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**Broadening Horizons:**  
*Climate Change and the U.S. Armed Forces*

By Commander Herbert E. Carmen, USN, Christine Parthemore  
and Will Rogers



Center for a  
New American  
Security

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### Cover Image

Scientists with the Applied Physics Laboratory Ice Station clear ice from the hatch of the attack submarine USS Annapolis (SSN 760) after breaking through ice on March 21, 2009, while participating in Ice Exercise (ICEX) 2009 in the Arctic Ocean.

(MASS COMMUNICATION SPECIALIST 1ST CLASS TIFFINI M. JONES/U.S. Navy)

## BROADENING HORIZONS: CLIMATE CHANGE AND THE U.S. ARMED FORCES

By Commander Herbert E. Carmen, USN,  
Christine Parthemore and Will Rogers

*This report is a capstone to a larger study on climate change and the U.S. armed forces, which includes chapters on the maritime, air and ground forces and combatant commands. The entire study is available on the CNAS website at [www.cnas.org/publications](http://www.cnas.org/publications).*

### Executive Summary

Climate change holds important consequences for national security and the way the Department of Defense (DOD) does business. The effects of global climate change are likely to reshape the current and future security environment. Analysts expect changes such as extreme drought, more frequent heat waves, desertification, flooding and extreme weather events. The combined impact of these effects will intertwine with existing political, social, cultural and economic trends, with significant implications for U.S. interests worldwide. Countries and regions of strategic importance – from Afghanistan to the Arctic, China to Yemen – are likely to confront major environmental pressures on both their societies and ecosystems. Physical changes to the environment may also disrupt U.S. military capabilities and facilities. For instance, military installations or training ranges may experience increased flooding, wildfires or major coastal erosion.

Addressing the dual pressures of climate change and energy analyzed in this report will require the Department of Defense, U.S. armed services and combatant commands to explore how they might plan and adapt, help partner nations around the world adapt, and mitigate climate-changing greenhouse gas emissions. In some cases, such as with improving energy efficiency, solutions will be simple. In others, addressing these issues will require tough trade-offs. This report identifies many of the key policy questions and trade-offs, and, we hope, assists in mapping a road ahead that meets U.S. national security needs.

Based on extensive research, expert interviews and site visits, this report offers the following recommendations to improve the country's ability to promote national security in the face of a changing climate:

- DOD should ensure that it is included in the emerging debate over geoengineering (the

intentional manipulation of the climate, which is often discussed as a means to counter the effects of the climate change generated by human activity).

- The Senate should ratify the UN Convention on the Law of the Sea (UNCLOS) in order to protect U.S. and DOD interests.
- U.S. Northern Command (NORTHCOM) should be assigned the role of the supported commander on issues related to the Arctic.
- The U.S. government should make an informed decision about siting nuclear reactors on military bases as a means of generating carbon-free energy; as a first step, it should establish a blue ribbon panel led by the Department of Energy to examine this issue.
- The Congress and DOD should provide incentives to encourage the armed services to implement conservation and efficiency practices and continue to invest in renewable energy programs.
- All of the services should improve their understanding of the effects of climate change and what these effects will mean for their specific missions and capabilities.
- The Air Force should fully integrate energy security and climate change into planning efforts.

This report contains several elements. First, it begins with a capstone that summarizes key findings that cut across the armed services and regional combatant commands. Second, it examines how climate change is likely to affect the military services, with separate chapters on the maritime, air and ground forces. Third, the report examines the national security implications of climate change on the regional combatant commands, which will make the operational and tactical level decisions about how to adapt. Finally, an appendix to this volume examines how DOD integrated climate change considerations into the Quadrennial Defense Review.

## Introduction

The effects of global climate change are likely to reshape the current and future security environment. Analysts expect changes such as extreme drought, more frequent heat waves, desertification, flooding and extreme weather events. The combined impact of these effects will intertwine with existing political, social, cultural and economic trends, with significant implications for U.S. interests worldwide. Countries and regions of strategic importance – from Afghanistan to the Arctic, China to Yemen – are likely to confront major environmental pressures on both their societies and ecosystems. Physical changes to the environment may also disrupt U.S. military capabilities and facilities. For instance, military installations or training ranges may experience increased flooding, wildfires or major coastal erosion.

As the largest consumer of fossil fuel in the world and a defender of global security interests, the U.S. military both influences and is influenced by climate change. To reduce the military's own climate-changing emissions and increase operational effectiveness, the most direct approach in the near term is to improve energy efficiency (i.e. to ensure the Department of Defense [DOD] gets more use out of the energy it consumes). In addition, the United States must adapt to and prepare for the expected effects of climate change. Developing a more nuanced understanding of where, when and how climate change will affect U.S. security interests will improve the odds that the U.S. government can properly plan for contingencies. It will also help partner countries to adapt in ways that will hedge against destabilizing forces.

Beyond the operational benefits of improving energy efficiency and the strategic benefits of addressing climate change, DOD is increasingly subject to new policy requirements that all federal agencies work to reduce climate-

altering greenhouse gas emissions and reduce petroleum consumption. These requirements are likely to mount. Given that 86.1 percent of U.S. greenhouse gas emissions are tied to energy use, over the medium and long term, the United States and DOD should strive to transition to a lower-carbon energy system.<sup>1</sup> This transition would present several opportunities. Addressing climate change will give DOD a better understanding of the operational environment and global trends, as it requires analyzing information concerning the major political, economic, security and environmental characteristics of the world. Most importantly, it can often bring operational and tactical benefits in the short term in addition to long-term emissions reduction benefits. As for readiness considerations, energy efficiency and fuel conservation can increase flexibility in logistics chains, allow ships and aircraft to travel greater distances and remain on station longer and mitigate contributions to climate change.

This transition also presents challenges. While, at first glance, energy efficiency appears to be a win-win approach to addressing the energy and climate issues raised above, in practice the need for DOD to use less polluting fuels may entail difficult trade-offs. Fuel usage, after all, has profound consequences for readiness to conduct military missions, whether those missions rely on refueling stations, ships at sea or refueling aircraft in flight. The standardization of fuels (ensuring that the armed services can operate a wide range of equipment on a single type of fuel) has had enormous logistical benefits, especially given that the United States can acquire petroleum supplies worldwide. Particularly in a time of war, such operational considerations should remain paramount.

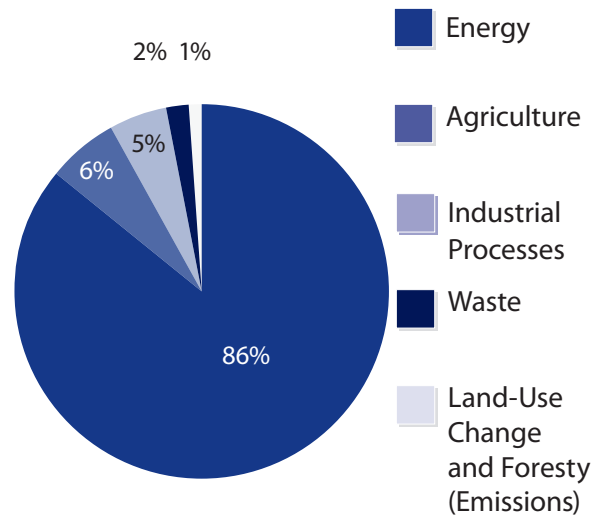
Despite these current operational needs, however, current energy use cannot be held in isolation from the effects of its use. Given the

geopolitical, budgetary and operational risks our current energy system entails – not to mention the changing global regulatory and business environments – perpetuating DOD reliance on high-carbon fuels, and in particular petroleum, may set DOD on an unsustainable course in the longterm.

To address these critical issues, the Center for a New American Security (CNAS) launched this research project in the summer of 2009. The multifaceted nature of the climate change challenge means that no one enterprise has all the answers. Thus, we engaged a diverse range of stakeholders in an ongoing discussion and debate in order to understand the complexity of climate science and projected climate effects, identify which climatic changes could impact security, and what the solutions might be. Through the course of this project, we conducted independent research and analysis, personal interviews and group discussions. We met with representatives of every regional combatant command, several functional combatant commands and bases around the country in order to foster a climate change dialogue.

To effectively study what climate observations and projections mean for specific actors within the DOD, we conducted separate studies of how the effects of climate change – both the environmental changes and the policy changes – would affect ground, air and maritime environments, missions and capabilities. We also studied the specific roles of the combatant commands and their greatly differing areas of responsibility, which warranted focused attention. These studies, originally released as individual working papers, are included in this volume and also summarized here.

**Table 1: U.S. Greenhouse Gas Emissions by Sector**



Source: Environmental Protection Agency, "Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008."

**Climate Change and the Services:  
A Summary**

Within the DOD structure, the services individually choose how to prioritize the short- and long-term implications of climate change. All share the priority of ensuring secure access to energy and learning how to improve efficiency. However, understanding of how climate change may affect the strategic environment, missions and capabilities varies across the services.

Among the services, the Navy has been most proactive in addressing the related challenges of climate change and energy security. The Chief of Naval Operations, Admiral Gary Roughead, established Task Force Energy and Task Force Climate Change in 2009 to recommend appropriate actions and investments in both areas. The first major step was the release of the Arctic Roadmap, a comprehensive five-year strategy intended to help the Navy navigate future

challenges in a thawing Arctic. Additionally, Secretary of the Navy Ray Mabus issued a set of ambitious new plans to boost Navy and Marine Corps energy efficiency and alternative energy use, including the goal of fielding a completely sustainable carrier strike group. Task Force Energy and Task Force Climate Change coordinate closely, ensuring these issues are considered together. In the maritime chapter of this report we outline in detail the multi-year process the Navy has undertaken in order to better understand how climate change will affect it and the Navy's best policy responses. We find that it is a highly replicable model that would benefit the Army and Air Force as well.

The Air Force has focused its efforts on reducing its demand for energy. It prioritizes assured access to fuel supplies because doing so reduces operating costs and has a direct, positive impact on mission effectiveness. Energy security and cost volatility are major concerns for the Air Force. A 10-dollar increase in the price of a barrel of oil, for instance, increases the annual fuel cost by 619 million dollars. But even if fuel were free, transporting, storing and delivering aviation fuel in a combat zone constitutes a significant logistical risk.

Turning to the ground forces, the U.S. Army, Marine Corps and National Guard are in the early phases of considering how climate change might affect them in the future. Each has focused attention on improving energy efficiency, particularly operational energy use on the battlefield, and individuals within each of the services have devoted careful attention to considering what climate change could mean for their future responsibilities. However, deeper study along the lines of the Navy's efforts over the past several years of how climate change will affect the ground forces' specific equities would help to ensure that both analyses and policies are tailored correctly to the concerns of these services.

The different emphasis placed on climate change by the services is easy to explain: services like the Navy witness the effects of climate change daily, especially in areas of major concern like the Arctic. The Coast Guard too has observed discernible climate change impacts firsthand, such as a reduction in Arctic summer ice and a northerly migration of fish stocks. Indeed, the Arctic is proving to be the first case study in how climate change affects military missions, and the maritime services are gaining firsthand experience on the impacts and complexities that may lie ahead for the United States. Several Alaskan villages are being relocated with the help of the maritime services and National Guard. Increased human activity from boaters and ecotourists with inadequate survival equipment and increased maritime traffic through an increasingly open Northwest Passage creates the possibility of a daunting scenario: a large scale search and rescue mission in the Arctic. What concerns the services is that they don't have sufficient capacity or the required capabilities – such as communications equipment and operable icebreakers – to respond to such a mission on a large scale, a more frequent basis or quickly enough to save lives in the frigid Arctic waters.

For the Army and Air Force, the ways in which climate change may affect them in the future are not as apparent. Without currently observable indicators, in many cases the information needed for them to conduct analysis with meaningful fidelity is simply lacking today.

To address the variables of climate change effectively, the services will need to determine how climate change will modify the existing physical, military and civil conditions within the context of the operational environment. These conditions are variables used in the mission essential task development process to describe the current and potential capabilities of the armed forces. In order to do this,

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the services will need better – and more localized – information on when and to what degree different climatic effects could manifest. For example, climate change could cause reductions in permafrost which could then affect terrain firmness, terrain traction and runway weight bearing capacity. Changes to the ocean due to melting ice can cause changes in currents, salinity, ocean acoustics, shipping presence and ambient noise. Resulting sea level rise can cause changes to coastal terrain features, and availability of space for maritime maneuver. Because sea level rise is difficult to project and will vary by location, it is difficult to accurately

determine which coastal areas are most at risk. In such cases, regional, coastal or base-by-base assessments might better inform the services rather than global climate projections.

With improved information, more extensive analysis and targeted investments, the services will be able to navigate the challenges posed by the effects of climate change. But to help them do so, DOD, executive branch leaders and Congress will need to address several key issues.

### **Key Issues**

Our research highlighted several pressing issues at the nexus of climate change, energy and national security. These threads emerged in our study of each of the services as well as the combatant commands.

**Climate change holds important consequences for national security and the way DOD does business. However, since DOD will likely not be the lead agency for addressing most climate change and energy issues, defining DOD’s proper voice in addressing these matters will be critical.**

Climate change will sculpt the future security environment. As such, promoting national security in the decades ahead will require non-military capacities and extensive efforts by non-DOD government agencies in addition to DOD roles and responsibilities. Indeed, the Quadrennial Defense Review (QDR) notes that DOD will need to rely on the knowledge and capacities housed in other U.S. agencies in order to effectively address climate change:

As climate science advances, the Department will regularly reevaluate climate change risks and opportunities in order to develop policies and plans to manage its effects on the Department’s operating environment, missions, and facilities. Managing the national security effects of climate change will require DoD to work collaboratively, through

a whole-of-government approach, with both traditional allies and new partners.<sup>2</sup>

President Obama's Interagency Ocean Policy Task Force may be an early example of the kind of interagency collaboration called for in the QDR and the kind of collaboration necessary for the maritime services to address climate change effectively. Launched in June 2009, it brought together the Council on Environmental Quality, the Coast Guard, the National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency, the Navy and other agencies to coordinate policies throughout the government on oceans and coastal areas, and international governance thereof. Its early work identified "resiliency and adaptation to climate change and ocean acidification" as one of the priorities.<sup>3</sup> The Pentagon, the services and the combatant commands are also collaborating in important ways with the Department of Energy and the U.S. Department of Agriculture on energy infrastructure, biofuels and improvements to U.S. electric grids. These kinds of interagency partnerships often lead to important advances for meeting DOD energy needs and reducing emissions, and they serve the important symbolic effect of showing that even with the heavy security implications they carry, solutions are not primarily the responsibility of the DOD.

**Deepening understanding of the security implications of climate change is likely to add to current questions about the proper role of the DOD relative to civilian agencies.**

As the military increasingly engages in activities such as building water infrastructure and improving agricultural practices in Afghanistan, debates over the "militarization" of foreign policy and the role of the armed services in development activities are heating up. The effects of climate change on environmental

conditions in regions of high strategic importance to DOD will make questions regarding the proper balance of civilian and military activities overseas even more salient. And for situations like the current opening of Arctic sea ice, it is important to consider the public and international impression involved with the Navy and Coast Guard serving as, for the most part, the leading experts and proponents on Arctic issues. While interagency collaboration is useful for meeting this challenge, matching the advanced work by the Navy and Coast Guard on issues like climate change with equal civilian leadership will be critical.

**Inadequate fidelity in climate projections affects planning, budgeting and acquisition decisions, with repercussions that can last for decades.**

Though planning for an uncertain future is common for the DOD, improved observations and projections of how climate change is manifesting around the world would go a long way toward improving the process of integrating climate science into security decision making. For now, gaps or vagueness in climate information reduce the likelihood that policy decisions will account for the knowledge that the science community could add. Luckily, many countries are working to address deficiencies in information. The recent launch of the European Space Agency's CryoSat 2, which can measure ice thickness to within 1 centimeter, may one day greatly improve the accuracy of climate projections.<sup>4</sup> Until better projections are available, the Air Force and the ground forces have given less attention to what the mid- to long-term climate change effects will be on their missions or how they will incorporate climate change into future planning considerations. Climate change has not yet affected their operating environments as tangibly as it has the maritime services.

**For more localized energy and climate-related acquisition decisions, not providing a financial incentive for cost avoidances and reallocating savings to other programs is effectively serving as a disincentive.**

Stated simply, we found that many officials charged with improving energy efficiency, increasing alternative energy use and reducing DOD greenhouse gas emissions did not see a direct benefit to doing so. In every case where individuals still worked to meet climate and energy requirements, the lack of financial or other tangible incentives seemed to cause frustration. While fuel dollars saved from efficiencies gained in the air, at sea and on land are considered cost avoidances, those dollars are spent elsewhere within the services. Thus, to the installation managers and operational forces, there are no direct financial incentives for saving energy – or, relatedly, for reducing greenhouse gas emissions. Indeed, many representatives from all of the services spoke of meeting their climate and energy requirements as unfunded mandates. The 2009 stimulus package provided funding for an array of clean energy projects at bases nationwide, and the Obama administration and Congress should examine lessons learned from dispersing this funding and find ways to replicate its successes.

The next policy decisions regarding energy and climate change will be more sweeping and more difficult, but could result in dramatic improvements to long-term U.S. security. The services (and the nation broadly) have been working for years to increase energy efficiency, which means that the most basic and easiest measures (such as switching to energy-saving light bulbs and increasing vehicle fuel economy) are already underway. Meanwhile, the challenge of transitioning to a low-carbon energy economy that meets domestic, geopolitical and military needs is looming larger than ever. Fortunately, as U.S.

policy follows along, scientists and engineers – including those at DOD labs and the Defense Advanced Research Projects Agency – are making bold strides and often rapid advances in next-generation biofuels and electric transportation. However, if embraced, these advances will require major policy decisions. Nuclear energy advances will raise safety and proliferation concerns. And policy makers may need to grapple with efforts at atmospheric manipulation to cool the global climate.

### Recommendations

Throughout our research, several specific policy issues emerged continually and we believe that four in particular will present the toughest and most complicated climate change-related decisions in the coming years. As a result, the following section makes recommendations to help the United States better navigate the potential geopolitical implications of the changing climate. Specifically, we recommend that the United States engage in a serious international discussion of geoengineering; ratify the UN Convention on the Law of the Sea; and designate U.S. Northern Command to take responsibility of the Arctic region, with support from European Command and Pacific Command. Finally, we believe that nuclear power will be the biggest question in debates concerning how to improve energy security and mitigate greenhouse gases at domestic DOD installations. Consequently, we recommend that the U.S. government create a clear policy regarding nuclear reactors on military installations.

#### 1. GET INVOLVED IN THE GEOENGINEERING DEBATE

A lingering but critical policy question for DOD is what its role should be in discussions concerning geoengineering, i.e. the intentional manipulation of the climate, which is often discussed as a means to counter the effects of the climate change generated by human activity. This issue involves U.S. bilateral and multilateral

relations, domestic science and technology policy and an array of other security issues. Perhaps most starkly, it involves the potential of a single nation to intentionally manipulate the air and sea environments globally.

The security issues at stake are today not even well defined or fully explored but key questions include:

- Does the United States consider deliberate, unilateral and intentional manipulation of the climate a threat to the global commons, and if so, how are U.S. greenhouse gas emissions characterized?<sup>5</sup>
- Will the international community even know when and how another country engages in geoengineering if that country does not declare it publicly?
- Who is responsible for negative climatic effects of geoengineering on other countries and how should those repercussions be addressed?
- If the international community embraces geoengineering as a means for addressing climate change, who will fund, direct and provide oversight for research, development and implementation?

The debate over geoengineering today is both nascent and polarized. Opponents are already advocating a binding international treaty akin to the Biological Weapons Convention or Non-Proliferation Treaty, or complete bans on researching or implementing possible geoengineering techniques. At the same time, others are advocating geoengineering as a cheap and easy band-aid for the climate damage that human activity has created (this argument is often a thinly veiled attempt to simply stop any requirements for mitigating greenhouse gas emissions). Both sides tend to ignore the relatively weak scientific foundation most geoengineering approaches have today.

Still, the debate on this issue is heating up, and there are to date no international treaties, laws or even norms that point to a pragmatic approach to this policy question. Congress is beginning initial steps to explore this issue. The House Committee on Science and Technology, for example, held a series of three hearings between November 2009 and March 2010 to examine geoengineering, and it signed a joint statement with the commensurate UK House of Commons committee. (Notably, while this document speaks of “important international implications” of geoengineering, the words “security” and “defense” do not appear.)<sup>6</sup> In the executive branch, we recommend that the White House Office of Science and Technology Policy be the lead agency examining this policy question for the federal government, as it can convene and coordinate among the myriad federal agencies that have strong interests in climate, space and atmospheric issues. Yet some of the most important questions will involve U.S. security and foreign policy issues. Particularly as it involves deliberate manipulation of what the United States considers the global commons, DOD has an interest in – at minimum – being at the table for discussions of this approach to the climate change challenge.

## **2. RATIFY THE UN CONVENTION ON THE LAW OF THE SEA AT THE EARLIEST PRACTICAL OPPORTUNITY**

Ratifying the UN Convention on the Law of the Sea (UNCLOS) is perhaps the most important next policy step in ensuring that the United States and DOD are prepared to adapt to a changing climate and realize the opportunities that climate change may enable. Senate ratification of this treaty would afford the United States a major leadership role in maritime security issues that it presently cannot fully perform from the sidelines. UNCLOS gives the United States legal certainty in securing resource rights in its Exclusive Economic Zones (EEZs). By the nature of its coastline, the United

States enjoys the largest EEZ in the world, which includes Alaska's connection to a changing Arctic Ocean. For these economic and security reasons, UNCLOS ratification has long enjoyed strong support across the maritime services – not only for ensuring U.S. interests given the opening Arctic, but across the oceans worldwide. Reductions in Arctic summer sea ice have created new opportunities for access to maritime trade routes and sea lines of communication, and potential access to vast supplies of zinc, nickel, palladium, precious stones and other various minerals, as well as oil and natural gas under the ocean with an estimated value of 1.2 trillion dollars. Many of these resources lie in the extended continental shelf up to 600 nautical miles of the Alaska coast. As access to the Arctic and industry technologies continue to improve, heightened energy needs could spur private corporations to increase exploration and exploitation of these reserves. UNCLOS establishes the process for mining firms to obtain access and exclusive rights to these resources and title to the minerals once recovered. A failure to ratify UNCLOS prevents the United States from submitting a claim for rights in the extended continental shelf and prevents firms from securing these rights. This will hinder growth in the emerging seabed mining industry and related industries in the United States – as well as the jobs supporting those industries – because corporations will wisely seek the protection and legal certainty afforded only to member nations of UNCLOS before investing in these opportunities. Ratification of UNCLOS therefore protects and adds certainty to U.S. economic interests.

Furthermore, the signed 1994 UNCLOS agreement gives the United States the only permanent seat on the Council of the International Seabed Authority, its main decision-making body. The United States would be afforded this opportunity by virtue of having the largest economy in terms

of gross domestic product on the date of agreement. Failure to ratify the treaty as currently agreed would effectively abdicate a uniquely influential role in seabed mining. If a subsequent UNCLOS treaty agreement is reached before Senate ratification, there is no guarantee that the United States will still have the opportunity for this permanent seat, and if the treaty is not ratified, it will have no legitimate international voice on these issues.

The Obama administration began initial work with the Senate to push for UNCLOS ratification in mid-2009. The Interagency Ocean Policy Task Force noted in its September 2009 interim report that “By joining the Law of the Sea Convention now, we can reaffirm and enhance U.S. leadership in the development and interpretation of international law applicable to the ocean.”<sup>7</sup> It states explicitly that the Office of Science and Technology Policy intends to “Work to ratify the Law of the Sea Convention – an agreement supported by more than 150 countries, which will protect our economic and security interests.”<sup>8</sup> Likewise, Secretary of State Hillary Clinton stated in her January 2009 confirmation hearing before the Senate Foreign Relations Committee that the administration favored UNCLOS ratification, including to advance U.S. mining and other commercial interests in the opening U.S. Arctic territories.<sup>9</sup>

Despite a long history of overwhelming bipartisan support for UNCLOS, the political hurdles to its Senate ratification persist. The most frequently and vocally cited objection is the contention that ratifying UNCLOS will reduce U.S. sovereignty by forcing it to provide economic and technical information and to participate in consensus decision making internationally. Three U.S. representatives formed a “Sovereignty Caucus” in early 2009 to support the narrative that U.S. treaty participation negatively affects the U.S. ability to protect its interests.<sup>10</sup>

This argument has been a pervasive part of the UNCLOS dialogue since its first ratification attempt in 1982. We contend that U.S. leadership in international forums, and coordination with other countries is vital to protecting U.S. maritime interests worldwide. The security interests at stake with this treaty are becoming increasingly clear with the effects of climate change on the Arctic, and the U.S. Congress has a responsibility to promote these interests.

Though ratifying UNCLOS is important to America's ability to protect its security interests, history shows the difficulty in obtaining advice and consent ahead of an election cycle. A failed attempt at ratification could be more damaging to the overall ability to ratify it, particularly because this treaty is so critical to the economic future of the United States. Timing is important, but so is ratification. Thus, the introduction of the UNCLOS for legislative consideration should be well considered and carefully done.

### **3. DESIGNATE U.S. NORTHERN COMMAND AS THE SUPPORTED COMMANDER ON ARCTIC ISSUES, SUPPORTED BY U.S. EUROPEAN COMMAND AND U.S. PACIFIC COMMAND**

In the current Unified Command Plan, UCP 2008, three separate unified combatant commanders have responsibilities for portions of the Arctic. Until now, this has not presented a problem, but the effects of climate change in the Arctic have given rise to and may ignite new security challenges and expanded military missions. As other Arctic nations build capabilities to increase their presence in the Arctic, the United States currently lacks unity of command and unity of effort in the Arctic. Without unity of effort, the U.S. hampers its ability to protect its own interests, project a credible U.S. presence and coordinate diplomatic, military and inter-agency efforts in the region. A single supported unified combatant commander is needed in order to deal with the challenges ahead in the Arctic.

U.S. Northern Command (NORTHCOM) should assume the role as the supported commander on issues related to the Arctic. NORTHCOM's area of responsibility (AOR) includes Alaska and adjacent waters, meaning that the U.S. EEZ is within the AOR of NORTHCOM. NORTHCOM already has functional relationships with the Department of Homeland Security and other agencies that have interests or operate in the Arctic. Furthermore, NORTHCOM collaborates with Canadian forces in much of its activities related to security. While U.S. European Command's AOR includes the Arctic nations of Denmark, Norway and Russia and a correspondingly large portion of the Arctic coast, the commander's dual role as the military commander of NATO could place EUCOM in a difficult position. Therefore, we feel that NORTHCOM is best positioned to take the lead.

If NORTHCOM is designated as the supported commander for the Arctic, direct senior civilian involvement in such an arrangement would be critically important from the start. A potential solution is suggested by our colleagues Patrick Cronin and Kristin Lord in an April 2010 op-ed:

We need to create civilian-led equivalents of military combatant commands that can unify our diplomatic, development, public engagement and defense efforts... Washington-based agencies focus on formulating and coordinating policy, not implementation. That step must occur in the field. This does not necessarily mean simply placing a civilian on top of an existing military command, such as U.S. Africa Command, where a civilian is a prominent deputy. It may mean creating regional or subregional hubs, regional equivalents of embassy country teams, that enable U.S. agencies to integrate diplomacy, development, public engagement and defense more effectively.<sup>11</sup>

This kind of regional hub for the Arctic could be designed as a test case for the concept of creating these “civilian COCOMs.” The military challenges in the Arctic resulting from changing climatic conditions generally stem from non-military U.S. interests. Even more important, ensuring U.S. security interests in the Arctic will be impossible without strong and dedicated diplomacy and international coordination. Joint DOD and State Department leadership of this region offers the ideal way of promoting U.S. interests in the Arctic.

#### **4. MAKE INFORMED DECISIONS ABOUT NUCLEAR REACTORS ON MILITARY BASES**

Adjudicating whether or not domestic military bases should embrace nuclear energy as a means of meeting emissions reductions and energy security goals is beyond the scope of this study. Yet interviewees asked “where is Washington” on this issue in nearly every meeting we held at DOD installations around the country (not to mention several vocal proponents and critics within the Pentagon). Depending on technological advances and other factors, there are likely benefits to this approach but there are also serious drawbacks. Thus, there is a strong need for the federal government to examine carefully and create policy guiding the installation of nuclear power generation on domestic DOD bases.

A persistent question that civilian and military officials raised in our discussions over the past year therefore concerned the status of what many consider to be the ultimate no-carbon energy source: nuclear power. The 2005 Energy Policy Act required domestic federal buildings to reduce energy use and increase the use of renewable energy. Subsequent 2007 legislation increased these targets to achieve 30 percent energy consumption reductions by 2030.<sup>12</sup> As the services have done well to implement the relatively easy measures to reduce energy use and increase low-carbon energy generation, it may be increasingly

difficult to continue meeting these targets. Could locating small nuclear power plants on U.S. military bases be the next logical step in improving energy security and reducing emissions?

Proponents point to several benefits. Nuclear energy does not produce the climate-changing greenhouse gases that coal, oil and natural gas-based electric generation create. Nuclear reactors produce energy at a consistent rate, which is best for outdated U.S. power grids. Until better energy storage devices are on hand, they may also be the most reliable form of carbon-free power generation available to achieve the energy security goals of bases being self-sufficient during emergencies or long-duration power outages. Though security levels vary by location, proponents assert that military bases tend to have the gates and guards necessary to provide basic security measures necessary for nuclear facilities.

Many serious complications must be weighed as well. Military base personnel often do not have the necessary training in nuclear reactor management, oversight and regulatory credentials. Nuclear reactors would necessitate additional qualified personnel and improved physical security requirements to meet the 24/7 operations needs. As with siting for all energy production, local public resistance could be problematic. When considering the impact of a reactor casualty, the resulting impact on the operational mission effectiveness of the tenant commands on the base must also be considered so as to avoid a single point vulnerability that disables all military operations on site. And while many private companies are touting new designs for small reactors that would work well in this capacity, the technology may still be years away from fully meeting technical requirements and federal regulatory standards.<sup>13</sup> Proliferation considerations would also need to be part of any adjudication of what types of reactors are most suitable for these purposes.

## THE U.S. MILITARY AND NUCLEAR ENERGY: A HISTORY

As the United States assesses installing nuclear power reactors on domestic military bases, as mandated by both the FY 2009 and 2010 National Defense Authorization Acts, it may be useful to look back to the country's history of producing nuclear energy on U.S. bases.

Under the Army Nuclear Power Program (ANPP), which ran from 1952 until 1979, U.S. bases featured both portable and stationary reactors at the following locations:

### **Fort Belvoir, Va.**

Stationary: Pressurized Water, 1957-1973

### **National Engineering and Environmental Laboratory, Idaho**

Stationary-Testing: Gas Cooled, 1959-1962

Portable-Testing: Gas Cooled, 1961-1965  
Stationary-Testing: Boiling Water, 1958-1961\*

### **Camp Century, Greenland**

Portable: Pressurized Water, 1960 - 1964

### **Fort Greeley, Alaska**

Stationary: Pressurized Water, 1962-1972

### **Sundance, Wyo.**

Portable: Pressurized Water, 1962-1968

### **McMurdo Sound, Antarctica**

Portable: Pressurized Water, 1962-1972

### **MH-1A Sturgis floating nuclear power plant, Panama Canal**

Docked: Pressurized Water, 1967-1976

Major ANPP activities ceased in 1977, following the closing of the Sturgis plant, due to changing military requirements and funding limitations. Nevertheless, a historical examination of previous efforts to generate nuclear power on U.S. bases may be useful to inform public policy on this issue moving forward.

*By Daniel Saraceno, Joseph S. Nye, Jr. National Security Researcher*

*Source: U.S. Department of Energy National Nuclear Security Administration Office of the Deputy Administrator for Defense Programs, Highly Enriched Uranium: Striking a Balance (September 2001): 145 – 148.*

*\*destroyed in an accident*

The question of whether or not to locate nuclear reactors on domestic DOD installations has been raised for years, and the 2010 National Defense Authorization Act required DOD to assess the feasibility, costs and benefits of going this route. The need to mitigate greenhouse gas emissions, and recent debates over “islanding” energy systems and integrating smart grid technologies for energy and cyber security reasons, have all created a new sense of urgency for definitive answers to this pressing policy question.

The concept of energy islanding is enjoying increased attention today, and several Army, Navy and Air Force officials we spoke with explicitly stated that small nuclear reactors could help DOD to create islanding capabilities. The February

2008 Defense Science Board report “More Fight – Less Fuel” states that “The Task Force recommends DoD pursue the concept of ‘islanding,’ which would isolate critical loads, and selectively entire installations, from the grid and make them self-sufficient.”<sup>14</sup> Likewise, in response to a question about islanding for DOD bases, Deputy Under Secretary of Defense for Installations & Environment Dr. Dorothy Robyn stated in February 2010 that the source of electricity generation could be important to meeting the goals of islanding: “Is the backup diesel capability, or whatever that we now have, sufficient? Do we need to do more than that? And renewable can be helpful, nuclear could be very helpful, I don’t see renewable and nuclear as either or, it could be both.”<sup>15</sup>

If improving energy security includes all strategic assets, personnel and logistics involved with a given base's activities, then the definition of islanding would similarly need to expand to include parts of the greater community around the base, for example nearby ports. There is also a concern over negative public image that could stem from military bases having vast energy resources while the surrounding communities experience disruptions and other problems. This speaks to the idea that promoting nuclear energy for the purpose of creating islanding capabilities for bases would require careful definition of the goals of this approach and intricate planning.

The DOD-led report required by the 2010 NDAA is sure to offer initial insights on some of the important costs and benefits to consider in adjudicating this policy question. However, final policy choices should be informed by an extensive review conducted by an entity external to DOD (for example the National Academies of Science or DOE). While the United States has had nuclear reactors on domestic bases in the past, modern climate and energy concerns require a fresh look at siting nuclear reactors on military bases, and recommendations to Congress on whether (and perhaps where) this approach to increasing the use of climate-friendly energy is feasible and desirable. While providing a definitive answer to the question of siting nuclear reactors on military bases is beyond the scope of this project, we strongly recommend that a non-DOD entity conduct a major thorough examination of this question with the goal of setting national policy on this topic. A high-level public effort to define and answer this question is overdue.

On January 29, 2010, Energy Secretary Steven Chu announced his establishment of the Blue Ribbon Commission on America's Nuclear Future to "provide recommendations for developing a safe, long-term solution to managing the

Nation's used nuclear fuel and nuclear waste."<sup>16</sup> We recommend that the Obama administration follow up that initiative by applying the same model to the pressing national policy question of whether the United States should locate nuclear reactors on DOD installations.

## CONCLUSION

Given the complexity of climate change and its implications for national security, we do not imagine that a single research project could answer all questions or address every facet of climate change and national security. While we hope that we have provided both useful observations and concrete recommendations, our primary goal was to spark a richer and more public discussion on the national security implications of climate change and to link this discussion to the needs of America's armed forces.

Yet we do believe that this project succeeded in highlighting the most important near-term policy questions for the military services, combatant commands, the Department of Defense and policy makers concerning energy and climate change. In the near term, decision makers will need to answer important questions identified in this report's chapters, to include the following:

- How can DOD balance energy consumption, mission effectiveness and national climate change mitigation goals in concert?
- What trade-offs are involved with focusing time and funding on climate change, given that operational and maintenance budgets are finite and increasingly constrained?
- What specific climate change effects are likely to occur and how are these effects likely to affect the armed services?
- How can officials access actionable climate science data and use it to better plan for future contingencies?

- Where would DOD make the greatest contributions to national security goals through its study of climate change and investments in reducing emissions?

The following chapters analyze how climate change may affect U.S. maritime, air and ground forces and the combatant commands. In so doing, they provide some preliminary answers to these questions and point to key challenges ahead.

While we believe there is still much work ahead, there is a growing commitment to addressing energy and climate change within the DOD. Indeed, in our conversation with officials in the Office of the Secretary of Defense for Policy, it was clear that, in developing the climate change and energy section of the 2010 QDR, the Department of Defense has developed a nascent, intellectual infrastructure of civilian and military professionals who will continue to study the national security implications of climate change, and, we hope, will continue to reevaluate climate change risks and opportunities as the science continues to evolve. We applaud these efforts. As the United States addresses the global implications of climate change and reduces its own operational vulnerabilities, this understanding will enhance American security.

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