominate the mass and volume of the energy system compared to the fuel cell and battery. Liquid oxygen is recommended for oxidant storage based on the mission length requirement.

Unmanned underwater vehicles (UUVs) are ideally suited to provide surveillance, remote sensing and communication relay capabilities for both military and civilian applications. Practical examples include oceanographic data gathering, environmental monitoring, mine detecting and coastal defence. The power system of a UUV has long been a major consideration in designing and manufacturing these vehicles for particular missions. This is because the power system usually determines the ultimate performance (e.g. **endurance, cruising speed and distance**) of a UUV. The work reported here aims to investigate viable power system architectures that meet the requirement of UUVs.

Stealth is the highest design priority of a UUV as it enables the UUV to operate anywhere, at any time, without being detected. Besides helping to avoid detection, stealth enhances a submarine’s ability (by eliminating / reducing selfnoise) to detect targets. To meet the stealth requirement, an air independent power (AIP) system is beneficial to UUVs. The ideal AIP source for a submarine will be quiet, have a low thermal signature, will not need to discharge anything from the submarine system, and will of course be capable of operating without atmospheric air. In its simplest form, the AIP power source is a battery. However, batteries alone encounter technology difficulties for use as the power source of UUVs, as current battery technologies cannot provide sufficient endurance to allow for large area coverage and short turnaround time between missions. Hybrid fuel cell / battery systems have a number of advantages over either stand-alone fuel cells or batteries. For example, the battery would enable instant cold-start operation whilst the fuel cell was initiating. The battery, as the dynamic energy storage device, would supply peak and pulse power and power for start-up of the hybrid system. The fuel cell, as the device that converts the energy from the fuel, supplies base-load power and recharges the battery. A hybrid system would allow both components to be of smaller dimensions and operate with higher efficiency, since neither would have to provide the full load power.

#### UUVs are critical to maintaining naval power—ISR and communications key to unlock all other capabilities

Troy Vandenberg, Naval Postgraduate School, 2010, Manning and maintainability of a submarine Unmanned Undersea Vehicle (UUV) program a systems engineering case study, https://calhoun.nps.edu/public/bitstream/handle/10945/5226/10Sep\_Vandenberg.pdf?sequence=1

Future naval battles will rely heavily on advantages gained through the combination of strategies, tactics, procedures, and technologies called network-centric warfare and implemented through the strategy of ForceNet. These ideas rely heavily on Joint Force assets working together with common communication nodes. Large-scale undersea networks, like those adhering to ForceNet, will be used heavily in the future of USW, with UUVs acting as crucial communication nodes to and from submarine and surface assets. The following subsections will outline three different submarine missions and the future involvement UUVs will have with those missions. Each of the three missions (ISR, Communications, and ASW) can be evaluated as part of the overall ForceNet image.

Many missions may require the submarine to have the ability to launch and recover a UUV, but this is not a necessary factor in analyzing the possible mission sets. Currently, launch and recovery efforts have been possible via torpedo tubes and vertical launch tubes, but none of the missions discussed in this thesis require this to happen. Moving forward in the militarization of UUVs, it is important to remove the “platformcentric” thinking of programs and analyze how systems can interact with other systems.

1. Intelligence, Surveillance, and Reconnaissance

One of the many examples of applying ForceNet to ISR for the submarine force is through a program titled Persistent Littoral Undersea Surveillance Network (PLUSNet), a multi-institution effort combining key government assets via ONR and Space and Naval Warfare Systems Command (SPAWAR). PLUSNet is an unmanned systems approach to undersea surveillance that involves the use of mature technologies. The system involved an autonomously processed cable-free nested communication network with fixed and mobile sensor nodes (Martin, 2005).

In any ISR example, including PLUSNet, there are four fundamental tasks necessary to complete the mission: collect, communicate, process, and act. These tasks are performed in various different ways by a number of unique systems (both manned and unmanned). In the case of UUVs, however, one vessel has the ability—given the appropriate payloads—to perform all four tasks on board. One UUV can include sensors that collect the data, a platform that communicates and processes the data, and an implementer on board that takes action via movement, external communication, or weapon deployment (Fletcher, 2001). This concept is currently the main focus of UUV platform development for the Navy, namely a single, multi-payload UUV that can handle long (greater than 30 days) ISR missions.

Figure 10. Operational concept of PLUSNet (From: Martin, 2005)

However, one UUV does not have to have all three systems (sensor, platform, and implementer) on board to perform the tasks, as is the case of collaboratively networked UUV groups. Instead of having one large scale UUV with multiple payloads performing multiple missions, the groups of small UUVs would include single payloads performing individual missions. These UUVs would then communicate data amongst themselves and/or a larger node (either a separate UUV or manned vessel) to gain a common operational picture of the battlespace. Currently, DARPA has given some funding to develop grouped UUV programs, but this is not the main focus of the submarine force.

In both cases, unmanned systems add a strategic advantage to the war-fighter and will allow friendly forces to gather ISR information from locations otherwise currently inaccessible or of high risk to manned systems. Possible ISR missions using these strategies include (Department of the Navy, 2004):

Deployment of leave-behind surveillance sensors or sensor arrays Specialized mapping and object detection and localization could deploy one or more UUVs a safe distance from the shoreline and sit out of harm’s way while they patrol harbors, collecting ISR data and eventually returning to the host platform to refuel, upload data, and receive necessary operator level maintenance. This mission will free up valuable time for the submarine and the Special Operating Forces (SOF) on board to perform other valuable missions. Ultimately, due to the simplistic nature and emerging technologies, the submarine ISR mission-set will see the first full scale use of UUVs.

2. Communications

Communication is an important aspect for all military operations. UGVs and UAVs have distinct advantages of being able to easily communicate large amounts of data over long distances in air. Underwater communications, however, are not quite as simple and pose many problems in the area of USW. One solution to the problem of undersea communication is a concept called “Seaweb.” Seaweb uses battery-limited sensor technology to set up a wide-area network with expendable network nodes. In an article entitled “Enabling Undersea ForceNET with Seaweb Acoustic Networks” in the Biennial Review 2003, author Joseph Rice of SPAWAR San Diego concluded that:

Undersea, off-board, autonomous systems will enhance the war-fighting effectiveness of submarines, maritime patrol aircraft, amphibious forces, battle groups, and space satellites. Wide-area sensor grids, leave behind multi-static sonar sources, mine-hunting robots, and AUVs are just a few of the battery-powered, deployable devices that will augment space and naval platforms. (Rice, 2003)

#### Naval power key to prevent a laundry list of wars

Eaglen 11, research fellow for national security – Heritage, and McGrath, former naval officer and director – Delex Consulting, Studies and Analysis, 5/16/’11

(Mackenzie and Bryan, “Thinking About a Day Without Sea Power: Implications for U.S. Defense Policy,” Heritage Foundation)

Global Implications. Under a scenario of dramatically reduced naval power, **the** **U**nited **S**tates **would cease to be active in any international alliances.** While it is reasonable to assume that land and air forces would be similarly reduced in this scenario, the lack of credible maritime capability to move their bulk and establish forward bases would render these forces irrelevant, even if the Army and Air Force were retained at today’s levels. In Iraq and Afghanistan today, 90 percent of material arrives by sea, although material bound for Afghanistan must then make a laborious journey by land into theater.

China’s claims on the South China Sea, previously disputed by virtually all nations in the region and routinely contested by U.S. and partner naval forces, are accepted as a fait accompli, effectively **turning the region into a “Chinese lake.”** China establishes expansive oil and gas exploration with new deepwater drilling technology and secures its local sea lanes from intervention. Korea, unified in 2017 after the implosion of the North, signs a mutual defense treaty with China and solidifies their relationship.

Japan is increasingly isolated and in 2020–2025 executes long-rumored plans to create an indigenous nuclear weapons capability.[11] By 2025, Japan has 25 mobile nuclear-armed missiles ostensibly targeting China, toward which Japan’s historical animus remains strong.

China’s entente with Russia leaves the Eurasian landmass dominated by Russia looking west and China looking east and south. Each cedes a sphere of dominance to the other and remains largely unconcerned with the events in the other’s sphere.

Worldwide, trade in foodstuffs collapses. Expanding populations in the Middle East increase pressure on their governments, which are already stressed as the breakdown in world trade disproportionately affects food importers. Piracy increases worldwide, driving food transportation costs even higher.

In the Arctic, Russia aggressively asserts its dominance and effectively shoulders out other nations with legitimate claims to seabed resources. No naval power exists to counter Russia’s claims.

India, recognizing that its previous role as a balancer to China has lost relevance with the retrenchment of the Americans, agrees to supplement Chinese naval power in the Indian Ocean and Persian Gulf to protect the flow of oil to Southeast Asia. In exchange, China agrees to exercise increased influence on its client state Pakistan.

The great typhoon of 2023 strikes Bangladesh, killing 23,000 people initially, and 200,000 more die in the subsequent weeks and months as the international community provides little humanitarian relief. Cholera and malaria are epidemic.

Iran dominates the Persian Gulf and is a nuclear power. Its navy aggressively patrols the Gulf while the Revolutionary Guard Navy harasses shipping and oil infrastructure to force Gulf Cooperation Council (GCC) countries into Tehran’s orbit. Russia supplies Iran with a steady flow of military technology and nuclear industry expertise. Lacking a regional threat, the Iranians happily control the flow of oil from the Gulf and benefit economically from the “protection” provided to other GCC nations.

In Egypt, the decade-long experiment in participatory democracy ends with the ascendance of the Muslim Brotherhood in a violent seizure of power. The United States is identified closely with the previous coalition government, and riots break out at the U.S. embassy. Americans in Egypt are left to their own devices because the U.S. has no forces in the Mediterranean capable of performing a noncombatant evacuation when the government closes major airports.

Led by Iran, a coalition of Egypt, Syria, Jordan, and Iraq attacks Israel. Over 300,000 die in six months of fighting that includes a limited nuclear exchange between Iran and Israel. Israel is defeated, and the State of Palestine is declared in its place. Massive “refugee” camps are created to house the internally displaced Israelis, but a humanitarian nightmare ensues from the inability of conquering forces to support them.

The NATO alliance is shattered. The security of European nations depends increasingly on the lack of external threats and the nuclear capability of France, Britain, and Germany, which overcame its reticence to military capability in light of America’s retrenchment. Europe depends for its energy security on Russia and Iran, which control the main supply lines and sources of oil and gas to Europe. Major European nations stand down their militaries and instead make limited contributions to a new EU military constabulary force. No European nation maintains the ability to conduct significant out-of-area operations, and Europe as a whole maintains little airlift capacity.

Implications for America’s Economy. If the United States slashed its Navy and ended its mission as a guarantor of the free flow of transoceanic goods and trade, globalized world trade would decrease substantially. As early as 1890, noted U.S. naval officer and historian Alfred Thayer Mahan described the world’s oceans as a “great highway…a wide common,” underscoring the long-running importance of the seas to trade.[12]

#### Effective UUVs necessary to deter Chinese submarine movement—otherwise, they’ll patrol off the US coast causing crisis situations

Michael Robinson, Defense and Technology Specialist, 1/14/13, moneymorning.com/2013/01/14/this-profit-play-builds-hunter-drones-to-counter-the-chinese-sub-threat/

That's why I was glad to learn recently that SAIC is taking a leadership role in a major defense trend unmanned vehicles, usually referred to as drones. SAIC is helping the Pentagon pioneer underwater drones that can detect a new generation of ultra-quiet diesel-electric submarines that threaten U.S. security. In a moment I will share those details with you. But first, I want to make sure you know why I spend time talking to senior leaders like Beyster. See, these guys are not only big thinkers driving the Era of Radical Change, but many of them are also profit machines. They often define U.S. entrepreneurship the unique quality that makes America the perennial leader in global high tech ... and in the creation of wealth for its free-market investors. An entrepreneur himself, Beyster is known for taking two bold management steps. First, he laid the groundwork for employee ownership of a publicly traded firm. That may sound like an inherent contradiction. But not the way Beyster did it. At the time I talked with him, only the employees could own stock in SAIC. Beyster stands out today as a leader in pushing the concept of employee-owned firms. After he retired as CEO, the company launched an IPO, and its shares are publicly traded still. (In fact, to better focus on a changing market, SAIC later this year plans to split into two publicly traded firms.) Second, Beyster became the ultimate change agent. He created an atmosphere that catered to entrepreneurs which turned SAIC into an incubator for innovation. Indeed, many of Beyster's "employees" went off to start their own firms. Between 1975 and 2003 the 18-year stretch for which Beyster kept records roughly four dozen alumni started new companies. No doubt, most never became household names. You likely never heard of Michael A. Chipman. Fact is, he created a little software package called TurboTax. Shortly after going public in 1993, Intuit Inc. (NasdaqGS: INTU) acquired that firm and has gone on to return roughly 2,600% to investors. In 2004, Beyster retired from the company he'd founded back in 1969, at the height of the Vietnam War. But his focus on making sure that SAIC would remain a technical leader lives on today. That's clear from the recent news that the mid-cap firm just got a key "drone" contract with DARPA, the Pentagon's research unit. These days, most drones are airborne, and are known as "unmanned aerial vehicles," or UAVs. They represent a major trend toward pilotless military planes. But under a contract worth at least $58 million, SAIC will build and test an unmanned underwater vehicle (UUV) with a very special purpose. Simply put, DARPA wants a robotic anti-submarine vehicle a "sub-hunter" drone that can operate for extended periods, and cover thousands of miles of ocean as it does so. You see, China, North Korea and Iran between them now have 73 diesel-electric "boats," as they're known in military parlance. About half are the new, super-quiet subs. And more are on the way. In an era in which ultra-modern nuclear subs get all the headlines, here's a stunner: Diesel-electric technology which dates back to the late 1920s is one of the biggest sources of worry in the Pentagon's shadowy corridors. And for good reason. The propulsion systems of these boats are nearly silent. Diesel-electrics run on big diesel motors when running on the surface, but switch to batteries when submerged. That power system is nearly silent, making it the perfect design for the shallow waters just off our coastlines. These submarines also possess the "passive" sonar systems that make it possible for these submarines to sit and listen, submerged and quiet, just off our shores. It's a nasty package, and one that can't be ignored: We don't want the silent subs of our enemies to be able to launch a first strike on the U.S. from as little as a mile away. I believe this technology is vital, and the sooner we field these drones, known as ACTUVs, the better. It will give us an edge over China we'll be able to find their quiet subs long before they can find ours, shifting the balance of power back to the United States.

#### Limiting Chinese sub proximity key—allowing close patrols cause hair trigger alert and use-it-or-lose-it situations—causes nuclear escalation

Michael Glosny, Harvard John M. Olin Institute for Strategic Studies Fellow, 1/9/2008, Federal News Service, CHINA'S BOOMERS: IMPLICATIONS IF CHINA'S DETERRENT GOES TO SEA, Lexis

The first thing I want to say is there's a lot we just don't know about the boomer force. But there are a few things we do know or know with a reasonable amount of certainty, and I want to talk about how two specific factors -missile range and geographic situation -are going to impact the way the PLA would put out a boomer force if it decides to put out a boomer force. The first thing to say is the 094 clearly a vast improvement on the Xia class, on their former SSBN, that either never went out or went out in one deterrent patrol. And the JL-2 which is the missile that will eventually go on the 094 is about probably a four-fold increase in range over the current missile. But what does that mean in practice? When a lot of people talk about what the 094 with the JL-2 means for U.S. security, there are a lot of people that talk about the Chinese in their own territory, in their own territorial waters in the Bohai Gulf or in the Yellow Sea, being able to attack the continental United States. This is in lots of newspaper articles and lots of places it shouldn't be. For instance, it's all the time it appears in Jane's which should know better. But there's a '99 piece in Jane's Missiles and Rockets that I'll pull out. It says, quote, "JL-2 has a maximum range of 8,000 kilometers. When deployed, it will allow Chinese SSBNs to target portions of the U.S. for the first time from operating areas located near the Chinese coast." I'm sure if you've read anything on 094, you've probably read that before. In order for that statement to be true, based on what we know about the range, you need to stretch one of those two key concepts. You either need to stretch what counts as waters near the Chinese coasts, or you need to stretch what means portions of the United States. After the very next sentence in this article is the SSBN, quote, "would only have to patrol just to the northeast of the Kurile Islands to put approximately 75 percent of the United States at risk." Now, that's a big difference between sitting in Chinese territorial waters and holding Washington at risk or having to go a very, very long way. We didn't bring a map, but if you look at a map, it's a very, very long way to go from Chindao out into the deep north Pacific. MR. LEWIS: Mike, if I could just interrupt you. If you picked up a copy of one of my blog posts I printed out, it actually does have a said map. MR. GLOSNY: Great. You do the self-promotion, too, I see. (Laughs.) So that is a very big difference, and I'll talk a little bit about what some of the implications of the range of the missile is. But if you leave this room knowing nothing else, know that the 094 with the JL-2 in Chinese territorial waters cannot hit the continental United States. There is a follow-on missile which is going to be the sea-based version of the DF-31A which has a much longer range which could do so. And later in the Q&A or in the discussion, we can talk about what the implications for that are either for stability or for the U.S. Navy. The second factor that we're even more sure of, right, the missile range that's based on DOD estimates of what the DF-31's range is, and it's been roundabout 8,000 kilometers. On the DF-31, it's been reduced to 7,250. But we're roughly sure that it's somewhere in that range. It would be very surprising if it came in at 10,000 kilometers or something like that. So we're pretty sure of that. One thing we're really sure of is what the geographic situation is that China faces. If you look at where China is likely to be operating these submarines from, which is near Chindao, and then you look at what these patrol areas are that I'm talking about, which are very far east, very far east of the Kurile Islands, one thing you look at when you look at a map is there are very few ways for the Chinese to get there. There are essentially two major ways to get there. One would be going up north between Japan and South Korea through the Sea of Japan and then out. The other way would be to go south of Japan, sort of through Okinawa. And what does this mean for ASW concerns? Well, it narrows the areas that these submarines could possibly be. So this serves as something of a queuing in terms of where we would be looking for these submarines. The other thing that Jeff points out in the piece that you have is it draws the comparison between that and what in the Cold War was called the Greenland-Iceland-U.K. gap, right. When the Soviet Union had to get their submarines out into the Atlantic, we set up a gap of passive sonars, of P-3s dropping sonobuoys of attack submarines, and the Soviet submarines had to get through this in order to get to the promised land on the other side. Essentially, this is what this geography presents as a possibility, that in order for the Chinese SSBN to get out into that part of the world to launch, it would need to go through a similar type of gap. And although there's been a lot of discussion about how U.S. ASW has atrophied, much of this is focused on the idea of a small, diesel electric submarine operating in the coral shallow waters. What the geography means here, what the geography and the range of the missile mean is where the SSBN would need to go is not only through these gaps, that at least in the Cold War we were very good at setting up ASW bastions, but then would need to patrol in very deep water. And for those -not to get too technical -but for those that know a little bit about Cold War anti-submarine warfare, in deep water, sound propagates a lot longer, and it's a lot easier to make detections. So the missile range and the geography together essentially put the Chinese in a situation where they are far more constrained in how they would actually put this Boomer at sea if it wanted to, right. It limits how -it sets a constraint on how quiet the submarine needs to be in terms of being survivable. If the submarine only needs to be in its own waters to launch, it doesn't need to be anywhere near as quiet as it does if it needs to go through a very long patrol through fairly good ASW barriers. And this issue also impacts lots of other things like how many submarines they would need to have in order to be able to put submarines out in that deployed area. This is what, sort of, Air Force people call "the base loss factor," right -the further you need to go, the more, overall, you need to have to get one out there at that point in time. This is also probably going to impact readiness rates and maintenance requirements. If a submarine only has to sit off its own waters, that mission is not as demanding as it is if you're having to transit as -transit that far, so there's certainly a greater chance of breakdowns happening more often. Furthermore, there's this loss of home field advantage that we hear about in terms of diesel submarines acting in the littorals and thinking of Chinese submarines acting around Taiwan. The Chinese submarines know the water around Taiwan very, very well -they know where temperature changes happen; they know where salinity changes happen; they know how to hide, and where not to go. They are far, far, far less familiar with these waters out in the North Pacific. And this means that it's far more likely that they will run into places where they'll make a lot more noise. It's also likely -or not likely, but possible if you remember what the U.S.S. San Francisco did a couple of years ago, running into underground mountains that you didn't know were there because you're not familiar with the waters. Another thing that this geography and missile range together, put a constraint on the way communications work. Communications are much easier with a submarine if it's right off your own waters. When it's further away, it's far more difficult. And then, lastly, it's going to be much more difficult to keep allies -U.S. allies out of cooperating in this ASW fight than it would be if they were patrolling off their own waters. If you look at, sort of, the two ways you get out to the North Pacific, you're pretty much going around Japan. So while it might be unlikely to think that Japan is going to fly P-3s off the Chinese coast -and drop sono buoys off the Chinese coast and cooperate in ASW there, it's far more likely that they would cooperate in ASW as it's essentially coming through its own territory. I'll just say one more quick thing and then I'll shut up. I'm equally very worried about crisis stability. The Navy's response to the SSBN seems to be, okay, there's this threat, what do we need to have to neutralize it, deal with it, or be able to keep these Boomers, if they go out, at risk? Some of these escalation concerns are similar to what debates that happened in the 1980s maritime strategy, right, in terms of escalation and whether or not both tracking, trailing and then prosecuting Soviet SSBNs would put the -would provoke a situation where the crisis got out of control. I would say those issues are here, but in spades, right. What we would essentially be doing is putting the Chinese in a use-it-or-loseit situation, right. If you think of -whatever your estimates are of the readiness rates, and how many they build, and how many they get out, we're not talking about a lot of submarines. So it's very likely that even just trailing them, and having a fire-control solution on them, would put them in a situation where they feel like they need to launch, or they lose the capability to launch. And there are very good reasons, in terms of defensive national security, that would lead us to trail them all the time and know where they are. What I want to suggest is before asking that question, what force structure do we need to trail them, we also need to ask the other question of, what are the costs and risks that we're running by trailing them? I would suggest that, for a country whose command-and-control and communications are not that well-developed -and I'm sure we'll get into that; for a country whose understanding of escalation -and what counts as escalation, and what counts as provocation we really don't fully understand, it seems like it might not be the best of idea to put their survivable nuclear weapons in a situation where they're using it or losing it. And I'll just stop.

#### Extinction

Wittner 11

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While nuclear weapons exist, there remains a danger that they will be used. After all, for centuries national conflicts have led to wars, with nations employing their deadliest weapons. The current deterioration of U.S. relations with China might end up providing us with yet another example of this phenomenon. The gathering tension between the United States and China is clear enough. Disturbed by China’s growing economic and military strength, the U.S. government recently challenged China’s claims in the South China Sea, increased the U.S. military presence in Australia, and deepened U.S. military ties with other nations in the Pacific region. According to Secretary of State Hillary Clinton, the United States was “asserting our own position as a Pacific power.” But need this lead to nuclear war? Not necessarily. And yet, there are signs that it could. After all, both the United States and China possess large numbers of nuclear weapons. The U.S. government threatened to attack China with nuclear weapons during the Korean War and, later, during the conflict over the future of China’s offshore islands, Quemoy and Matsu. In the midst of the latter confrontation, President Dwight Eisenhower declared publicly, and chillingly, that U.S. nuclear weapons would “be used just exactly as you would use a bullet or anything else.” Of course, China didn’t have nuclear weapons then. Now that it does, perhaps the behavior of national leaders will be more temperate. But the loose nuclear threats of U.S. and Soviet government officials during the Cold War, when both nations had vast nuclear arsenals, should convince us that, even as the military ante is raised, nuclear saber-rattling persists. Some pundits argue that nuclear weapons prevent wars between nuclear-armed nations; and, admittedly, there haven’t been very many—at least not yet. But the Kargil War of 1999, between nuclear-armed India and nuclear-armed Pakistan, should convince us that such wars can occur. Indeed, in that case, the conflict almost slipped into a nuclear war. Pakistan’s foreign secretary threatened that, if the war escalated, his country felt free to use “any weapon” in its arsenal. During the conflict, Pakistan did move nuclear weapons toward its border, while India, it is claimed, readied its own nuclear missiles for an attack on Pakistan. At the least, though, don’t nuclear weapons deter a nuclear attack? Do they? Obviously, NATO leaders didn’t feel deterred, for, throughout the Cold War, NATO’s strategy was to respond to a Soviet conventional military attack on Western Europe by launching a Western nuclear attack on the nuclear-armed Soviet Union. Furthermore, if U.S. government officials really believed that nuclear deterrence worked, they would not have resorted to championing “Star Wars” and its modern variant, national missile defense. Why are these vastly expensive—and probably unworkable—military defense systems needed if other nuclear powers are deterred from attacking by U.S. nuclear might? Of course, the bottom line for those Americans convinced that nuclear weapons safeguard them from a Chinese nuclear attack might be that the U.S. nuclear arsenal is far greater than its Chinese counterpart. Today, it is estimated that the U.S. government possesses over five thousand nuclear warheads, while the Chinese government has a total inventory of roughly three hundred. Moreover, only about forty of these Chinese nuclear weapons can reach the United States. Surely the United States would “win” any nuclear war with China. But what would that “victory” entail? A nuclear attack by China would immediately slaughter at least 10 million Americans in a great storm of blast and fire, while leaving many more dying horribly of sickness and radiation poisoning. The Chinese death toll in a nuclear war would be far higher. Both nations would be reduced to smoldering, radioactive wastelands. Also, radioactive debris sent aloft by the nuclear explosions would blot out the sun and bring on a “nuclear winter” around the globe—destroying agriculture, creating worldwide famine, and generating chaos and destruction.

#### Chinese subs enable effective A2/AD strategies—destroys US Asia strategy—UUV anti-sub capabilities crucial

Eleni Elkmektsioglou, Handa Fellow at Pacific Forum CSIS, Masters from King’s College London War Studies Department, and Matthew Hallex, GW Masters, Scitor Strategic Analyst, 8/27/11, Chinese submarines and US anti-submarine warfare capabilities, www.e-ir.info/2011/08/27/the-undersea-balance-in-the-western-pacific-chinese-submarines-and-u-s-anti-submarine-warfare-capabilities/

China’s military modernization has been a source of great concern for the United States and its allies in the Asia-Pacific region. American anxiety has been fueled by double digit defense budget increases over the last decade along with the veil of mystery that covers Chinese defense spending. Much of these funds have been devoted to the acquisition of platforms and weapons that will allow China to implement Anti-Access/Area Denial strategies (A2/AD.)[1] Despite the growth of Chinese economic and military power, it is in no position to challenge the United States and in particular the U.S. Navy on equal footing.

Sea control in the face of U.S. maritime power is still beyond the People’s Liberation Army Navy (PLAN) but sea denial is an achievable goal.[2] Sea denial aims not to eliminate U.S. naval forces but drawing on the same toolkit as insurgents, aims to inflict unacceptable costs on enemy forces and erode their political will to continue fighting.[3] Such a strategy relies upon an asymmetric approach – confronting U.S. surface forces with PLAN surface forces would serve to play to the strengths of the United States. Rather, the PLAN aims to inflict unacceptable costs by focusing on the weaknesses of the United States. Multi-layered Chinese systems, threatening U.S. forces from the land, the surface, the air, and under the waves could threaten to deny access to key strategic areas to the United States.

Submarines, unsurprisingly, can be expected to play a significant role in Chinese asymmetric A2/AD strategies.[4] The inherent stealth of submarines makes anti-submarine warfare (ASW) one of the most difficult tasks facing a modern navy. This challenge is complicated further by Chinese acquisition of new nuclear (SSNs) and advanced conventional submarines (SSKs.) When armed with advanced torpedoes, sea mines, and anti-ship missiles, even relatively unsophisticated submarines can pose a significant threat to U.S. surface forces, including the aircraft carriers that are the heart of the U.S. ability to project power into the Western Pacific region.

This paper will address the role submarines are likely to play in Chinese maritime strategy. It will review the structure of the Chinese submarine force and procurement trends that are shaping its future structure. China has identified a growing gap in U.S. military capabilities since the end of the Cold War and this paper will identify some of the operational uses and missions of submarine the PLAN will likely use to exploit it. The paper will also review current weaknesses in U.S. ASW capabilities, efforts currently underway to address them, and conclude with suggestions of further steps that should be taken to improve the ability of the U.S. to properly exploit the undersea domain. Chinese Submarine Forces Modernization and expansion of the submarine fleet has been a high priority for the People’s Liberation Army Navy. Acquisitions from abroad as well as a number of indigenous development programs have added advanced conventional and nuclear submarines to China’s fleet. In addition to bolstering the number of vessels deployed by China, the acquisition of new weapons systems have made Chinese forces a more potent threat to U.S. and allied forces in the region. Force Size While China has maintained a number of obsolete vessels in service, procurement in recent years has been focused on replacing outmoded vessels and increasing the size of the force. According to the Congressional Research Service, the PLAN’s annual commissioning rate of 2.6 submarines of all types will eventually result in an undersea force of 53-79 submarines.[5] The final size of the submarine force will depend upon China’s choice of deploying large numbers of less costly diesel-electric submarines or acquiring a smaller force of nuclear submarines. Platforms Beginning in the 1990s, China undertook an extensive modernization of its submarine force. Initially, the PLAN focused on acquiring advanced submarines from abroad and purchased 12 Kilo class submarines from Russia in 2002. In addition to foreign acquisitions, China has indigenously developed four classes of submarines including a nuclear ballistic missile submarine (Type 094/Jin-class), a nuclear attack submarine (Type 093/Shang-class) and two classes of conventional diesel electric submarines the Song and Yuan classes.[6] The Yuan class is believed by many analysts to be equipped with an Air Independent Propulsion (AIP) system which would significantly improve its stealth capabilities.[7] In addition to the new submarines that have been fielded, China is developing two additional submarine classes that represent steps towards a sophisticated submarine force. China seems determined to develop an improved version of its indigenously produced Shang class nuclear attack submarine. According to the U.S. Office of Naval Intelligence report, this improved attack submarine is expected to enter service in 2015.[8] An improved variant of the Yuan class is also under production. This variant is reported to be notably different from its predecessors and incorporates a number of features from the Kilo class submarines acquired from Russia.[9] Weapons Systems Procurement of advanced weapons systems is key to making China’s newly acquired submarines an effective fighting force, in addition to boosting the combat capabilities of China’s current forces. Chinese submarines are equipped with wake-homing-torpedoes which can threaten U.S. surface forces. Kilo-class submarines are equipped with the SS-N-27 Sizzler anti-ship missile. The Sizzler is a supersonic sea skimming missile designed to defeat the Aegis missile defense system deployed by the U.S. Navy.[10] The Yuan and Song class submarines are expected to be equipped with the new CH-SS-NX-13 anti-ship missile when it completes development and testing. As well as being able to threaten U.S. surface vessels, Shang class submarines are capable of firing land attack cruise missiles that would allow it to threaten bases in the region and other infrastructure that support U.S. power projection in the Western Pacific. The Chinese Submarine Force in the Context of a Sea Denial Strategy Chinese procurement trends suggest a preference for smaller and stealthier submarines rather than long-range endurance platforms. While China is moving towards a blue water navy, it is capitalizing on advantages conventional submarines present to green water navies. Conventional submarines, particularly those equipped with AIP systems, can operate with a greater degree of stealth and freedom in the waters near China than larger U.S. nuclear submarines. Advanced weapons systems deployed on submarines along with land based missile and air forces would serve to deny the waters near the Chinese coast to U.S. and other combat forces. While U.S. submarines play an important role in ASW activities, Chinese operational planners seem to focus more on the development of anti-surface warfare (ASuW) doctrine enabled by stealthy conventional submarines. Through the purchase and indigenous production of quiet diesel-electric boats, China intents to create a ‘ghost’ submarine force that would move silently along the Chinese coast looking for possible surface targets while avoiding encounters with the enemy’s submarine force. The difficult underwater geography of the littoral region as well as the noise from coastal shipping, fishing, and other economic activities make it an ideal operating environment for China’s submarines. Chinese investments in hydrographic studies enhance its knowledge of the underwater topography, thermoclines, and other elements of the coastal area and would allow the PLAN to take full advantage of the opportunities offered by the Chinese coastal operation theater. [11] While Chinese operational plans and possible missions for their submarine force remains opaque to outside analysts, the limitations of their current systems suggest that submarine forces are unlikely to operate independently. Rather, as Admiral McVadon suggests in the Naval War College Review, Chinese submarine forces would work in coordination with shore based missile systems.[12] Given that older Chinese submarines would encounter difficulty attempting to penetrate U.S. ASW defenses to conduct anti-surface strikes under normal conditions, the PLAN would be more likely to wait until missile strikes launched from the mainland had degraded U.S. missile defenses before launching anti-ship missile and torpedo attacks. The supersonic Sizzler ASCM fired by Kilo class submarines could threaten U.S. surface forces if launched in sufficiently numbers, or if a Kilo managed to surprise its target.[13] The subsonic missiles and torpedoes carried by the rest of the Chinese submarine fleet would be easier for U.S. forces to defeat but they could still pose a significant threat to U.S. surface vessels after U.S. defenses were degraded by other attacks. Older submarines including the Ming, Romeo, and Han class vessels based on obsolete Soviet designs, can also pose a threat. Such submarines could act as mine layers or as bait, bringing in U.S. submarines and ASW forces into the range of missiles carried by more advanced Chinese submarines.

The technological developments undertaken by the Chinese submarine force have had an impact on the PLAN’s assessment of their own capabilities and roles. The Kitty Hawk incident, in which a Chinese submarine surfaced in the midst of a U.S. carrier battle group, suggests that Chinese submariners are confident in their ability to avoid detection by U.S. ASW escorts.[14] Such incidents as well as an increasing number of submarine patrols suggest that China aims at operating its forces further afield in the region and sending the message across that China is a non- negligible maritime power in the Asia Pacific.[15]

The United States and the Chinese Undersea Challenge

While the submarine forces of the PLAN have expanded and improved their technological capabilities, the ASW capabilities of the United States have eroded. Throughout the Cold War the United States faced a persistent threat from Soviet submarines and ASW was to be a primary mission of the U.S. Navy during a conflict as it attempted to eliminate Soviet sea based nuclear forces and ensure that sea lanes to NATO allies in Europe remained open. The fall of the Soviet Union eliminated the undersea peer threat to the United States and ASW has not been a major component of U.S. naval operations in recent conflicts. The U.S. has retained qualitative and technical superiority in the undersea domain but ASW capabilities have suffered in recent decades.

Much of the difficulty faced by U.S. ASW forces stems from the technical challenge posed by the stealth of advanced conventional submarines. Conventional submarines operating on battery power have a smaller passive sonar signature than nuclear submarines which must keep their reactor machinery operating. AIP systems serve to extend the period in which SSKs can operate quietly making them more capable and more difficult to detect. In addition to the technical challenge posed by modern conventional submarines forces, the balance of undersea forces in the Pacific is shifting. While the PLAN expands its submarine forces, U.S. naval forces are drawing down. The current shipbuilding plan of the U.S. Navy envisions a reduction in submarine forces to a fleet of only 39 nuclear attack submarines in 2030, significantly less than the 48 that the Navy projected as necessary to fulfill future missions.[16] While U.S. submarines are unmatched technologically, their low numbers will be a significant shortcoming due to the heavy demands that would likely be placed on them to perform both strike and ASW missions during a potential conflict between the U.S. and China. Other shortfalls in U.S. ASW capabilities can also be expected. Anti-submarine warfare is a planned mission for the Littoral Combat Ship (LCS), a program which has proven to be deeply troubled. Currently deployed LCSs have developed significant problems with structural damage due to corrosion. The LCS also lacks organic ASW capabilities and is not equipped with the towed sonar array found on previous dedicated ASW combatants. Rather, the LCS can be equipped with an ASW mission module when necessary that is projected to include unmanned undersea vehicles (UUVs) and unmanned aerial vehicles (UAVs) that can carry out ASW missions. The LCS mission modules are facing a number of development hurdles and are significantly behind schedule.[17] U.S. aerial ASW capabilities have similarly eroded. The U.S. retired the S-3 Viking leaving U.S. carriers without a fixed wing ASW capable aircraft. While the U.S. is replacing its P-3 Orion maritime surveillance and ASW aircraft with the advanced P-8, such aircraft must operate from land bases. While the P-8 will likely be a highly capable ASW combatant, the bases it operates from would be highly vulnerable to the types of missile and air attacks that would be integral to a Chinese A2/AD strategy. While the U.S. Navy faces significant challenges in the ASW arena, it has taken a number of steps to cope with the increased threat posed by Chinese and other submarines. U.S. naval forces in the Pacific have placed a renewed emphasis on ASW training. As part of an effort to build greater familiarity with conventional submarines equipped with AIP systems the U.S. conducted two years of training with the Gotland, an advanced Swedish diesel submarine.[18] Such training continues as part of the Diesel Electric Submarine Initiative which involves regular training exercises involving U.S. ASW forces and the conventional submarines of allies.[19] While this training is a step in the right direction, exercises have demonstrated that advanced diesel submarines are highly capable threats that can threaten major U.S. surface combatants. Shipbuilding shortfalls are unlikely to be improved due to expected future cuts in the U.S. defense budget and the significant problems that plague current U.S. navy procurement efforts. The U.S. has coped, in part, by shifting its current forces to better face the threat posed by expanding Chinese capabilities. The U.S has permanently home ported four Los Angeles class submarines and a tender in Guam and shifted other submarines to bases in Hawaii and California.[20] The U.S. is also planning to base future LCSs in forward bases in Singapore.[21]While forward deployment does risk putting the infrastructure supporting U.S. ASW forces within range of Chinese missile systems, it would also reduce the transit time for U.S. forces, allowing them to deploy more quickly and remain in theater longer during a conflict. The shortcomings in China’s own ASW capabilities would allow U.S. submarine forces to disrupt Chinese attempts to project power in the region and threaten PLAN surface forces. Cruise missile armed U.S. submarines would also play an important role in strikes against targets within China. During Desert Storm just 10% of missile strikes came from subs, while one third of such strikes were launched from submarines during the conflicts in Afghanistan and Iraq.[22] The conversion of Ohio class ballistic missile submarines to guided missile submarines (SSGNs) has expanded this capability further. U.S. submarines represent a power projection force that is relatively immune to Chinese A2/AD capabilities as they can’t be threatened by air and missile forces and China currently lacks ASW forces to credibly threaten them. While the striking abilities of U.S. undersea forces will be diminished by the retirement of Ohio class SSGNs, they represent a threat that the PLAN lacks the ability to credibly respond to. Recommendations for the United States

Shifting submarines forces to the Pacific and increasing ASW training is an important first step in responding to the challenge posed by China’s expanding and improving submarine forces. However, it is insufficient. There are a number of steps the United States could take to improve the undersea balance of power in the Asia Pacific region. Submarines are a vital asset which can serve as the primary ASW tool for U.S. naval forces, and which can carry out strike missions without interference from Chinese A2/AD systems. Addressing the shrinking size of the U.S. fleet is vital. The U.S. Navy should continue its efforts to improve the cost effectiveness of its current procurement programs and consider shifting a larger portion of the shipbuilding budget to submarine acquisition. In particular, the U.S. should procure additional guided missile submarines to replace retiring Ohio class SSGNs and to expand the ability of the U.S. to strike targets despite China’s deployment of A2/AD systems.

The United States should also invest in new technical solutions that could bolster American ASW capabilities. Unmanned surface and underwater vehicles are increasingly capable and further development in this area would provide alternatives to expensive and vulnerable manned assets. Ships deploying a number of unmanned sensors from a standoff distance would be better able to detect stealthy submarines while being less vulnerable to Chinese missile attacks. Deploying fixed sensors in strategic points in the waters near China would also improve the ability of the U.S. to detect PLAN submarines. During the Cold War fixed acoustic sensors deployed between Greenland, Iceland, and the United Kingdom allowed U.S. forces to detect Soviet submarines as they entered the North Atlantic. Similar systems could serve as tripwires for the entrances to the Western Pacific from the South China Sea. The cooperation of Vietnam and the Philippines would be required for the deployment of the shore based support infrastructure, but as Chinese naval deployments grow more threatening, the support of these states is more likely to be forthcoming.[23]

#### Causes fast widespread Asia prolif

Friedberg, 2009

Aaron Friedberg, Professor of Politics and International Affairs, Woodrow Wilson School, Princeton University, Sep-Oct 2009, “Menace,” The National Interest, http://nationalinterest.org/greatdebate/dragons/menace-3818

FAST-FORWARD to the present. America's ability to project power into the western Pacific, once unchallenged, is now threatened by the maturation of what Pentagon planners refer to as China's "anti-access/area-denial" strategy. The goal here is not to match the Americans ship-for-ship and plane-for-plane but rather to develop certain specialized capabilities designed to make it difficult, if not impossible, for U.S. forces to operate freely anywhere close to China's coasts. In the past decade, Beijing has made considerable progress toward achieving this goal. Every one of the relative handful of bases on which the United States relies to sustain its presence in East Asia will soon be within range of bombardment by repeated salvos of precisely targeted Chinese conventional ballistic and cruise missiles. At the same time, the PLA is in the process of knitting together a network of satellites, onshore radars and other sensors that will permit it to locate and track an enemy's surface ships hundreds of miles off its coasts and then use a combination of torpedoes, high-speed cruise missiles and land-based ballistic missiles to sink or disable them. America's huge and costly aircraft carriers are the key to its global power-projection capabilities. In a future crisis, Washington might have little choice but to pull them far back from China's coasts, well beyond the effective range of their aircraft. This would dramatically reduce their ability to provide air defense for U.S. friends or to conduct strikes against Chinese forces on land or at sea. In addition to these more direct modes of attack, the PLA is experimenting with antisatellite weapons and techniques for taking down an enemy's computer networks, thereby rendering him deaf and blind during the critical opening phases of a war. On the defensive side of the equation, the PLA Navy (PLAN) is turning out attack submarines at a record pace and developing sophisticated undersea mines; it is in the process of completing a massive new submarine base adjacent to the South China Sea, and has reportedly begun to deploy an undersea detection system that would aid it in engaging U.S. submarines operating off its shores. Finally, China is investing heavily in "passive defenses" (hiding or hardening critical facilities) and in advanced radars and surface-to-air missiles, including some that may be effective against "stealthy" Western aircraft and cruise missiles. THIS COMBINATION of rapidly advancing offensive and defensive capabilities is beginning to raise doubts in the region about America's ability to defend its allies and project its power. What is worse, over the next several years there will be an increasing danger that, in an extreme crisis, China's leaders might believe that they have a chance of starting a war by effectively knocking the United States out of the western Pacific and blunting its initial, retaliatory response, all without striking the American homeland and without the need to fire a single nuclear weapon. If it were successful, such an attack would leave a president with some agonizing choices. Much as during the cold war, if faced with the possibility of a quick conventional defeat in Western Europe, American decision makers would have to contemplate the use of nuclear weapons. But, as was true then, the plausibility of escalatory threats will diminish as the probability of retaliation rises. Beijing is fast approaching the point where it will have a secure second-strike force capable of dealing a devastating blow no matter how hard the United States might try to prevent it. As risky as an American attack on Chinese nuclear forces, ports, airfields and communications centers would be today, it will be considerably more so a few years from now. Beijing is in the process of deploying intercontinental-range ballistic missiles (ICBMs) that will be far less vulnerable than their predecessors. In addition to its small force of fixed, single-warhead ICBMs, over the next few years China will place in service several dozen hard-to-locate road-mobile and submarine-launched missiles, each capable of striking the United States with multiple warheads. OF COURSE, there are alternatives to the nightmare of nuclear war. If Washington chose not to use nuclear weapons, it might respond to a Chinese attack by engaging in "horizontal escalation," hitting back at another location where the opponent is vulnerable and U.S. forces still enjoy an overwhelming advantage. The most obvious way to do this, though perhaps not the only one, would be to use America's global naval strength and airpower to cut China off from the sea. This is an arena of military competition in which the United States maintains overwhelming superiority. While the PLAN may be able to contest control of its immediate coastal waters, its capabilities fall off rapidly with distance. If the United States wanted tomorrow to constrict China's maritime access to oil, minerals and markets, there would be very little Beijing could do in direct response. Chinese strategists are acutely aware of this potential vulnerability and they are hard at work on a variety of projects which, taken together, may help to mitigate the danger. Included among these are: a strategic petroleum reserve; transcontinental pipelines to Russia and Central Asia; the pursuit of undersea resources close to China's coasts; new transportation routes through Southeast Asia that would permit oil and gas from the Middle East to bypass the narrow straits off Indonesia; the construction of ports and airfields in Myanmar and Pakistan that could be used in an emergency by a future Chinese air and naval "rapid-deployment force"; a deepening strategic relationship with Iran that could provide a bridgehead to the Persian Gulf; and the development of aircraft carriers and long-range nuclear-powered attack submarines, and the construction of large numbers of diesel subs, which will give the PLAN some capacity to defend China's sea-lanes and perhaps to attack the shipping of its rivals. If produced in sufficient numbers, the same antiship ballistic missiles (ASBM) that will soon threaten American aircraft carriers could also be used against commercial vessels. Using a combination of missiles and submarines, Beijing might be able to impose a blockade of its own on key American allies like Japan, perhaps weakening its will to stay in the fight or, better yet, dissuading it from ever joining with the United States in the first place. AMERICA'S INFLUENCE in and access to Asia will be drastically reduced, with harmful long-term consequences for its security, prosperity and ability to promote the spread of liberal democracy, if it is seen to be in long-term decline relative to China or, even worse, if it appears irresolute, incompetent, unwilling or simply unable to fulfill its commitments. Other governments will then have no choice but to reconsider their national strategies either by developing their own nuclear capabilities or-worse-by bandwagoning with Beijing.

Nuclear war

Van Jackson, Exec. Ed. Of Asia Chronicle, 5-8-2009, “Can U.S. Nuclear Plan Prevent Asian Arms Race?” YPFP, http://www.ypfp.org/content/can-us-nuclear-plan-prevent-asian-arms-race

One of the myriad fears associated with North Korea’s possession of nuclear weapons is the potential for it to spark a nuclear arms race in Asia. The doomsday scenario plays out rather intuitively: 1) North Korea confirms unequivocally that it will be keeping its existing nuclear weapons or possibly adding to its stockpile; 2) Japan, which has repeatedly mentioned its belief that a nuclear North Korea is a threat to Japanese security, dramatically builds up its defensive and offensive military capability, possibly developing its own nuclear program while it pushes for greater involvement in transnational security issues such as terrorism; 3) China, continuing to see Japan as the only near-peer realistically capable of challenging its regional leadership, is threatened by Japan’s remilitarization and responds by increasing its own military spending; 4) Partly in response to China’s increased military expenditures and partly in response to nagging historically based concerns over Japan’s remilitarization, both South Korea and Taiwan build up their own conventional armaments, potentially engaging in secret nuclear programs as well. Under such circumstances, political risk indicators would shoot through the roof and foreign direct investment inflows of capital would quickly dry up as multinational corporations seek a safer, more stable region in which to do business. The region’s resulting economic contraction would place increasing pressure on national governments to pander to xenophobic and nationalistic sentiments, as has been done many times before, thus stoking the fire of conflict. The region, in sum, would become a powder keg. This is not overly pessimistic hyperbole but a realistic scenario according to the classic literature on security dilemmas.[1] Just imagine a world where the most powerful countries in Asia all either possess nuclear weapons or are engaged in covert programs to develop a nuclear weapons capability, each in the name of its own security. Such a dreadful possibility is exactly what the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) was designed to prevent.

## adv 3

#### Adv 3 water diplomacy

#### DOD SMRs key to water diplomacy---only way to ensure effective supplies in drought-affected areas

Pfeffer, 1

(Physical Scientist- Army Nuclear and Chemical Agency, MS-Physics at Johns Hopkins, “Nuclear Power: An option for the Army’s Future,” http://www.almc.army.mil/alog/issues/SepOct01/MS684.htm)

The idea of using nuclear power to produce synthetic fuels, originally proposed in 1963, remains feasible today and is gaining significant attention because of recent advances in fuel cell technology, hydrogen liquefaction, and storage. At the same time, nuclear power has become a significant part of the energy supply in more than 20 countries—providing energy security, reducing air pollution, and cutting greenhouse gas emissions. The performance of the world's nuclear power plants has improved steadily and is at an all-time high. Assuming that nuclear power experiences further technological development and increased public acceptance as a safe and efficient energy source, its use will continue to grow. Nuclear power possibly could provide district heating, industrial process heating, desalination of seawater, and marine transportation. Demand for cost-effective chemical fuels such as hydrogen and methanol is expected to grow rapidly. Fuel cell technology, which produces electricity from low-temperature oxidation of hydrogen and yields water as a byproduct, is receiving increasing attention. Cheap and abundant hydrogen eventually will replace carbon-based fuels in the transportation sector and eliminate oil's grip on our society. But hydrogen must be produced, since terrestrial supplies are extremely limited. Using nuclear power to produce hydrogen offers the potential for a limitless chemical fuel supply with near-zero greenhouse gas emissions. As the commercial transportation sector increasingly moves toward hydrogen fuel cells and other advanced engine concepts to replace the gasoline internal combustion engine, DOD eventually will adopt this technology for its tactical vehicles. The demand for desalination of seawater also is likely to grow as inadequate freshwater supplies become an urgent global concern. Potable water in the 21st century will be what oil was in the 20th century—a limited natural resource subject to intense international competition. In many areas of the world, rain is not always dependable and ground water supplies are limited, exhausted, or contaminated. Such areas are likely to experience conflict among water-needy peoples, possibly prompting the deployment of U.S. ground forces for humanitarian relief, peacekeeping, or armed intervention. **A mobile desalination plant using waste heat from a nuclear reactor could help prevent conflicts** or **provide emergency supplies of freshwater to indigenous populations**, and to U.S. deployed forces if necessary. Promising Technology for Tomorrow Compact reactor concepts based on high-temperature, gas-cooled reactors are attracting attention worldwide and could someday fulfill the role once envisioned for the energy depot. One proposed design is the pebble bed modular reactor (PBMR) being developed by Eskom in South Africa. Westinghouse, BNFL Instruments Ltd., and Exelon Corporation currently are supporting this project to develop commercial applications. A similar design is the remote site-modular helium reactor (RS-MHR) being developed by General Atomics. If proven feasible, this technology could be used to replace retiring power plants, expand the Navy's nuclear fleet, and provide mobile electric power for military or disaster relief operations. Ideally, modular nuclear power plants could be operated by a small staff of technicians and monitored by a central home office through a satellite uplink. The technology of both the PBMR and the RS-MHR features small, modular, helium-cooled reactors powered by ceramic-coated fuel particles that are inherently safe and cannot melt under any scenario. This results in simpler plant design and lower capital costs than existing light water reactors. The PBMR, coupled with a direct-cycle gas turbine generator, would have a thermal efficiency of about 42 to 45 percent and would produce about 110 megawatts of electricity (MWe). The smaller RS-MHR would produce about 10 to 25 MWe, which is sufficient for powering remote communities and military bases. Multiple modules can be installed on existing sites and refueling can be performed on line, since the fuel pebbles recycle through the reactor continuously until they are expended. Both designs also feature coolant exit temperatures high enough to support the thermochemical water-splitting cycles needed to produce hydrogen. For military applications, RS-MHR equipment could be transported inland by truck or railroad, or single modules could be built on barges and deployed as needed to coastal regions. The Army's nuclear reactor on the barge Sturgis, which provided electric power to the Panama Canal from 1968 to 1976, demonstrated the feasibility of this concept. In fact, the military previously used several power barges (oil-fired, 30-MWe power plants) during World War II and in Korea and Okinawa as emergency sources of electric power. Research teams around the world also are examining other reactor concepts based on liquid-metal-cooled reactor systems with conventional sodium or lead-alloy coolants and advanced water-cooled systems. The Department of Energy (DOE) is supporting research and development of innovative concepts that are based on ultra-long-life reactors with cartridge cores. These reactors would not require refueling, and they could be deployed in the field, removed at the end of their service life, and replaced by a new system. The proposed international reactor innovative and secure (IRIS) design, funded by DOE's Nuclear Energy Research Initiative, would have a straight burn core lasting 8 years and may be available by 2010. Based on increasing costs of fossil fuels, a growing consensus that greenhouse gas emissions must be reduced, and a growing demand for energy, there is little doubt that we will continue to see significant advances in nuclear energy research and development. Nuclear power is expected to grow in the 21st century, with potential benefits applicable to the military. Small, modular nuclear power reactors in mobile or portable configurations, coupled with hydrogen production and desalination systems, could be used to produce fuel and portable water for combat forces deployed in remote areas and reduce our logistics requirements. Assuming the inevitability of hydrogen fuel replacing fossil fuels, a clearly defined objective that was missing in 1966 now exists. The partnership between DOD and the former AEC to develop Army nuclear reactors contributed to the technology of both military and small commercial power plants. This historical relationship should be renewed based on recent technological advances and projected logistics requirements. DOD logistics planners should reconsider military applications of nuclear power and support ongoing DOE research and development initiatives to develop advanced reactors such as RS-MHR, IRIS, and others. For the Army to fight and win on tomorrow's distant battlefields, nuclear power will have to play a significant role.

#### Military SMRs key to mobile desalination and water delivery—only energy source that solve

Butler 10

Lieutenant Colonel, Glen, Why the Marine Corps should lead the environmental and energy way forward and how to do it http://www.mca-marines.org/gazette/not-green-enough

Environmental and energy (E2) issues have been politically ladened topics throughout their existence in the public’s consciousness. In the 1970s, E2-concerned citizens were stereotypically depicted as hippies building solar farms on communes, although OPEC’s (Organization of Petroleum Exporting Country’s) actions and the oil embargo of 1973 shot fuel dependency into the mainstream. Nevertheless, the country took little sustained notice after a brief period of heightened concern. In the 1980s and 1990s, the Marine Corps’ E2 was largely focused on compliance with existing regulations, prevention of oil spills and hazardous material incidents, and stewardship of threatened or endangered species. However, “green fever” transitioned E2 from an emotional peacenik mantra—first into the marketer’s delight, and more recently, into genuine national concern. The government, for its part, has brought in another important consideration particularly emphasized within the last few years—E2 as a national security linchpin.1 Whether you stand behind global warming or “climategate” matters little; we as Marines should understand that these issues are not Republican or Democrat and not a mere debate between Al Gore and Sean Hannity.2 E2 issues are now at the forefront of everything we do, validated by a preponderance of Federal directives and related military mandates. Both the Secretary of the Navy (SecNav) and Commandant of the Marine Corps (CMC) have made their positions clear via broad and innovative guidance.3 From the CMC’s Marine Energy Assessment Team and Expeditionary Energy Office to Secretary Raymond Mabus’ “Great Green Fleet,”4 the Navy-Marine Team has never had stronger green leadership. Nevertheless, **the Marine Corps has yet to fully seize the moment and take truly bold and daring steps.** Most every Service and successful organization has embraced the green revolution in some form, but **the Marine Corps has work remaining if it desires to lead the charge in typical Marine fashion**. With support to our combat deployed forces remaining the number one priority, it is understandable that expeditionary energy is the focus. But if installations are truly the fifth element of the MAGTF,5 this emphasis must be broadened to include warfighters’ stateside homes. There are many avenues in the E2 arena to accomplish this; here are just a few recommendations. Back Policy With Resources Much green verbiage today is delivered in neat, round goals (“reduce XXX 20 percent by 2020,” etc.) bathed in cliché ecoterms like “alternative,” “renewable,” “clean,” and “sustainable.”6 Yet without resources to support those goals, this is but a promulgation of the ends but not the ways or means. To help correct this problem the Marine Corps should lead endeavors for joint force planning, identify potentially synergetic projects, lobby for substantial E2-targeted resources,7 and develop more Marine-specific, Corps-wide guidance to secure future mission capabilities. Continue Multifaceted Approach, but Standardize Best Practices Many significant E2 initiatives exist across the Corps, yet most remain a patchwork of uncoupled and often competing efforts cobbled together by energetic commanders and creative action officers. We need a centralized, web-based hub to share best practices, voice concerns, and foster additional E2 learning,8 and all bases and stations should establish dedicated, robust energy websites.9 Although installations should retain a degree of flexibility to suit local nuances of region, they should capitalize on successful programs by replication through directives and with resources from the top; where good ideas exist, adopt these best practices Service-wide.10 Pursue bold, long-term programs but also easy quick-kills to show progress and produce a gradual paradigm shift.11 Even so, be leery of excessive “innovations” that substitute unnecessary inconvenience (like trayless mess halls) in place of education and impractical rationing that ignores realities of operational requirements, mission expansion, and population growth.12 Focus on educating Marines and families to make proper choices. Enhance Education For better linkage with our Operating Forces, infuse the E2 sector across the fifth element with uniformed Marines. Just as developing computer/Internet technology and operations necessitated the creation of new computer-related MOSs/billets in the 1990s, so too should we now lean forward and inject professionally trained active duty officers into the E2 field (not just civilian logisticians).13 Higher level guidance on E2 issues is (overly) abundant,14 yet the education piece—(key to drive a cultural shift and often the most effective method for positive change) is severely lacking. Our resident and nonresident professional military education curricula lack any modern E2 instruction.15 The majority of actionable and educational initiatives are left to the local commander’s own resourcefulness. In addition to attendance at E2 conferences16 and liaison between the new Marine Corps/Navy Energy Offices, the Marine Corps should collaborate with our Navy leadership to develop high-quality educational programs, available on a variety of levels (from MarineNet to The Basic School to the war colleges to the Naval Postgraduate School), to ensure that our next generation of Marines and sailors is poised to lead the way forward in E2 fields, including renewable, alternative and, yes, nuclear energy technologies. Consider Nuclear Power On 16 March 1979, The China Syndrome opened in theaters across the country, depicting a fictitious story about a reporter witnessing an accident at the Ventanna nuclear plant outside Los Angeles and the subsequent evil plot to suppress the truth. Twelve days later the Three Mile Island partial core meltdown in Pennsylvania helped propel The China Syndrome to theatrical success and permanently scarred the American psyche. The nail in the nuclear energy coffin was the nuclear disaster 7 years later at Chernobyl, in the Ukrainian Soviet Socialist Republic.17 But despite these stains on the nuclear power industry, the time has never been better for the Marine Corps (and Navy) to dive in than now. Here’s why. First, the political climate, though still tenuous, is shifting to favorable, with the change coming from the top down. During his 27 January 2010 State of the Union address, President Barack Obama echoed themes from his campaign trail by clearly voicing his intention to include nuclear power in American’s playbook of energy security options.18 Similarly, as the Department of Energy’s (DoE’s) Secretary of Energy, Steven Chu has articulated similar sentiments, declaring that “President Obama and I are committed to restarting the nuclear industry in the United States.”19 Many other political leaders and policymakers indeed support a true “nuclear renaissance,”20 and the growing momentum stands a chance to bury the ghosts of Chernobyl once and for all. Second, with our **well-replicated but limited pursuit of the standard renewable energies,21 we’re putting all energy eggs in one basket, a vessel unlikely to hold a sufficient load for success**. Currently pursued renewable energy sources do have limitations.22 More importantly, with military installations relying almost exclusively on external sources for energy, and those sources largely unpredictable, unsecured, and reliant on foreign-based oil,23 if energy security is truly a national security issue, then nuclear power should be considered. Solar demonstrations at Miramar and Barstow are not enough. Third, nuclear technology today has advanced well beyond the days of Three Mile Island. Specifically, small modular reactors (**SMRs) offer great potential to safely and effectively provide energy island/net zero capabilities to Marine Corps** and Navy **installations** across the country.24 SMRs have relatively low plant cost, can replace aging fossil plants, and do not emit greenhouse gasses. Some are as small as a “hot tub” and can be stored underground, dramatically increasing safety and security from terrorist threats.25 Encouragingly, in fiscal year 2010 (FY10) the DoE allocated $0 to the U.S. SMR Program; in FY11, they’ve requested $38.9 million. This funding is to support two main activities—public/private partnerships to advance SMR designs and research and development and demonstrations. According to the DoE’s website, one of the planned program accomplishments for FY11 is to “collaborate with the Department of Defense (DoD) . . . to assess the feasibility of SMR designs for energy resources at DoD installations.”26 The Marine Corps should vigorously seek the opportunity to be a DoD entity providing one platform for this feasibility assessment.27 Fourth, SMR technology offers the Marine Corps another unique means to lead from the front—not just of the other Services but also of the Nation, and even the world.28 This potential Pete Ellis moment should be seized. There are simple steps we could take,29 and others stand ready to lead if we are not.30 But **the temptation to “wait and see**” and “let the others do it; **then we’ll adopt it” mentality is not always best.** Energy security demands boldness, not timidity. To be fair, nuclear technology comes with challenges, of course, and with questions that have been kicked around for decades. An April 1990 Popular Science article asked, “Next Generation Nuclear Reactors—Dare we build them?” and included some of the same verbiage heard in similar discussions today.31 Compliance with National Environment Policy Act requirements necessitates lengthy and detailed preaction analyses, critical community support must be earned, and disposal challenges remain. Still, none of these hurdles are insurmountable.32 Yet despite the advances in safety, security, and efficiency in recent years, nuclear in the energy equation remains the new “n-word” for most military circles. And despite the fact that the FY10 National Defense Authorization Act called on the DoD to “conduct a study [of] the feasibility of nuclear plants on military installations,” the Office of the Secretary of Defense has yet to fund the study.33 Fifth, the cumbersome, bureaucratic certification process of the Nuclear Regulatory Commission (NRC), often enough to scare away potential entrepreneurs and investors, is not necessarily a roadblock to success. The NRC is “responsible for licensing and regulating the operation of commercial nuclear power plants in the United States.” Military installations offer unique platforms that could likely bypass an extended certification process. With established expertise and a long safety record in nuclear reactor certification, operations, training, and maintenance, the Naval Nuclear Propulsion Program comprises the civilian and military personnel who: . . . design, build, operate, maintain, and manage the nuclear-powered ships and the many facilities that support the U.S. nuclear-powered naval fleet.”34 Bypassing the NRC and initiating SMR experimentation under ADM Hyman Rickover’s legacy umbrella of naval reactors could shorten the process to a reasonable level for Marine and naval installations.35 Finally, Marine Corps-SMR technology opens the pathway for related endeavors and synergetic undertakings. The Army has several smart and influential individuals poised to partner in nuclear energy endeavors, and our naval brethren enjoy a long history of nuclear reactor expertise. Partnerships and enhanced use leases to support SMR deployments should be leveraged.**36 As the collective military expertise in SMR technology grows**, additional capabilities, such as expeditionary and vehicular power sources, could be explored. And **related technologies, such as** hybrid/electric vehicle power storage and recharging facilities and **water desalination plants, could collocate with nuclear plants on installations to both use the energy.**37 Explore Desalination Desalination is another evolving technology that many avoid discussing, mainly because it is still a very expensive and immature technology with problems such as high energy consumption, brine disposal, and potential for harm to marine life. But once again, fear of the challenges should not prevent expanded exploration in this area. Worldwide, there are over 13,000 desalination plants, collectively producing more than 12 billion gallons of water each day, many of them in the Middle East, but the trend is spreading to the United States.38 Camp **Pendleton surfaced** in 2009 **as a potential** desalination **plant location, but the official Marine Corps stance has been hesitant** rather than an eager courtship of the opportunity.39 Indeed, many major Marine bases are in coastal areas and could benefit from SMR/desalination cogeneration plants. Potential **future Marine sites** like Guam could undeniably benefit from such advancements,40 and as the number of reverse osmosis sites increases, the cost per unit will decrease. The CMC has repeatedly explained how the Marine Corps Warfighting Laboratory looked 25 years into the future and believes that, by then, **water will be as precious a commodity as oil**, so the time to start preparing for that dire situation is now.41 Overall, the Navy-Marine Team has made huge strides in the E2 fields, yet much remains to be accomplished. E2 is more than compact fluorescent lightbulbs and protection of sea turtles and tern nests. The warfighting mission will always come first, but combat mission accomplishment and E2 goals are not mutually exclusive; the first can be strengthened through the latter. When considering the Marine Corps’ Service Campaign Plan 2009–2015,42 we should remember that one of the CMC’s seven main focus areas in his planning guidance is to “Posture the Marine Corps for the Future.” A decade ago, some discussed the “Revolution in Military Affairs.” Now is the time to be bold and daring, to recognize that the Marine Corps is not yet green enough. Now is the time to embark on a revolution in environmental and energy affairs. Our natural, and national, security depends on it.43 “What the Navy and Marine Corps are doing now is great, but I am here to encourage you and us to go farther—to dream what might be rather than to simply accept what is. Bold steps are in our nature as Americans and what make us a great nation; no one has ever gotten anything big done by being timid.”

#### Domestic military demonstration spills-over

Galloway 10

**(**Brigadier General Gerald E, Former Dean of the Academic Board, US Military Academy and Dean of the Faculty and Academic Programs, Industrial College of the Armed Forces, "On the Need for Creative Energy Solutions", Summer, www.cna.org/sites/default/files/research/WEB%2007%2027%2010%20MAB%20Powering%20America%27s%20Economy.pdf)

Based on the progress made in technology, and on the findings of a study he chaired for the National Academies, General **Galloway believes it may be time for the Army to revisit** the initiative and consider paradigm shifting technologies like **sm**all, modular nuclear reacto**rs**. “In 1999, our report on logistics for the future Army recommended looking once again into small nuclear plants. It found that now there are additional benefits, **like producing hydrogen for fuel cells.** Today, small nuclear reactors are being marketed in the U.S. It’s probably time to think more about this,” General Galloway says. “No one’s envisioned bringing them out in combat zones, but they could provide energy in theater at large staging areas.” General **Galloway sees a special role for DOD in demonstrating these reactors in the U**nited **S**tates. “The challenge at many military facilities is that they’re tied to the grid. We’ve seen the grid go down. At the same time, energy demands are rising. Putting a small reactor on a military installation not only provides a reliable and sustainable power source and a test bed to define its long term utility, but also **places the plant in a secure location**. Within the United States, **it’s hard to find a more physically secure place than a military installation,” says** General **Galloway**. “**If the tests go well on bases in the United States**, these **small reactors could be used to support overseas military operations** or disaster recovery activities.”

#### Water assistance vital to effective public diplomacy—key to combat perception of American foreign policy as militarized

Seib, 10

(Professor of journalism and public diplomacy and director of the Center on Public Diplomacy-USC, Considering Water Diplomacy, 6/29, http://www.huffingtonpost.com/philip-seib/considering-water-diploma\_b\_629487.html)

The vitality and seriousness with which the institute addresses such issues is a reminder **that water-related assistance is an underused tool of public diplomacy**. Rather than an "advertising" approach to public diplomacy ("We are wonderful! Love us!"), water diplomacy answers a crucial question often asked by recipients of public diplomacy efforts but just as often ignored by public diplomacy planners: "What can you do for us?" Throughout the world, few things are more precious than a safe and abundant water supply. **A country that can help another nation improve the availability and quality of water is likely to win friends, regardless of how the respective governments get along**. Water diplomacy is an excellent tool for the United States to use in improving relations with Syria, which is enduring a prolonged drought, and other **countries where the public has been indifferent or even hostile toward American interests, but would welcome water-related assistance.** Public diplomacy does not need to be a unilateral enterprise. Engaging in water diplomacy offers the United States an opportunity to develop international partnerships for creating and delivering public diplomacy programs. A U.S.-Singapore joint venture in this field would enhance both countries' credentials as leaders in improving lives throughout the world, and for the United States it would be an improvement on the go-it-alone approach that characterizes much of its foreign policy. Private sector participation by foundations and corporations should be another facet of such partnerships, and could include funding for research into ways to combat water-borne diseases. Developing the concept of water diplomacy requires an essential, but often neglected, element of public diplomacy: imagination. Too much public diplomacy today has become a process of simply going through the motions in overblown public relations campaigns that misjudge the needs and underestimate the sophistication of global publics. **Actually improving people's lives** is given short shrift, and as a result public diplomacy fails to reach its potential as a means of advancing national interests.

#### Public diplomacy key to AFRICOM effectiveness

Seib, 9

(Professor of Public Diplomacy & International Relations-USC, America’s New Approach to Africa: AFRICOM and Public Diplomacy, http://uscpublicdiplomacy.org/CPD\_Perspectives.pdf)

Regardless of what reasons are proffered for AFRICOM’s importance, public diplomacy is often cited as **an essential element of the command’s work**. Ryan Henry, principal deputy undersecretary of defense for policy, has stated that “AFRICOM, at its core, is about public diplomacy, which is **critical to its mission** and how we as a nation compete not only in Africa but in the wider marketplace of ideas concerning governance and security facing key regions, critical indigenous peoples, and global stakeholders throughout the world today. Whether you want to call it ‘soft power’ or ‘smart power,’ or even just ‘the right power,’ the bottom line is we have created, for a variety of reasons, a national security structure that today is currently out of balance and is biased toward the military toolset.” He added: “AFRICOM is a risk-laden experiment on the part of government and the Department of Defense specifically on how to more holistically engage the continent of Africa, a specific region of emerging interest. **And public diplomacy is a fundamental element of its success**. **We cannot continue to pursue 21st century missions** in an information digital network age with bureaucratic constructs and thinking laid out as part of the Industrial Age in the aftermath of World War II.” Despite efforts by Gates and his deputies to assuage **concerns about further militarization of U.S. foreign policy**, such worries **cast a shadow on AFRICOM’s prospects**. As the Barack Obama administration begins, the Pentagon’s role in public diplomacy is still being defined. So too is the American view of Africa and Africa’s perception of America.

#### Solves global climate adaptation

Yackle, 7

(MA -Naval War College, “Global Climate Change: Threat Multiplier for AFRICOM?,” http://www.dtic.mil/dtic/tr/fulltext/u2/a476789.pdf)

Adaptation is not a proactive approach - it is purely reactive. Should the combatant commander fail to start planning for climate change then the response will continue to be a reactive force vice a proactive force. Africa’s population size produces an unprecedented number of people who are competing for the same basic needs – food, water, and shelter. The availability of these necessities is diminishing due in part to global climate change. When access to water, for example, is becoming so scarce, people’s desperation for survival leads to irrational behavior. Darfur is the first climate change war and should provoke planning to mitigate the risks of similar conflicts. History sets a foundation for planning; however, as the situation changes, so must the planning. Water scarcity is now being mitigated through the production of fossil aquifers and wastewater reclamation. More and more conflicts are driven by internal and local pressures. Poverty and instability are changing the national security issues. Climate change is presenting a serious threat to resources that create the world-wide balance that we are accustomed to. It will affect an unprecedented number of people simultaneously. Africa will suffer more than other nations from the effects of climate change, yet it has the least ability to survive by merely adapting. “Climate change could exacerbate current instability in Africa in a number of ways. Droughts, floods, and other effects of climate change could lead to crop failures, massive refugee flows, and significant damage to African economies and societies. The chaos and desperation of these tragedies could help undermine governments, increase civil unrest, and promote extremism in a number of countries.” – General Ward The expansive impact of climate change in Africa will require multinational and multi-agency cooperation, supported by the military range of operations, on a much broader scale than is currently projected. Previous attention to environmental scarcities has been focused at the tactical level. For instance, CJTF-HOA has been involved in the critical tasks of infrastructure reconstruction, drilling wells for water, building roads and renovating schools, and military training to assist in counterterrorism efforts. A recent change, illustrated by the UN’s first climate change brief, has moved the discussion to the national and strategic level. As a result, U.S. leaders are now identifying climate change as a global threat multiplier and recognizing the need to protect national interests as well as state stability throughout Africa. Addressing climate change at both the tactical and national levels is crucial for planning to mitigate the effects; however, the geographic combatant commander at the operational level must also be actively involved. The African commander must be prepared for the predicted changes that will occur as a result of global climate change. The potential for an increased magnitude of humanitarian assistance and disaster relief support is intrinsically linked to controlling instability throughout the region. Environmental scarcity used to be a regional problem; however, the predicted global effects now require it to be considered when planning stability operations. Scarcity also affects the economy and is a source of human migration. A weak government, further weakened into a failed state when unable to cope with climate change effects, will result in regional conflicts and power struggles. Now is the time for AFRICOM to take the initiative and plan for this impending threat. Subsequently, an interagency response is needed for the operations that shape theaters in order to promote stability and peace – Phase Zero operations. Fortunately, AFRICOM has a unique command and control structure that will be partially staffed with senior civilian representation providing capability to plan and execute Phase Zero operations effectively. This structure will enable the combatant commander to engage the government, nongovernment relief agencies, and international assistance agencies to build African government capacity and infrastructure so they will be able to confront global climate change as it occurs. Also, the interagency response will be more effectual within a new Joint Interagency Coordination Group for Climate Change (JIACG-CC). This internal command JIACG-CC would be comprised of personnel from both the Civil-Military Activities and the Military Operations components to cultivate a unity of effort. No additional man-power would be required given that the JIAC-CC would be comprised of personnel currently employed at the command. This new JIAC-CC would be a temporary planning cell formed to fill the void of current direction from a higher authority to plan for climate change. Moreover, this planning will be different in nature to traditional military planning as it does not have a known timeframe. Thus, climate change may happen catastrophically in the short-term or evolve at a more gradual pace. The speed of the change and the extent to which it occurs will necessitate contingencies for both short-range and long-term planning. As such, the planning cell will need to create plans for both timeframes and further define them to separate African geographic regions. Once these plans are created for each region, the planning cell will need continuously update the plans as the onset of climate change dictates. The JIAC-CG **will not only prepare AFRICOM but serve as a learning tool for other geographic commands to emulate**. Furthermore, AFRICOM has the opportunity to learn from and use the initiatives that CJTF-HOA has already developed. The CJTF’s experience and cultural sensitivity will offer immense benefits for the new African command to garner as it becomes operational in its Area of Responsibility. Should CJTF-HOA remain under the U.S. Central Command structure, a coordination cell between the two combatant commanders will need to be created to streamline the effort between the two commands. Lastly, the combatant commander should take advantage of centers such as the Naval War College’s War Gaming Department to exercise the new response plans. Consequently, the African commander’s role in planning for climate change will create a more structured and focused reaction to the effects of climate change. Without prior planning, reactionary chaos will likely be the result and the U.S will have lost a positive step towards acting proactively with its African partner. Although the African combatant commander does not have the formal tasking to plan for the effects of global climate change, taking the initiative to plan for it now will ensure readiness to deal with the catastrophic events predicted. Stability in Africa is important for protecting U.S. strategic and economic interests. In accessing future threats, environmental scarcities have a role in promoting regional tensions and conflict, such as seen in Darfur, coupled with the exportation of terrorism. Moreover, large population migrations and permanent displacement of people will need to be prevented for both economic and political ramifications. Stability on this continent hinges on mitigating the effects of global climate change. A unity of effort generated within the unique African command structure to create a JIATF-Climate Change would effectively fill the interlude from current lack of directed Department of Defense planning for climate change. Accordingly, not only will the time gap be proactively filled, the effects of this new threat will be mitigated. Additionally, the JIACG-CC’s interim structure would ensure multinational, multiagency and military efforts in the African Area of Responsibility are synchronized and implemented with utmost efficiency and effectiveness. Immediate planning will allow for more coordinated and proportional responses to the speed and onset of climate change. In conclusion, pessimism when faced with such an enormous problem may overwhelm, but proactive and timely planning to tackle wicked problems will produce manageable solutions. The AFRICOM combatant commander has the opportunity to proactively plan for a threat that demands a military problem-solving-like approach.

#### Extinction

Romero, 8

(Purple, reporter for ABS-CBN news, 05/17/2008, Climate change and human extinction--are you ready to be fossilized? http://www.abs-cbnnews.com/nation/05/16/08/climate-change-and-human-extinction-are-you-ready-be-fossilized)

Climate change killed the dinosaurs. Will it kill us as well? Will we let it destroy the human race? This was the grim, depressing message that hung in the background of the Climate Change Forum hosted on Friday by the Philippine National Red Cross at the Manila Hotel. "Not one dinosaur is alive today. Maybe someday it will be our fossils that another race will dig up in the future, " said Roger Bracke of the International Federation of Red Cross and Red Crescent Societies, underscoring his point that no less than extinction is faced by the human race, unless we are able to address global warming and climate change in this generation. Bracke, however, countered the pessimistic mood of the day by saying that the human race still has an opportunity to save itself. This more hopeful view was also presented by the four other speakers in the forum. Bracke pointed out that all peoples of the world must be involved in two types of response to the threat of climate change: mitigation and adaptation. "Prevention" is no longer possible, according to Bracke and the other experts at the forum, since climate change is already happening. Last chance The forum's speakers all noted the increasing number and intensity of devastating typhoons--most recently cyclone Nargis in Myanmar, which killed more than 100,000 people--as evidence that the world's climatic and weather conditions are turning deadly because of climate change. They also reminded the audience that deadly typhoons have also hit the Philippines recently, particularly Milenyo and Reming, which left hundreds of thousands of Filipino families homeless. World Wildlife Fund Climate and Energy Program head Naderev Saño said that "this generation [is] the last chance for the human race" to do something and ensure that humanity stays alive in this planet. According to Saño, while most members of our generation will be dead by the time the worst effects of climate change are felt, our children will be the ones to suffer. How will Filipinos survive climate change? Well, first of all, they have to be made aware that climate change is a problem that threatens their lives. The easiest way to do this – as former Consultant for the Secretariats of the UN Convention on Climate Change Dr. Pak Sum Low told abs-cbnews.com/Newsbreak – is to particularize the disasters that it could cause. Talking in the language of destruction, Pak and other experts paint this portrait of a Philippines hit by climate change: increased typhoons in Visayas, drought in Mindanao, destroyed agricultural areas in Pampanga, and higher incidence rates of dengue and malaria. Sañom said that as polar ice caps melt due to global warming, sea levels will rise, endangering coastal and low-lying areas like Manila. He said Manila Bay would experience a sea level increase of 72 meters over 20 years. This means that from Pampanga to Nueva Ecija, farms and fishponds would be in danger of being would be inundated in saltwater. Sañom added that Albay, which has been marked as a vulnerable area to typhoons, would be the top province at risk. Sañom also pointed out that extreme weather conditions arising from climate change, including typhoons and severe droughts, would have social, economic and political consequences: Ruined farmlands and fishponds would hamper crop growth and reduce food sources, typhoons would displace people, cause diseases, and limit actions in education and employment. Thus, Saño said, while environmental protection should remain at the top of the agenda in fighting climate change, solutions to the phenomenon "must also be economic, social, moral and political." Mitigation Joyceline Goco, Climate Change Coordinator of the Environment Management Bureau of the Department of Environment and Natural Resources, focused her lecture on the programs Philippine government is implementing in order to mitigate the effects of climate change. Goco said that the Philippines is already a signatory to global agreements calling for a reduction in the "greenhouse gasses"--mostly carbon dioxide, chloroflourocarbons and methane--that are responsible for trapping heat inside the planet and raising global temperatures. Goco said the DENR, which is tasked to oversee and activate the Clean Development Mechanism, has registered projects which would reduce methane and carbon dioxide. These projects include landfill and electricity generation initiatives. She also said that the government is also looking at alternative fuel sources in order do reduce the country's dependence on the burning of fossil fuels--oil--which are known culprits behind global warming. Bracke however said that mitigation is not enough. "The ongoing debate about mitigation of climate change effects is highly technical. It involves making fundamental changes in the policies of governments, making costly changes in how industry operates. All of this takes time and, frankly, we're not even sure if such mitigation efforts will be successful. In the meantime, while the debate goes on, the effects of climate change are already happening to us." Adaptation A few nations and communities have already begun adapting their lifestyles to cope with the effects of climate change. In Bangladesh, farmers have switched to raising ducks instead of chickens because the latter easily succumb to weather disturbances and immediate effects, such as floods. In Norway, houses with elevated foundations have been constructed to decrease displacement due to typhoons. In the Philippines main body for fighting climate change, the Presidential Task Force on Climate Change, (PTFCC) headed by Department on Energy Sec. Angelo Reyes, has identified emission reduction measures and has looked into what fuel mix could be both environment and economic friendly. The Department of Health has started work with the World Health Organization in strengthening its surveillance mechanisms for health services. However, bringing information hatched from PTFCC’s studies down to and crafting an action plan for adaptation with the communities in the barangay level remains a challenge. Bracke said that the Red Cross is already at the forefront of efforts to prepare for disasters related to climate change. He pointed out that since the Red Cross was founded in 1919, it has already been helping people beset by natural disasters. "The problems resulting from climate change are not new to the Red Cross. The Red Cross has been facing those challenges for a long time. However, the frequency and magnitude of those problems are unprecedented. This is why the Red Cross can no longer face these problems alone," he said. Using a medieval analogy, Bracke said that the Red Cross can no longer be a "knight in shining armor rescuing a damsel in distress" whenever disaster strikes. He said that disaster preparedness in the face of climate change has to involve people at the grassroots level. "The role of the Red Cross in the era of climate change will be less as a direct actor and increase as a trainor and guide to other partners who will help us adapt to climate change and respond to disasters," said Bracke. PNRC chairman and Senator Richard Gordon gave a picture of how the PNRC plans to take climate change response to the grassroots level, through its project, dubbed "Red Cross 143". Gordon explained how Red Cross 143 will train forty-four volunteers from each community at a barangay level. These volunteers will have training in leading communities in disaster response. Red Cross 143 volunteers will rely on information technology like cellular phones to alert the PNRC about disasters in their localities, mobilize people for evacuation, and lead efforts to get health care, emergency supplies, rescue efforts, etc.

#### AFRICOM partnerships key to disease prevention

Martin, 9

(MD & US Naval Officer, 1/9, “Africa Command Health Symposium: Health as a Bridge to Peace and Stability” http://intlhealth.fhpr.osd.mil/Libraries/IHDocuments/AfricaCommandHealthSymposiumProceedings.sflb.ashx)

The newly established United States Africa Command (AFRICOM) intends to incorporate health as a bridge towards security. AFRICOM was declared a fully unified command on October 1, 2008. It was designed to be a “different kind of command” focusing on war prevention rather than war-fighting (AFRICOM, 2008a). Over half the personnel who will ultimately be assigned to AFRICOM will be civilians, including representatives from nonmilitary U.S. government agencies. Africa Command’s mission is to work in concert with other U.S. government agencies and international partners. It will conduct sustained security engagement through military-to-military programs to promote a stable and secure African environment in support of U.S. foreign policy (AFRICOM, 2008b). The intention of this new command is to increase security on the African continent through an integrated and coordinated approach. There is a reflexive relationship between public health, civil security, and economics. Improvements in one of these areas generally help the status of the others. The medical and health issues representative to Africa Command is the Command Surgeon, who has many mission objectives. His goal is to enhance coordination and create more sustainable medical programs through military-to-military engagement efforts. There are many potential positive benefits for civilian public health infrastructure and capacity building that may ensue from these engagements. To help facilitate these objectives, the U.S. Assistant Secretary of Defense for Health Affairs sponsored the Africa Command Health Symposium convened at the National Academy of Sciences from January 8-9, 2009. The goals of the Africa Command Health Symposium were to: 1) Introduce the U.S. Africa Command Surgeon; 2) Explore the successful public-private partnership model in Africa; 3) Explore the potential role of health research in developing host nation capabilities; and 4) Develop a communication and coordination mechanism to share best practices among service providers regarding health care capabilities and programs. The intent of the conference was to bring together senior government and non-government agency leaders and allow them the opportunity share successful development models with Africa Command. The aim is to build stronger and more effective partnerships for current and future joint development projects in Africa. These goals were accomplished by bringing together experts from academia, U.S. Government, private sector, and the African Union to address challenges across the healthcare spectrum. Public Health and Military Significance Health as a Bridge for Peace was formally accepted by the 51st World Health Assembly in May 1998. It has been defined as the integration of peace-building concerns, concepts, principles, strategies and practices into health relief and health sector development (WHO, 2009). Deficiencies in transnational governance may create a global public health crisis. Health is no longer just a humanitarian issue, but rather a major economic and security issue (Kickbusch, 2002). In 2005 a Department of Defense directive defined “stability operations” as a “core U.S. military mission” with a “priority comparable to combat operations.” This required the DoD to expand from its traditional war-fighting mission to one that includes preventing or mitigating collapse of failing nations (DoD, 2005; Reaves, Schor, & Burkle, 2008). With globalization, every communicable disease is now potentially only an airplane trip away from any of us. It is imperative that surveillance programs be as robust as possible. Collaboration between U.S. Africa Command and local African military forces provides an opportunity both to **expand U.S. knowledge of emerging diseases and improve the local African health systems**. Military-to-military and military-to-civilian partnerships support ministers of health in obtaining laboratory, epidemiological, and logistical resources (Chretien et al., 2007). Direct health-related strategic threats to the United States include infectious diseases such as pandemic influenza. However, chronic diseases, maternal and child mortality, sanitation, malnutrition, and access to basic health care also affect U.S. national interests due to their impacts on key countries’ economies, governments, and militaries (NIC, 2008)

#### Key to containment

Geller, 9

(MD & Lt. Colonel-US Army, 1/9, “Africa Command Health Symposium: Health as a Bridge to Peace and Stability” http://intlhealth.fhpr.osd.mil/Libraries/IHDocuments/AfricaCommandHealthSymposiumProceedings.sflb.ashx)

The Africa Command Surgeon’s priorities include developing a DoD medical strategy for the continent, regional situational awareness and developing medical common operating picture, CJTF-HOA integration of medical MAPE’s-2009, component medical integration-RMTR, developing partnerships into effective programs, and developing measures of effectiveness that are outcomes driven. We need to show measurable outcomes like the 40% weight gain in herds vaccinated by JTF-HOA compared to herds that were not vaccinated. Other key medical measures of effectiveness include Partner Nation (PN) militaries having medical capabilities to support all necessary force health protection issues, deployable medical capabilities to support PKOs and regional security organizations, medical capabilities to assist with HN and regional disaster response efforts, comprehensive HIV education/testing/treatment programs, and effective AI/PI (EID) contingency plans in place. How is Africa Command going to accomplish Theater Strategic Objective 3: The American population is protected from deadly contagions emanating from Africa? It will measure percentage of military trained in Force Health Protection measures, percentage of military medically-ready for deployment as defined by African Union, verify incidence rate of HIV/AIDS in military continues to decline, and verify State’s military has a specified epidemic response mission. Subjective indicators include: military has developed and routinely-exercised epidemic response plans which are assessed to be **effective to contain the spread of pandemic influenza** and other high-risk contagions, military has medical/veterinary surveillance and reporting capability sufficient to identify pandemic influenza (PI) or other high-risk contagions, military has access to an accredited diagnostic reference laboratory, military has adequate medical logistical capability for epidemic response to pandemic influenza or other high-risk contagions, and no increase in regional instability due to emerging disease threat.

#### Africa’s key – new pandemics are likely

Boyer, 11

(9/24, Reporter-EMax Health, http://www.emaxhealth.com/8782/us-not-well-prepared-flu-pandemic-man-infects-pigs-h1n1-swine-flu)

UCLA Scientists studying the H1N1 swine flu virus have discovered the first evidence of animal infection between man and pigs in Central Africa and believe that such transmission can lead to a new pandemic of the H1N1 swine flu. The H1N1 swine flu virus is a genetic hybrid of DNA from bird, swine and the human influenza viruses. According to the Centers for Disease Control (CDC) the swine flu virus is responsible for a pandemic in 2009 which infected an estimated 60 million people resulting in 270,000 hospitalizations and 12,500 deaths. In a recent study published in the scientific journal Veterinary Microbiology, scientists from UCLA traveled to Cameroon to determine whether the H1N1 virus was present in African livestock. The researchers collected nasal swabs and blood samples from randomly selected domestic pigs in outlying villages and farms. What they found were two cases of active H1N1 virus infection from the nasal samples. The blood samples, however, showed that 28% of the pigs tested positive for past infection of the virus, and of that 28% almost all demonstrated that their infection was due to the H1N1 influenza virus isolated from humans during the 2009 pandemic. Although theH1N1 virus has been detected in livestock in other countries, this was the first evidence of it in Africa and showing that contamination was from man to pig. According to a press release from the University of California the authors of the paper were surprised by the results. "I was amazed that virtually every pig in this village was exposed," said Thomas B. Smith, director of UCLA's Center for Tropical Research and the senior author of the research. "**Africa is ground zero for a new pandemic.** Many people are in poor health there, and disease can spread very rapidly without authorities knowing about it." "The pigs were running wild in that area," said lead author Kevin Njabo, a researcher in UCLA's department of ecology and evolutionary biology and associate director of the Center for Tropical Research. "I was shocked when we found out it was H1N1. Any virus in any part of the world can reach another continent within days by air travel. We need to understand where viruses originate and how they spread, so we can destroy a deadly virus before it spreads. We have to be prepared for a pandemic, but so many countries are not well-prepared - not even the United States." According to Njabo, the importance of their findings is that it shows how that farming practices can lead to a viral outbreak. "The pigs got H1N1 from humans," Njabo said. "The fact that pigs in Africa are infected with the H1N1 flu virus illustrates the remarkable interconnectedness of the modern world with respect to diseases. The H1N1 virus that we found in livestock in Cameroon is virtually identical to a virus found in people in San Diego just a year earlier, providing an astonishing example of how quickly the flu can spread all over the globe.” The authors of the paper have also collected hundreds of sample from chickens, ducks and wild birds for additional studies to determine the interaction of viruses and infections between humans and both wild and domestic animals. "The world is a global village; no area is truly isolated," said Njabo, who was born and raised in Cameroon. "There are so many unknowns about the transmission rates of viruses between humans and wild animals. We have to expand screening."

#### Zoonotic disease causes extinction—diagnosis is key, and their impact defense doesn’t apply

Quammen, award-winning science writer, long-time columnist for *Outside* magazine for fifteen years, with work in National Geographic, Harper's, Rolling Stone, the New York Times Book Review and other periodicals, 9/29/2012

(David, “Could the next big animal-to-human disease wipe us out?,” The Guardian, pg. 29, Lexis)

Infectious disease is all around us. It's one of the basic processes that ecologists study, along with predation and competition. Predators are big beasts that eat their prey from outside. Pathogens (disease-causing agents, such as viruses) are small beasts that eat their prey from within. Although infectious disease can seem grisly and dreadful, under ordinary conditions, it's every bit as natural as what lions do to wildebeests and zebras. **But** conditions aren't always ordinary. Just as predators have their accustomed prey, so do pathogens. And just as a lion might occasionally depart from its normal behaviour - to kill a cow instead of a wildebeest, or a human instead of a zebra - so a pathogen can shift to a new target. **Aberrations occur**. When a pathogen leaps from an animal into a person, and succeeds in establishing itself as an infectious presence, sometimes causing illness or death, the result is a zoonosis. It's a mildly technical term, zoonosis, unfamiliar to most people, but it helps clarify the biological complexities behind the ominous headlines about swine flu, bird flu, Sars, emerging diseases in general, and the threat of a global pandemic. It's a word of the future, destined for heavy use in the 21st century. Ebola and Marburg are zoonoses. So is bubonic plague. So was the so-called Spanish influenza of 1918-1919, which had its source in a wild aquatic bird and emerged to kill as many as 50 million people. All of the human influenzas are zoonoses. As are monkeypox, bovine tuberculosis, Lyme disease, West Nile fever, rabies and a strange new affliction called Nipah encephalitis, which has killed pigs and pig farmers in Malaysia. Each of these zoonoses reflects the action of a pathogen that can "spillover", crossing into people from other animals. Aids is a disease of zoonotic origin caused by a virus that, having reached humans through a few accidental events in western and central Africa, now passes human-to-human. This form of interspecies leap is not rare; about 60% of all human infectious diseases currently known either cross routinely or have recently crossed between other animals and us. Some of those - notably rabies - are familiar, widespread and still horrendously lethal, killing humans by the thousands despite centuries of efforts at coping with their effects. Others are new and inexplicably sporadic, claiming a few victims or a few hundred, and then disappearing for years. **Zoonotic pathogens can hide**. The least conspicuous strategy is to lurk within what's called a reservoir host: a living organism that carries the pathogen while suffering little or no illness. When a disease seems to disappear between outbreaks, it's often still lingering nearby, within some reservoir host. A rodent? A bird? A butterfly? A bat? To reside undetected is probably easiest wherever biological diversity is high and the ecosystem is relatively undisturbed. The converse is also true: ecological disturbance causes diseases to emerge. Shake a tree and things fall out. Michelle Barnes is an energetic, late 40s-ish woman, an avid rock climber and cyclist. Her auburn hair, she told me cheerily, came from a bottle. It approximates the original colour, but the original is gone. In 2008, her hair started falling out; the rest went grey "pretty much overnight". This was among the lesser effects of a mystery illness that had nearly killed her during January that year, just after she'd returned from Uganda. Her story paralleled the one Jaap Taal had told me about Astrid, with several key differences - the main one being that Michelle Barnes was still alive. Michelle and her husband, Rick Taylor, had wanted to see mountain gorillas, too. Their guide had taken them through Maramagambo Forest and into Python Cave. They, too, had to clamber across those slippery boulders. As a rock climber, Barnes said, she tends to be very conscious of where she places her hands. No, she didn't touch any guano. No, she was not bumped by a bat. By late afternoon they were back, watching the sunset. It was Christmas evening 2007. They arrived home on New Year's Day. On 4 January, Barnes woke up feeling as if someone had driven a needle into her skull. She was achy all over, feverish. "And then, as the day went on, I started developing a rash across my stomach." The rash spread. "Over the next 48 hours, I just went down really fast." By the time Barnes turned up at a hospital in suburban Denver, she was dehydrated; her white blood count was imperceptible; her kidneys and liver had begun shutting down. An infectious disease specialist, Dr Norman K Fujita, arranged for her to be tested for a range of infections that might be contracted in Africa. All came back negative, including the test for Marburg. Gradually her body regained strength and her organs began to recover. After 12 days, she left hospital, still weak and anaemic, still undiagnosed. In March she saw Fujita on a follow-up visit and he had her serum tested again for Marburg. Again, negative. Three more months passed, and Barnes, now grey-haired, lacking her old energy, suffering abdominal pain, unable to focus, got an email from a journalist she and Taylor had met on the Uganda trip, who had just seen a news article. In the Netherlands, a woman had died of Marburg after a Ugandan holiday during which she had visited a cave full of bats. Barnes spent the next 24 hours Googling every article on the case she could find. Early the following Monday morning, she was back at Dr Fujita's door. He agreed to test her a third time for Marburg. This time a lab technician crosschecked the third sample, and then the first sample. The new results went to Fujita, who called Barnes: "You're now an honorary infectious disease doctor. You've self-diagnosed, and the Marburg test came back positive." The Marburg virus had reappeared in Uganda in 2007. It was a small outbreak, affecting four miners, one of whom died, working at a site called Kitaka Cave. But Joosten's death, and Barnes's diagnosis, implied a change in the potential scope of the situation. That local Ugandans were dying of Marburg was a severe concern - sufficient to bring a response team of scientists in haste. But if tourists, too, were involved, tripping in and out of some python-infested Marburg repository, unprotected, and then boarding their return flights to other continents, the place was not just a peril for Ugandan miners and their families. It was also an international threat. The first team of scientists had collected about 800 bats from Kitaka Cave for dissecting and sampling, and marked and released more than 1,000, using beaded collars coded with a number. That team, including scientist Brian Amman, had found live Marburg virus in five bats. Entering Python Cave after Joosten's death, another team of scientists, again including Amman, came across one of the beaded collars they had placed on captured bats three months earlier and 30 miles away. "It confirmed my suspicions that these bats are moving," Amman said - and moving not only through the forest but from one roosting site to another. Travel of individual bats between far-flung roosts implied circumstances whereby Marburg virus might ultimately be transmitted all across Africa, from one bat encampment to another. It voided the comforting assumption that this virus is strictly localised. And it highlighted the complementary question: why don't outbreaks of Marburg virus disease happen more often? Marburg is only one instance to which that question applies. Why not more Ebola? Why not more Sars? In the case of Sars, the scenario could have been very much worse. Apart from the 2003 outbreak and the aftershock cases in early 2004, it hasn't recurred. . . so far. Eight thousand cases are relatively few for such an explosive infection; 774 people died, not 7 million. Several factors contributed to limiting the scope and impact of the outbreak, of which humanity's good luck was only one. Another was the speed and excellence of the laboratory diagnostics - finding the virus and identifying it. Still another was the brisk efficiency with which cases were isolated, contacts were traced and quarantine measures were instituted, first in southern China, then in Hong Kong, Singapore, Hanoi and Toronto. If the virus had arrived in a different sort of big city - more loosely governed, full of poor people, lacking first-rate medical institutions - **it might have burned through a much larger segment of humanity**. One further factor, possibly the most crucial, was inherent in the way Sars affects the human body: symptoms tend to appear in a person before, rather than after, that person becomes highly infectious. That allowed many Sars cases to be recognised, hospitalised and placed in isolation before they hit their peak of infectivity. With influenza and many other diseases, the order is reversed. That probably helped account for the scale of worldwide misery and death during the 1918-1919 influenza. And that infamous global pandemic occurred in the era before globalisation. Everything nowadays moves around the planet faster, including viruses. **When the Next Big One comes**, **it will** likely **conform to the** same perverse pattern as the **1918 influenza**: high infectivity preceding notable symptoms. That will help it move through cities and airports like an angel of death. The Next Big One is a subject that disease scientists around the world often address. The most recent big one is Aids, of which the eventual total bigness cannot even be predicted - about 30 million deaths, 34 million living people infected, and with no end in sight. Fortunately, not every virus goes **airborne** from one host to another. If HIV-1 could, you and I might already be dead. If the **rabies** virus could, it **would be the most horrific pathogen on the planet**. The influenzas are well adapted for airborne transmission, which is why a new strain can circle the world within days. The Sars virus travels this route, too, or anyway by the respiratory droplets of sneezes and coughs - hanging in the air of a hotel corridor, moving through the cabin of an aeroplane - and that capacity, combined with its case fatality rate of almost 10%, is what made it so scary in 2003 to the people who understood it best. Human-to-human transmission is the crux. That capacity is what separates a bizarre, awful, localised, intermittent and mysterious disease (such as Ebola) from a global pandemic. Have you noticed the persistent, low-level buzz about avian influenza, the strain known as H5N1, among disease experts over the past 15 years? That's because avian flu worries them deeply, though it hasn't caused many human fatalities. Swine flu comes and goes periodically in the human population (as it came and went during 2009), sometimes causing a bad pandemic and sometimes (as in 2009) not so bad as expected; but avian flu resides in a different category of menacing possibility. It worries the flu scientists because they know that H5N1 influenza is extremely virulent in people, with a high lethality. As yet, there have been a relatively low number of cases, and it is poorly transmissible, so far, from human to human. It'll kill you if you catch it, very likely, but you're unlikely to catch it except by butchering an infected chicken. But if H5N1 mutates or reassembles itself in just the right way, if it adapts for human-to-human transmission, it could become the biggest and fastest killer disease since 1918. It got to Egypt in 2006 and has been especially problematic for that country. As of August 2011, there were 151 confirmed cases, of which 52 were fatal. That represents more than a quarter of all the world's known human cases of bird flu since H5N1 emerged in 1997. But here's a critical fact: those unfortunate Egyptian patients all seem to have acquired the virus directly from birds. This indicates that the virus hasn't yet found an efficient way to pass from one person to another. Two aspects of the situation are dangerous, according to biologist Robert Webster. The first is that Egypt, given its recent political upheavals, may be unable to staunch an outbreak of transmissible avian flu, if one occurs. His second concern is shared by influenza researchers and public health officials around the globe: with all that mutating, with all that contact between people and their infected birds, the virus could hit upon a genetic configuration making it highly transmissible among people. "As long as H5N1 is out there in the world," Webster told me, "**there is the possibility of disaster**. . . There is the theoretical possibility that it can acquire the ability to transmit human-to-human." He paused. "And then God help us." We're unique in the history of mammals. No other primate has ever weighed upon the planet to anything like the degree we do. In ecological terms, we are almost paradoxical: large-bodied and long-lived but grotesquely abundant. **We are an outbreak**. **And here's the thing about outbreaks**: **they end**. In some cases they end after many years, in others they end rather soon. In some cases they end gradually, in others they end with a crash. In certain cases, they end and recur and end again. Populations of tent caterpillars, for example, seem to rise steeply and fall sharply on a cycle of anywhere from five to 11 years. The crash endings are dramatic, and for a long while they seemed mysterious. What could account for such sudden and recurrent collapses? One possible factor is infectious disease, and viruses in particular.

#### Reactors make hydrogen feasible and economical

Science, 2.0, quoting Dr. Ibrahim Khamis of the International Atomic Energy Agency (IAEA), 3/26/12, 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.

#### New fuel cell tech makes it affordable—old evidence irrelevant

Commodity Online, 2011, US researchers claim breakthrough in Hydrogen Fuel Cell tech , www.commodityonline.com/news/us-researchers-claim-breakthrough-in-hydrogen-fuel-cell-tech-37501-3-37502.html

U.S. researchers say they've made a breakthrough in the development of low-cost hydrogen fuel cells that one day could power electric cars.

Researchers at Case Western Reserve University in Cleveland say catalysts made of carbon nanotubes dipped in a polymer solution can outperform traditional platinum catalysts in fuel cells at a fraction of the cost.

The scientists say the new technology can remove one of the biggest roadblocks to widespread cell use: the cost of the catalysts.

Platinum, which represents at least a quarter of the cost of fuel cells, currently sells for about $30,000 per pound, while the activated carbon nanotubes cost about $45 per pound, a Case release said Tuesday.

"This is a breakthrough," Liming Dai, a professor of chemical engineering and the research team leader, said.