The U.S. Navy - Navigating Through a Changing Climate

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DAVID TITLEY AND ROBERT S. FREEMAN, MAR 23 2012

For the U.S. Navy, the decision to build a new ship is never taken lightly. These state-of-the-art warships represent a major investment in taxpayer dollars, and they are expected to meet Navy needs over a roughly 30-year lifespan. When determining what type of ship to build, the Navy must first consider the missions it may be assigned throughout the ship's life cycle, and that is based on efforts to understand the security challenges for maritime forces in the coming decades.

Predicting the range of future challenges is no easy matter, but it is a necessary part of how military organizations prepare, invest in platforms and weapon systems, conduct training, and concentrate their forces. Strategic multi-disciplinary think tanks bring together military and civilian experts in a wide range of specialties to imagine the geopolitical future landscape, and military table top exercises help us work out the details. These informed scenarios are used by military leadership in the development of high-level strategic guidance, which helps us decide, among other things, what types of ships we will need 30 years from now.

Watching the rise and fall of regional powers and competing ideologies is one way to anticipate future challenges, but these are generally manifestations of larger forces at work. It is necessary to understand these larger forces in order to more accurately account for their impacts. As we pass the first decade of the 21st century, it is becoming clear that we are facing forces unforeseen even a decade ago.

Globalized trade, technology access, and proliferating communication venues are changing how developing nations and disenfranchised people see themselves and interact with other groups. Expanding populations, declining resources, and the migrations of people are further straining already factious relations between vulnerable nations. The world order is changing . . . and so is the geography.

Warming of the global atmosphere and ocean is altering the physical environment that we all grew up in. The opening of the Arctic has resulted in the exploration of the first new ocean in 500 years. The melting of glacial ice and land-based ice sheets will affect sea levels globally and, in some cases, the availability of fresh water resources. Sea level rise will, over time, change the appearance of coastlines. In the northern hemisphere, warmer temperatures will result in the slow spread of plant and animal species northward; and some commercial fish stocks have already been observed migrating northwards into the Arctic Ocean[1]. Extreme weather events are becoming more common, likely due to climate change[2].

As a globally-distributed force, the U.S. Navy may be the first military service to fully experience the impacts of climate change. Despite the decade-long focus on terrorism, the requirement for a global naval presence has never gone away. The security, prosperity, and vital interests of all nations are best served by fostering a peaceful global system of networked trade, finance, information, law, and governance. Protecting the intersection of sea lanes, resources and vital U.S. interests is one of the U.S. Navy's core responsibilities. Over 90 percent (by volume) of global trade and two thirds of the world's petroleum supply is conveyed by sea[3], and the U.S. Navy is committed to ensuring the sea lanes remain open for commerce. In conjunction with our international partners, we strive to protect the maritime freedom that is the basis of global prosperity. Seapower protects our way of life.

Any objective evaluation of the data will verify that the Earth's climate is changing, a fact the U.S. Navy acknowledges. The reasons for these changes have become a subject of political, if not scientific, debate. How our nation ultimately responds to anthropogenic climate change will be determined by our policies developed by our elected leaders. For the U.S. Navy, though, the appropriate approach is to determine the impact of climate change on future naval readiness and ensure we are prepared for the challenges that may confront us in the future.

So what is the Navy doing? Over the past decade, the Navy has been observing the changes in the Arctic and considering the ramifications for future operations. In 2009, the Chief of Naval Operations created Task Force Climate Change to assess the implications of Arctic and global climate change and make recommendations for the way ahead.

We have identified the Arctic as our first concern. The Navy's overall strategic objective for the Arctic is to ensure it remains a secure and stable region, free from aggression[4]. As the Arctic Ocean opens up for increased human enterprise, the Navy may be assigned to conduct operations or maintain a presence there. This is not as simple as it may sound. Despite the moderating changes in the Arctic, the environment remains harsh and remote, with formidable logistical challenges.

There is very little infrastructure on the Alaskan coast to support military operations and limited federal money to develop it. There are no deep water ports on the Arctic coast of Alaska. The only U.S. military base north of the Arctic Circle is Thule Air Base, on the northwest side of Greenland. The closest Coast Guard base to the U.S. Arctic coast is on Kodiak Island, off the southern coast of Alaska and nearly a thousand miles away. The federal fleet currently has one operational icebreaker, the U.S. Coast Guard Cutter Healy.

If naval ships are going to operate in the Arctic, how do we refuel them? How do we deliver fresh supplies? What do we do if there is a medical emergency? How do we conduct search and rescue operations? Are satellite communications reliable and robust enough to support Navy command and control requirements? Do our weapon systems and sensors operate effectively in very cold weather, or when covered with frozen sea spray? Are our ships, optimized for lower latitudes, able to provide a workable habitat for their crews? If needed, what are our options for ice-breaking capabilities?

A major concern is the cost of high-latitude operations. Fuel and supplies must be shipped to and staged in the Arctic, so cost of resupply is much higher than in lower latitudes. At a time when military budgets are being reduced, how do we prioritize Arctic operations within the President's new Defense Strategies and our counter-terror, Middle East and Pacific priorities?

Fortunately, we have time to figure this out. For the U.S. Navy, the changing Arctic is not a crisis – it is a challenge. Although there are some minor disputes over boundaries and rights of passage, the region is generally marked by a sense of cooperation. The Arctic Council, composed of high-level representatives from the eight nations that claim Arctic territory, provides a forum for policy and intergovernmental communications. In May 2011, member states signed the Arctic Search and Rescue Agreement, the first binding treaty by the Council.

The U.S. Navy views the Arctic as an opportunity to build partnerships with the other Arctic nation's militaries. This type of cooperation will allow us to share knowledge, reduce expense, and learn from each other's experience. The Navy's Task Force Climate Change has already engaged with military representatives of each of the Arctic nations.

To try to anticipate the challenges of high-latitude operations, the Navy identified several areas that required study. These were originally laid out in 2009's *U.S. Navy Arctic Roadmap**[5]***, a five-year plan of actions and milestones designed to guide Navy policy, investment, action, and public discussion on the Navy's role and actions concerning the Arctic.

The roadmap recommended the use of table-top exercises to better understand the challenges of Arctic operations. Table-top exercises provide a venue for experts in many areas to get together and think through multiple challenges and scenarios, using high-quality research, analysis, gaming and education to help shape key decisions on the future

of the Navy.

In 2010, the U.S. Fleet Forces Command hosted the Chief of Naval Operations Global Shipping Game. With over 70 representatives from the Navy and Coast Guard and experts in policy, economics, law, security, commercial shipping, and insurance, participants explored the strategic implications of future changes in international shipping patterns, including trans-Arctic shipping.

Similarly, the Naval War College hosted the Fleet Arctic Operations Game in 2011 to identify challenges inherent in Arctic naval operations. Approximately 80 participants from a variety of military, government, industry, and academic organizations engaged in the four-day exercise. Participants identified capability gaps that limit sustained maritime operations in the region and explored long term solutions to address these gaps.

In early 2012, the U.S. Northern Command conducted an Arctic Collaborative Workshop at the National Defense University to evaluate potential responses to various scenarios which could occur as human maritime activity continues to increase in the Arctic. Participants determined what U.S. military forces are available to assist civil government agencies in search and rescue and environmental mitigation situations. The workshop identified engagement and cooperation with international partners as an important component of a successful response.

In addition to table-top exercises, the Navy has conducted several studies to help identify priorities and focus our energies more effectively. These studies are focused on the types of missions the Navy may be called upon to conduct in the Arctic through the year 2040; the capabilities naval forces will need for Arctic operations and existing gaps in capabilities; and requirements and shortfalls in our ability to characterize and forecast the Arctic environment in support of operations.

Global climate change will create challenges for the Navy outside of the Arctic as well. Thermal expansion of the warming ocean and melting ice sheets and glaciers over land may cause sea levels to rise as high as one meter in some locations by the end of the century[6]. Since the majority of naval facilities are located on the coasts, this could create significant problems for our bases, including the piers and approaches. Enhanced tides and storm surges could create infrastructure damage and salt water intrusion may compromise water supplies. Rising sea levels will significantly expand the area of flooding and level of damage of the most routine storms experienced today. Such considerations need to be included in future infrastructure planning.

Here again, the issue is more complicated than it first appears. Sea level is affected by a variety of forces, including the vertical movement of the land, the density of the substrate, prevailing currents and tidal forces. Individual locations will exhibit quite different vulnerabilities. For Hampton Roads in Virginia, home to the largest U.S. naval complex, increases in sea level will act in concert with a slowly sinking land mass, which will enhance the impact of coastal inundation over time.

How do we comprehensively assess a location's risk? The Strategic Environmental Research and Development Program, an extramural research arm of the Department of Defense, is currently funding multi-year, multi-disciplinary studies at five coastal military bases to not only understand their vulnerability to sea level rise in the context of their different biophysical settings, but also to develop and test the necessary models and tools useful in conducting future vulnerability and impact assessments of coastal military installations. These projects are scheduled for completion in late 2012 and will inform future research as well as assessments.

It is true that global warming will benefit some nations by moderating their climate and extending agricultural growing seasons. Other regions will be seriously challenged due to their inability to adapt to environmental stresses and diminished resource availability. The *Quadrennial Defense Review**[7]***, one of the foundation documents of U.S. defense strategy, characterizes climate change as an "instability accelerant" due to the likelihood that climate stressors will increase instability in vulnerable parts of the world, areas that have neither the resources nor the political unity necessary to adapt to resource challenges.

As Navy leadership thinks through the climate challenges that may confront our service throughout the century, one

theme keeps emerging – *uncertainty*. We accept the fact that the Earth's climate is changing, but there is much we do not know regarding the timing, location, and specific extent of the changes. While remarkable progress has been made by researchers in developing computer models of climate processes, the detailed outputs of different models are rarely in agreement.

Part of the challenge is acquiring enough global data. To accurately represent the whole environment in the models, we need data from the atmosphere, ocean, cryosphere (collective ice domain), terrain, and space boundary. With the amount of data needed to capture the complexity of global climate dynamics, computer capacity will need to be immense, beyond the current capability of any one organization.

A second significant challenge is down-scaling from global forecasts to projects for specific regions. Global averages of change have little value for planning in a given region, whether for impacts to our own facilities or for potential climate-related stressors in fragile countries around the world. The coarse resolution required in global models for decadal forecasts produces forecasts with ever-improving accuracy at the global scale, but misses nuances which are very important in characterizing the climate in smaller regions. Just as all politics are local, so are the effects of climate change.

Strategic thinkers and planners in a wide array of governmental and business organizations absolutely require accurate predictions of the changing environment: this is not just an academic science issue. An ongoing initiative, known as the Earth System Prediction Capability (ESPC), will combine the computational power and scientific knowledge of the U.S. Navy, U.S. Air Force, National Oceanic and Atmospheric Administration, National Aeronautical and Space Administration, and U.S. Department of Energy. By combining resources, we expect to develop environmental models that will extend the forecast capability beyond the current standard of roughly ten days out to months, years, and even decades.

Atmospheric forecast models have been incrementally improving over the last 60 years to get us to our current capability, and the coupling of atmospheric and ocean data has greatly improved our ability to forecast global-scale processes. Along the way there have been numerous successes and failures, but dedicated efforts have consistently moved us forward. So it will be with our efforts to better characterize and understand the comprehensive influences that are changing the global climate.

In a time of diminished federal funding and increased mission requirements, it is essential the U.S. Navy be good stewards of taxpayer dollars. We do not wish to spend money ahead of need, nor do we wish to be unprepared for future challenges. It is critical that we achieve a better understanding of the nature and timing of climate change so that we know where and when to invest our precious resources of money, time and focus, to ensure we are able to meet any mission requirement in future decades.

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Rear Adm. David Titley *is Assistant Deputy Chief of Naval Operations for Information Dominance and Director of the U.S. Navy Task Force Climate Change.* **Robert S. Freeman** *works for the Office of the Oceanographer of the Navy.*

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[4] *U.S. Navy Strategic Objectives for the Arctic*, 21 May 2010, http://greenfleet.dodlive.mil/files/2010/09/US-Navy-Arctic-Strategic-Objectives-21-May-2010.pdf.

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[6] *Advancing the Science of Climate Change,* The National Academies Press, 2010, pg. 250. http://books.nap.edu/openbook.php?record_id=12782&page=243.

[7] *Quadrennial Defense Review, "Crafting a Strategic Approach to Energy and Climate* ," pp. 84-88 February 2010, http://www.defense.gov/qdr/.