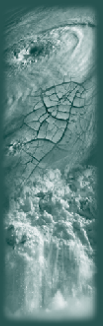


CHAPTER 8

INTEGRATION AND SYNTHESIS

IMPENDING CHANGES

CLIMATE



ENERGY SUPPLY & DEMAND



CLIMATE & ENERGY IMPERATIVES FOR FUTURE NAVAL FORCES

SOUTHCOM & NORTHCOM



CLIMATE & ENERGY IMPERATIVES FOR FUTURE NAVAL FORCES

EUCOM & AFRICOM



CLIMATE & ENERGY IMPERATIVES FOR FUTURE NAVAL FORCES

CENTCOM & PACOM





8.1 INTEGRATION AND SYNTHESIS PANEL MODERATOR'S SUMMARY

Mr. John Benedict

The goal of the Integration and Synthesis Panel is to identify the cross-cutting imperatives for future naval forces based not only

Mr. John Benedict is a Fellow in the National Security Studies Office and former head of the Joint Warfare Analysis Branch within the National Security Analysis Department (NSAD) at JHU/APL. Mr. Benedict has been focusing most recently on U.S. Navy missions and roles related to irregular warfare (IW) as well as investigating the national security implications of various future trends, including climate change and global energy shortages. Before this, he was a co-lead on a high-impact, high-visibility study for the Office of the Secretary of Defense that identified capability and capacity gaps and associated solution options relevant to three types of IW operations: counterinsurgency, unconventional warfare, and steady state/combating terrorism. The results were used to inform the 2009–2010 Quadrennial Defense Review. [1] Mr. Benedict has extensive experience in naval operations analysis, primarily in the area of undersea warfare with special emphases on anti-submarine warfare (ASW) and mine countermeasures. Before joining JHU/APL in 1985, Mr. Benedict worked at Vitro Corporation, where he supervised a group that did operations research and systems analysis in ASW. Mr. Benedict gives regular tutorials at the Naval Postgraduate School on the topics of ASW, mine warfare, and best practices for leading studies and analyses. He was a principal investigator in the mine warfare assessment that was conducted by the Naval Studies Board in 2001 and has been published in the Naval War College Review, U.S. Naval Institute Proceedings, The Submarine Review, U.S. Navy Journal of Underwater Acoustics, ASW Log, Johns Hopkins APL Technical Digest, and other journals. He has received numerous commendations and was a recipient of the Special Achievement “Bronze Medal” Award at the September 2002 National Defense Industrial Association USW Division Conference. Mr. Benedict has an M.S. in numerical science from The Johns Hopkins University and a B.S. in mathematics from the University of Maryland.

on what we've heard throughout this symposium but also, to some extent, on what we have not heard. We will not be synthesizing the science behind climate change and energy, but we will be synthesizing the operational and strategic implications of those changes for our naval forces. So please keep that in mind during the question and answer period.

We heard about the tactical and operational effects of climate change, including the adverse effects of sea level rise and storm damage on the viability of military operating bases, and the potential for an increased role of naval support to civilian authorities during domestic disasters like Hurricane Katrina. We also heard about a potential increased Navy role as first responders for humanitarian assistance and disaster relief (HA/DR) operations and a likely increased role for sea basing during those operations. We also heard about the vulnerability of our national electric grid to storms, with potentially adverse effects on the U.S. Navy and other services in some situations. We heard that demand for some types of Navy missions could increase as a result of climate change effects—including search and rescue, medical evacuation, HA/DR, environmental stewardship, and maritime security.

Shifting to the strategic level, we heard several times that climate change will exacerbate negative aspects of various societies. Things that are problems now will likely become more stressed when compounded by climate change. These changes could prove destabilizing in some regions and could even lead to failed states in some cases—think Somalia, think Darfur—based on regional food security issues, water availability and quality, spread of infectious diseases, and potential mass migrations and refugee crises.

We did not hear as much about the likelihood of increased demand for international institutions, who might be asked to take on a new or enlarged role to mitigate some of these serious problems. We also heard little about how climate change could significantly impact virtually everything about the way the military and the Navy operate.

Taking a regional perspective, we heard a lot about the Arctic. Open seas in the Arctic will provide opportunities for new

maritime shipping lanes and opportunities to harvest rich natural resources, with associated legal and sovereignty issues that are highlighted effectively in the presentations by Commander Kraska and Lieutenant Colonel Strader. We also heard about the potential for competition between the United States and Russia in the Arctic, and we even heard about possible U.S. and Canadian competition. Also discussed was the fundamental need for the Arctic nations, including the United States, to ensure safety, security, and stability in the region, with opportunities for new partnerships.

We heard a long list of potential new Arctic missions and roles, including maritime security and awareness, presence, patrols, escort shipping, environmental protection, fisheries enforcement, freedom of navigation, and overflight. We had a similar list of potentially new Arctic capabilities that would be needed, starting with icebreakers, different ship designs, weather and ice forecasting, enhanced navigation and communication suites, and additional infrastructure, including potential deep water ports that currently do not exist.

Shifting to Africa and the Middle East, we heard about climate-induced water and food shortages, with adverse effects and instabilities in various regions, including North Africa, the Sahel Region, the Horn of Africa, South Africa, Nigeria, Lagos and other mega-cities, mega-slums, and East Africa. Also mentioned was the potential for increased water-borne disease in sub-Saharan Africa, potential mass migrations in Nigeria and East Africa, humanitarian emergencies, and potential state failures.

We heard less about the Middle East. Some potential effects were alluded to in some of the CNA material, but there are serious food, water, and resource shortages there. Two-thirds of the Arab world depends on water resources external to their borders, and 75% of the water in the Middle East is located in four countries.

With regard to Asia, Australia, and New Zealand, we heard about potential large-scale flooding inundation and mass migration potentially in heavily populated mega-delta regions. Bangladesh in particular came up several times, with significant migration concerns for Pakistan, India, and China. We also heard about a

potential decrease in fresh water availability throughout Asia, particularly in large river basins, including large parts of India and China. The potential exists that the Gobi Desert could suddenly expand and that the melting of the glaciers in the Himalayas could eventually result in serious water shortages for hundreds of millions of people. We heard about low crop yields potentially in China and other places. As for Australia and New Zealand, Commander Cole from the Royal Australian Navy discussed the potential for a significant loss of biodiversity, water scarcity, and declines in crops and forestry.

Shifting to Europe, the Americas, and island nations worldwide, we heard about the possibility of large-scale human migration issues, particularly from North Africa. We heard about desertification issues in southern Europe and about flash floods in other parts of Europe.

However, we did not hear much about the potential fracturing of long-standing European alliances due to the pressures that can come from some climate-induced effects, particularly mass migrations, although these topics have been discussed at some length in other forums. We heard that the United States was very vulnerable to sea level rise, more frequent intense storms, potential water shortages in western states, and increased U.S. border stress. In Latin America, we heard about water-supply strains, disease outbreaks, and potential damage to the Amazonian rainforest. In the case of some of the more vulnerable island nations worldwide—Micronesia, for example—we heard about very serious issues with inundation, storm surge, and water scarcity.

We also learned about climate change uncertainties—how soon and for how long will various parts of the Arctic be ice-free? Opinions vary from within a few years to as far out as 2060, with a median indication of sometime in the next 25–30 years. We also learned that the 2007 Intergovernmental Panel on Climate Change (IPCC) report probably seriously underestimated the sea level rise expected by the end of the century. Rather than the half-meter rise identified in the IPCC report, we've heard from several sources that it could be 1–2 meters or more.

The same report estimated global surface temperature rise from 1°C to 6.5°C by the end of the century, depending on various scenarios, which are largely about energy consumption and demand across the globe. If these forecasts are ultimately tightened, will today's median estimates prove optimistic or pessimistic? We do not know.

We did not hear as much about tying together observations and projections about climate change with social trends, such as demographics and poor governance. Once you've done that and tried to really delineate in more detail the combination of social trends and physical effects, how is that going to change U.S. and global security? I think there is more work to be done there that we did not accomplish at this conference.

On the energy supply and demand side, at the tactical operational level, we heard a lot about over-reliance on oil on the battlefield; heavy just-in-time logistics potentially costly in dollars and lives, tying up combat assets and resulting in overall reduced combat effectiveness; and the need for more efficient approaches with less significant range and endurance constraints. We heard about the need for diversified energy sources to give us greater resilience, and we heard about our fragile electricity grid that is vulnerable to both natural and man-made threats.

I was concerned that we would not hear a lot about the strategic implications of petroleum use, but General Wald and Vice Admiral McGinn provided considerable food for thought. In addition to the scenarios offered by Vice Admiral McGinn, I think there are many other very interesting low-level, middle-level, and high-level scenarios where energy considerations are, or should be, pervasive. It is why you are there, it is what you are doing, it is what you are worried about protecting, it is what you are worried about getting.

So I think that there is a lot that could be done here to help us understand why energy security is so important on a global level. At the strategic level, we learned about our dependence on imported oil, the potential adverse strategic consequences undermining various foreign policy initiatives, the resulting entanglements

with repressive autocratic regimes, and the tremendous transfer of wealth to a small group of supplier nations, which allows countries like Iran to both support terrorism and pursue nuclear weapons. In addition, large U.S. oil imports contribute to our growing debt, which is a national security issue itself.

We heard about dependence on an increasingly tight supply of oil and other energy sources and the resulting volatile energy market. For the Navy, a \$10 increase in the price of a barrel of oil will be felt as a \$300 million increase in that service's annual fuel bill. Under certain scenarios, we could be talking about price increases that are several multiples of \$10. Market volatility was also mentioned, as was the possibility of intentional price manipulation of which the temporary denial of Russian natural gas to Europe was cited as an example.

We also learned that energy nodes are very attractive targets for terrorists and insurgents and that we need to diversify in order to ensure resilience. We also have uncertainties with future energy supply and demand. There is obviously controversy about peak oil, although that specific term was not used much during the symposium. We did talk about oil crunches and reductions in supply. When will global oil production begin to diminish? We heard a range of answers, with some saying in a few years and others saying we are already there. The International Energy Agency's chief economist, Dr. Fatih Birol, expects a plateau around 2020. Under the scenario that he has in mind, the world will need to find about 40 billion barrels per day of gross new capacity, equal to about four new Saudi Arabias, just to offset the decline that he thinks is going to happen on a business-as-usual case. We have opponents and proponents on both sides, notable people in organizations who think that there will be oil around for a long time and there will not be any oil crunch any time soon, and people who think we are already starting to see it.

There is also some disagreement on the stability of fuel prices. Two views are: prices will remain volatile indefinitely, and we have no choice but to learn to live with it; or prices will largely stabilize, and what we had recently was an aberration.

In development, speed, and scalability of alternative energy sources, there is a large diversity of opinion. There are those who think that we can largely mitigate the problem with technology in the next 20–30 years, and there are others who think that we have significant limits on how rapidly we can implement alternative energy source solutions on the scales needed to replace fossil fuel.

There are other relevant areas of uncertainty, too. For example, are energy security or rather energy insecurity and climate change mitigation measures largely in sync or somewhat at cross purposes? General Sullivan from the CNA Military Advisory Board stated—and I think he has really got it here—that energy, security, economics, and climate change are all interconnected. It is a system of systems. It is very complex, and we need to think of it that way.

What about other drivers? How do they play? Globalization trends; wild cards such as pandemics; rising powers in a changing, diverse, multi-polar world power structure; shifts in the nature of power; shifts in the nature of war. Will states and institutions effectively address global regional problems? On energy, how long will rising powers rely on traditional Western market-based institutions? On climate, were the recent G-20 differences an aberration, or was that a forecast of a changing future with great difficulty in getting together on global approaches?

On the economy, how long will rising powers be excluded from some of these institutions, or will rising powers not even want to join them and prefer regional or other approaches? On security, how effective will the G-20, the North Atlantic Treaty Organization, United Nations, and other international organizations be at addressing international security issues in the future? There is considerable uncertainty as to whether we can organize as a planet and implement some large-scale major mitigation and adaptation and prevention measures.

In summary, I think that climate and energy imperatives will impose considerable demands on the Navy's two new core capabilities identified in the 2007 Maritime Strategy: maritime security, and HA/DR. These capabilities will likely rise significantly in

importance, and not just on the margins. Maritime security activities will need to come in many flavors, including ones that have been done historically by other government agencies. In the future, the Navy will need to take on a set of tasks that includes environmental security, border migration security, fisheries and resources protection, and critical infrastructure protection. I also think that stability operations, and humanitarian assistance in general, will be increasingly important, with the U.S. Navy likely having an expanded role along with other services and agencies.

Finally, there is a clear need for the United States and the U.S. military to partner with others to address these types of global or regional issues. They are far too challenging to take on alone.

REFERENCE

1. Department of Defense, *Quadrennial Defense Review Report*, Feb 2010, <http://www.defense.gov/qdr/>.



8.2 THE WHO, WHAT, WHERE, AND WHEN OF CLIMATE AND ENERGY

Dr. Ed McGrady

I have the unenviable challenge of trying to synthesize a diverse group of opinions and provide an integrated view of how the Navy is going to train, plan, equip, and operate in the future; and I have to do it in 10 minutes. Whenever I have that kind of problem, I always think of the basic law enforcement investigative

Dr. Ed McGrady is a senior research analyst at CNA. He develops games and conducts studies on a wide range of topics from force structure and planning to operational deployment of medical forces. He is currently working on projects related to the effect of climate change on U.S. military involvement in humanitarian assistance and disaster relief operations. Dr. McGrady's research work includes studies of humanitarian emergencies, disaster response operations, the role of naval and other military forces in medical humanitarian missions, cooperation between military forces and nongovernmental organizations, and the role of military forces in domestic disaster response. He has led studies examining recent hospital ship deployments, including the tsunami relief efforts and follow-on humanitarian medical assistance operations in the Pacific. During the Katrina response, he led a group of 10 analysts examining the full spectrum of disaster response operations, from military support to civil authorities to internal Navy disaster response. He has also examined the role of military forces in complex emergencies, such as occurred during the U.S. intervention in Haiti. As part of that effort, he deployed with U.S. forces onboard the USS Enterprise. Dr. McGrady has written extensively on the role of military forces in humanitarian assistance and disaster relief operations, authoring papers on such diverse topics as the role of naval forces in providing emergency communications support, the nature of these operations and their impact on national security objectives, and the types of emergencies that military forces typically are called upon to support. He holds a B.A. in chemical engineering from the University of Florida and a Ph.D. in chemical engineering from the University of Michigan.

process in which one tries to identify who, what, where, and when, but in this case, I am not going to talk about why. But that is how I am going to try to organize things.

I am going to talk about the time frame, I am going to talk about what you seemed to be interested in as you talked, I'll talk a little bit about where these kind of things seem to be happening, and I'll talk a little bit about some of the other issues that I see.

Let's begin with the "who" question. I tend to think of things in terms of audiences. Who are the audiences that have been talked about over the last few days? In our case, I think there are three. First, there are the peers—the people you see as more or less equivalent to the United States. They face many of the same kinds of problems and the same kinds of challenges, and they have the same kinds of requirements strategically and nationally that we have. This group includes Russia, China, and Canada. Discussion about this group really focused on the Arctic; we heard about the challenges of managing and competing for resources in the Arctic. In fact, competition really factors in a lot when you start talking about peers and peer developments.

At the same time there is another group—what I would call populations at risk. These could be overseas, or they could even be domestic—Phoenix, for example, or New Orleans. The stability of these groups may be affected by climate change or by changing energy prices. It is not so much that these groups or countries are going to suddenly light their hair on fire and start running around and doing crazy things but rather that the pressures are going to mount as time goes on. Those pressures include the effects of climate change and changes in energy but also things like water, food, sea level rise, and disasters.

The third group is our own forces—our own Navy, Marine Corps, and Coast Guard. How do we do better with energy, how do we save money on energy, and how do we move to alternative fuel sources so that we are not so strategically reliant on specific sources and so that we can take care of our own mission and the problems within our own lifetimes?

I also think that you can divide up the “what” question into three different categories. The first “what” really talks to that group of peers with whom we are competing. That is the question of security: of certainty in the supply chain for oil, of sovereignty issues over the Arctic, of the cost of operations, as well as how do we deal with the tactical logistical problem of reducing the amount of fuel we send to our forward forces. But then there is also the whole stability issue for the populations at risk. As climate changes and as energy problems become more pronounced, those groups are going to be under more pressure from factors such as water, migration, and food, and that can ultimately result in the need for humanitarian assistance and disaster relief (HA/DR) responses.

There are projections that climate change may affect the number and severity of storms, including hurricanes, which will increase the demand for HA/DR responses. This, in turn, will place more stress on the security aspects of the overall mission. Well, if you look at what the U.S. Navy actually responds to, it responds very frequently to higher-category hurricanes. So as you start comparing what the Navy does to what is going to happen in climate change, many of these missions begin to overlap. You begin to see that stresses could be placed on the forces to take on a larger HA/DR role. I’ll talk a little bit about HA/DR in a minute.

Before I do, however, I’d like to talk about the entire resource issue. And by resources I do not mean more aircraft carriers; I mean things like oil and other resources that the peer competitors compete over. We heard a lot about that in terms of supply (for example, developing new oil fields and methane hydrates) as well as the price and the effect that price has both on the security mission and on stability.

Then there is a fourth area that I call the policing and the fairness of the commons. I think it is very interesting that we brought this up in terms of geo-engineering. But there is also a question of mitigation in emissions that revolve around this issue. If you have a situation where lack of carbon in the atmosphere becomes a resource, and as an industrialized nation or even a developing nation, the more of that negative resource that you capture, the better your economy will do, you’ve now set up an immediate

competition over how much you are going to be able to emit. And if by emitting you are affecting other countries, you may encounter security issues. If someone unilaterally initiates geo-engineering activities for whatever reason, that may affect the commons and trigger a security response.

So I think that this is a very interesting area that I have not heard much discussion of, but it was very interesting that it was brought up here. I think that all three of these work with the different audiences to pull apart what different impacts and what different missions the Navy is going to potentially face.

There is also the question of “when,” and I think this is really important because one of the things it is very easy to do is get the dynamic element of climate change ahead of ourselves. Climate change is a process. It is not something that is going to suddenly happen tomorrow, it is almost like boiling the frog. Things are going to get hotter, the mean surface temperature is going to go up, and therefore things are going to change. But they are going to change over a relatively long period of time.

There are things that we are talking about in this conference that occupy the “now” time frame. Those are the things that the Navy actually has control over for the most part. The Navy does not necessarily have a lot of control over climate change. Sure, they can turn off the lights or move to compact fluorescent bulbs on their ships, but that is not going to stop climate change, as we heard in Professor Lewis’ presentation.

Instead what the Navy is focused on are things like alternative fuels, energy security, and trying to decouple the Navy’s combat capability from the need to continue to have a fuel logistics train. There is also the question of the Arctic. The Arctic sea ice is withdrawing; it is moving even faster than a lot of the other issues with respect to climate change. And that triggers things that the Navy is accustomed to dealing with, like sovereignty issues and freedom of navigation.

Those things are relatively easy to deal with now because we have the framework both intellectually as well as physically and resource-wise. However as you begin to go to the later effects

and as the stress from all of these various climate effects begins to mount, there are other things that come online. The stability issue becomes more and more important, and then the question becomes, what are the tactical and operational impacts for increased instability around the world for the Navy and the types of missions it might have to engage in? And that is where things like HA/DR become more important.

But the other question is, where would this happen? This question actually stimulated this whole briefing in that I saw different geographical groupings for the topics addressed at this conference. We started off in the north dealing with our peer competitors, who are mostly focused on the north, mostly toward the North Pole. Issues regarding security, fuels, and the Arctic all tend to be northern peer competitor issues. Then you go to the central band, where you have a lot of the more stressed states; moreover, many of these states are far less robust than are the states in the north. In those areas, concerns over climate and energy tend to be more in the future in some ways. Sure, they are having HA/DR operations now, but most of these countries are under some form of development regime. In the future, climate change will impact these countries more than those in the north given their overall lack of resilience. As a result, many of the Navy's HA/DR and security assistance missions are likely to occur in the center. It is interesting to note that the state fragility index shows that the countries in the center have the highest index values. And they are the ones that may be impacted more severely by climate change.

Then our last session focused on Antarctica, Australia, and New Zealand. As the climate continues to warm, it is conceivable that what is happening in the Arctic now could become an issue in Antarctica as well.

So I think the conference moved from the north through the central band, where we were talking about HA/DR, and then finally wound up in the south. We also tended to move from issues that matter to us now to issues that will matter for us in the future.

The other thing I tried to do in the conference is look for feedback loops, things that would reinforce each other. I saw two that

I thought were interesting. One was this concept of “Yay, the ice is melting; we can go drill for oil in the Arctic.” Well, let’s just think about that response. If climate change is causing the ice to melt, which uncovers more oil reserves, which allows us to drill more carbon, which then allows us to burn more carbon and put more carbon into the atmosphere, then have not we created a feedback loop that will exacerbate the overall problem of climate change?

If you look at the area of the commons, eventually as you go from 2020, to 2030, to 2040, countries will start going under water. Eventually this may become as much of a national security issue as it is a climate change issue and may start changing the mission set for the Navy and the things that we see as an actual threat.

On a positive side, we had a feedback loop where the Navy is setting standards, the Navy is setting emission goals, the Navy is setting requirements, and then those requirements trigger industry to build the capability and then potentially create a negative feedback loop that decreases the overall problem. Still, a lot of questions remain. First of all, Climate and Energy—that is the title of the conference. They are related. At a strategic level, climate change and energy are obviously related.

But at the tactical level—the “do level” for the Navy—energy and climate change are different. Their issues arise on different timelines; they address different sets of problems. The Navy will need to develop specific climate-related and energy-related responses. In one case, it may need to potentially increase HA/DR and potentially change mission sets. In the other case, it may need to use alternative fuels and consider different ways to think about fuel. So one of the things that struck me is that a long time ago somebody said, “Oh, let’s call it CBRNE—Chemical, Biological, Radiological, Nuclear, and Explosive.” And that name stuck.

I cannot tell you the number of times I had to sit down with decision makers and explain to them that chemical is not the same as biological and is not the same as nuclear. So I think we need to be careful in associating the terminology of climate change and energy. Because if it sticks and it goes down the road 10 or 20 years from now, you could end up with a situation where things are

getting confused in the decision makers' minds. Particularly at the operational and tactical levels, we need to make it clear that some of the things that we'll need to do will differ between the two.

The other thing is that climate change is dynamic. There is a timeline associated with climate change; it is not going to happen at a defined event where the cameras can show up and you can put it on the evening news. What are the key decision points that will trigger some of the decisions that we have to make? We said one of the islands going underwater might be one of those key decision points. There are other things that might happen that might trigger important decisions. What will these decisions look like? I do not know, but that is, I think, something we need to be working on. We also need to think about what the Navy should be doing now because you have some time. That may not be the case with energy—there are things that we need to do now, but it may be quite a ways away before you are actually going to see the effects of climate change on much of the Navy's mission set.

But, we should still ask, what do we need to be doing now to change those mission sets or think about your mission sets? I think the big question is, what is the role of the Navy in HA/DR? I thought it was very telling that the senior officers who have recently been at the Combatant Commands spent considerable time talking about the Navy's incredible ability to provide phase zero engagement operations; that is, disaster response in environments like Katrina and Haiti where the Navy is flexible, is able to show up early, takes a lot of initiative, and has an incredibly good story to tell with respect to HA/DR. But for some reason, that story is not translating inside the Pentagon into "Gee, we've got to get some more of this HA/DR capability from the Navy."

Instead, a lot of the focus appears to be, at least from what I have seen, directed at improving our capability to deal with our peer competitors (the more classical threats) because that is what gets traction within the building. So I guess my question is, what is the story that the Navy needs to tell in order to capture the HA/DR mission as a phase zero capability that allows them to take advantage of it?

Finally, what are the questions that we really should be asking given that we've got a little bit of time on the climate change side? My first question is, what does that long tail in the distribution mean? Are we doing gaming? Are we doing modeling, simulations, and analyses to support understanding what that long tail means? I do not know. Also, I think the question becomes, and we've heard a lot about it here, how do we organize the interagency for true collaboration in dealing with a lot of these phase zero events? We need to begin collaborating now in an integrated way to make sure all of the capabilities are melded properly. If we can get that right, we'll be better prepared when climate change begins to provide additional stresses.

Finally, I think the Navy has a tremendous advantage in being present forward and being able to integrate not only with our own nation's interagency but also with the interagencies in other countries because it frequently visits those countries and works with their personnel. So how do we do a better job of integrating with foreign disaster response?

That is my attempt at organizing what I saw in terms of who, what, where, and when, as well as identifying some of the key issues that came out of the conference.



8.3 THINKING ABOUT CLIMATE AND ENERGY IN A SYSTEM-OF-SYSTEMS MANNER

Mr. Adam B. Siegel

Thank you for inviting me here. I think the symposium has proven to be an impressive event; 5 or 6 years ago, we would not have had a meeting like this. But climate and energy are certainly hot topics right now; I've received 19 invitations for energy or climate meetings so far this month, and there are two more on my Blackberry for next week. So it is good that we are having events like this. During the time that we've spent here, we've had a lot of solid examples of how the Navy is thinking about and actually investing in the climate and energy arenas that were not real several years ago.

Mr. Adam B. Siegel is the Senior Analyst, Naval/Energy, in the Northrop Grumman Analysis Center, where he is responsible for preparing in-depth assessments of military, political, technological, and economic developments worldwide. Within the Analysis Center, his principal focus is on naval, maritime, industrial (primarily shipbuilding), irregular warfare, climate, and energy issues. Before joining Northrop Grumman a decade ago, Mr. Siegel spent more than 15 years at the Center for Naval Analyses, where he worked a wide variety of issues and deployed as a civilian analyst with military forces for numerous operations, such as Desert Storm (Kuwait, 1990/1991), Uphold Democracy (Haiti, 1994), and Allied Force (Kosovo, 1999). He is a board member of several energy-related nonprofits, including the Energy Consensus, which has a leading role behind the Department of Defense (DoD) Energy Conversation lecture series. Mr. Siegel has an extensive publications record and has authored numerous reports and articles in more than 35 journals and newspapers, including the U.S. Naval Institute Proceedings, Naval War College Review, Marine Corps Gazette, Joint Force Quarterly, Acquisition Review Quarterly, Defense Nationale, and USA Today.

While I've been engaged in climate and energy issues for some time, I've learned a lot during this symposium. One of the things I've been mulling over is, how do we start thinking about climate and energy issues and integrating them in a system-of-systems fashion? To help us head in that direction, I am going to identify some specific issues that I think need more attention.

The first is, how do we start understanding the full values and costs related to energy and climate issues, from both a quantitative and a qualitative perspective? To see what I mean here, let's look in more detail at what it means to insulate the tents used to house our Marines in Iraq. We've heard that by doing so, we'll use less fuel in the generators and by doing so free up Marines for patrols. Before the tents were insulated, the air conditioners had a hard time "cooling" a tent from 130°F down to 100°F. Once the tent was insulated, they had no problem getting it down to 70°F.

Think about what that means to the Marine who is deployed for 6 months or a year. By being able to sleep in a tent at 80°F every night as opposed to 100°F, what do you think that will do to his operational effectiveness when he needs to go out on patrol? That is a value that needs to be understood and discussed. It goes beyond the value of having fewer Marines escorting convoys. It is not just that the Marines will need fewer fuel tankers, and it is not just that the Marines will be easier to deploy because they'll have fewer generators and fewer tankers. There is yet another thing to consider. I remember being deployed in Haiti and living in the tents. All of the generators were parked right next to the tents, and the fumes from those generators would blow into tents. The people in the tents were coughing, feeling sick, and having headaches.

Okay, if I am using 10% less fuel because I am more efficient and cutting it down further by using renewables, how much quieter is it, and how is the volume of noxious fumes affected? We clearly receive operational effectiveness now, but are not there long-term costs and benefits that we should consider? What is the impact on the long-term health care costs for the personnel involved?

What if I can reduce the demand for electricity? According to one estimate, about 11% of the diesel fuel that we move around

in Iraq is used to generate electricity to run our bases. My understanding is that the amount needed in Afghanistan is several times larger, although I do not have an exact number. If we can cut a significant portion of that away, we'll need to send fewer fuel trucks over the Khyber Pass. Will that make things easier for Afghanistan's civilian economy because they will now have less competition getting through the border or using the limited road space in that remote country? We need to be thinking in a more system-oriented fashion. We need to understand that it is not just about money, but it is also about operational capabilities. We need to be thinking about capability, capability, capability.

When you hear discussions about greening buildings, most of the conversation is about saved utilities. But greening also has a significant impact on worker productivity; the building is quieter, the temperature more comfortable, and the air cleaner. In one case I am aware of, about 30% of the workers in a green building ended up working several hundred hours more a year for free. It took the company several years to figure out why. It turned out that all the people with hay fever were working extra hours. They even found a woman who had brought in a sleeping bag so she could stay overnight. It was the first time she had not had hay fever in her life; the air in the building was clean. So in this case, we both increased worker productivity and lowered health care costs.

Yet another potential impact of lowering energy demand is that it improves resilience by reducing the demand on the electrical grid. While I truly appreciate the Secretary of the Navy's five energy goals, what did he say about the USS *Makin Island*? It saved \$2 million dollars on its first run, and it is going to save \$250 million dollars over its lifetime. Well, think about it this way: if he were talking to a room full of Navy Commanders and saying "I am about to give you a job choice. You can take command of Ship A, which has magnificent capability; it is got 6000-nautical-mile range. Or, you can take command of Ship B, which is basically the exact same ship but it is going to need a little bit less maintenance, it is got a little bit better capability because it can support directed energy weapons, it is got a 7000-nautical-mile range, and it comes at a lower cost. Which ship do you want?" We need to

focus on capability, capability, capability as part of our thinking. And, we need to do that in a system-of-systems way so that we take advantage of the fact that a hybrid power plant can support things like directed energy weapons in a way that our old steam plants cannot.

I agree completely with Dr. Gullede's observation that we need to change the way that we think about climate change. The IPCC is wrong because it is underestimating the risks and doing so in a potentially quite significant way. Simply using the average can be dangerous. After all, if Warren Buffet comes into the room, that does not make us all billionaires although if the room is small enough, on average, we might be billionaires.

So how do we start looking at that full end cost, that long tail, and not use the average but take a more conservative approach? Let's look at one possibility. I think that economists who use discounted costs end up significantly underplaying the economic cost risks associated with climate change. There is some reasonable work, as I recall, that says that climate change could impose a 30–40% hit on the U.S. economy.

What happens to America's ability to support its military, which some people say requires 4% of gross domestic product (GDP)? If GDP goes down by 40%, what are the implications for DoD? Vice Admiral McGinn raised another interesting point. If the number of Katrina-like events increases, each of those will impose a hit on the economy, making it harder to support the military. We may also have climate migrants being driven by economic factors. How do we deal with the possibility of drastic changes in our national security posture?

When I look at the tail-end risk, I think perhaps there is a discussion that could come from the military that says when we look at this far-end tail, the risks appear so severe that our reasoned military judgment says that the nation needs to "go all in" to ensure that we can avoid this highest end risk. The tail end is so dangerous, we need an insurance policy.

Another important issue that deserves analysis is: what strategic communication should be going on within the Navy,

both internally and externally? Let me begin by focusing on the internal side. In keeping with my earlier comments, I think the answer is to emphasize capability, capability, capability. I would like financial considerations to be a footnote at all times. How can we possibly convince our young sailors and marines that they should risk their lives so that we can save a little money? You've got to be kidding me. Are you willing to risk your life to save a penny? Efficiency enhancements need to be sold by providing convincing arguments that they improve capability. The Commandant of the Marine Corps is doing this fantastically well. The Navy is doing this by advertising the 7000-nautical-mile range attained by the USS *Makin Island*. That needs to be the message throughout the Department.

Although the Navy is also addressing climate issues, the military remains a hotbed of global warming skepticism. Perhaps we need a strong internal strategic communication effort based on Dr. Gullede's argument that the IPCC is wrong; they are too optimistic and climate change will be worse than projected. There is a nice case for laying that out.

The critical challenge for strategic communication is: how do we use it to affect cultural change and get people to think differently about energy and climate issues? What is the best strategic communication pathway for convincing the average sailor, the average marine? The fact that the Commandant of the Marine Corps is willing to spend all day at energy meetings sends a pretty strong signal. But we need to do the same for average civilian and military personnel across the entire Department of the Navy. We also need to engage professional societies and organizations, other militaries, and even public/private partnership. And we need to make certain that we include energy and climate considerations when we submit requests for proposals to industry. Unless we do that, commercial firms are almost legally obligated to ignore the issue unless we can figure out how to make a profit from it because the chief executive officer is obligated financially. It is just a truism. All of the words are well and good, but unless it is reflected in the government's requests for proposals that we ask industry to respond to, it will not be part of what goes on.

In terms of strategic communications, we need to ensure that we take advantage of every opportunity. The Secretary of the Navy is doing that. He wants to change how the Navy uses energy, and by doing so, influence how the larger society uses energy. Rear Admiral Titley is doing that by engaging with the other services and with other government agencies in order to create what is essentially an interagency for more effective environmental modeling. Rear Admiral Cullom is doing that by focusing on bio-fuels. Where else can the Navy and its money be used effectively?

Let me offer just one example. The Navy is considering buying some 25,000 hybrid vehicles to use on their bases. However, the Navy's buying 25,000 hybrids over the next 5 years will do little to change the economics associated with manufacturing those vehicles. On the other hand, if the Navy were to buy several hundred hybrid school buses, that might really make a substantial difference. Replacing standard diesel-powered school buses with plug-in hybrid electric vehicles would cut fuel use in half. The Department of Energy says that if somebody can place an order for 100 such buses, manufacturers could cut the cost by 40%. Lowering the purchase price per bus by 40% makes the hybrid cost-equivalent to a regular diesel-powered bus after 7 years because of the savings in the amount of fuel that needs to be purchased. And, by the way, according to medical research, the number one health risk to America's public school youth is exposure to diesel fumes from school buses. With plug-in hybrid electric school buses, you cut the exposure by 80%. Could the Navy, which has several hundred buses across all of its bases, be that purchaser of a hundred that drops the price from \$200,000 per vehicle to under \$130,000?

Finally, we should also be looking, in a system-of-systems manner, at the full set of structural impediments that hinder our ability to change the way that we use energy and respond to climate change, whether those impediments are legal, fiscal, or otherwise.



8.4 THINKING ABOUT CLIMATE AND ENERGY AS CHANGE

Dr. Michael Vlahos

As I was listening to the symposium presentations, it occurred to me that we might better understand climate change and energy

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change simply as change. To do that, we need to embrace the notion that we are moving through time and that this present is just this moment. And that we are, in effect, on a kind of a passage.

This passage has three parts; those three parts are well understood by us in terms of language. There is a near term, a mid term, and a long term. Now imagine this passage as a true sea passage in a vessel. In the near term, your vessel is fully aware of its surroundings. It can see all of the navigational aids, it knows where all of the landscape is close to shore, it is on a path, and it understands where it is right now and maybe a little ways downstream. But then there is a murkiness ahead—there is fog, there are all of the issues that come with looking ahead a little bit further in time. Now you can still see a few navigation lights that faintly guide you so that you can continue on your course with some confidence. But then farther out you cannot see anything. You are heading toward something, you are going to get there, but right now you are relying on dead reckoning.

Now if you imagine the world that we are in now going through these changes, your approach to both the mid term and the long term will be more urgent; it will inform the things that you are doing now. And yet we live in a very different kind of mental context. The world that we inhabit is more closely focused on just what we can see around us. So let me take you through a kind of matrix where we look at the near term, the mid term, and the long term in terms of the various ways that we describe energy change and climate change.

So today it is all about measurement. The policy-driving question that we are most concerned about is: how will climate change and energy change affect what we do now? It is essentially a different version of DoD's perennial question: what is the threat? Well, the threat is to the world we have built; it is called the strategic environment. It is an environment that we want to keep as it is, pretty much; we want to manage it. So our response is effectively always to try and figure out how to manage the threat within the current framework or within some slightly modified version of that framework.

In other words, what minor improvements or what doable alterations, shifts, responses, and modifications can we make that will allow us to just continue to manage change? And this is in organization, it is in forces, it is in command relationships, it is in the policy process itself, not to mention the whole POM process. What is the prognosis? Well, the prognosis is pretty easy to identify here. And these are terms of art, and they are very important terms of art. They define how we talk to each other and how we conceptualize the world we inhabit. And the term that I think is most apropos here is “increased risk.”

According to General Engel’s presentation, global climate change will have wide-ranging implications for U.S. national security. It will aggravate existing problems that threaten state stability. In other words, the context of the change is completely enclosed within a world that seeks to maintain itself and in a world, more specifically our world, that seeks to be the lead in managing the world system as we know it. Now let’s look at the geographical term of art that we use to inform effects and the problems that climate change or energy change create. That term is “the local level.” It is about the nation state or maybe non-state actors in that same local arena. What is the naval vehicle to address the problems of global climate change and energy change? That vehicle is captured in the term “maritime cooperation.”

There is a powerful new acronym that gets to our ability to adapt to or accommodate climate change, and that is “HA/DR”—short for humanitarian assistance and disaster relief. Now the issue of living in this kind of orbit is that it is very hard to do the very thing identified by Dr. McGrady, which is to assess things as they change in the out-years. However, I think if you seriously live in the entirety of the passage knowing that you are heading to the mid term and then to the long term, you might be willing to do your assessment differently. Because I don’t think it is a problem of intellectual capability, tools, or even money; it is a problem of urgency and significance in our minds. That significance becomes greater when we see the mid term. In the mid term—remember, those navigation lights are there—you can use extrapolation.

Now John Benedict did this a bit. He took the kinds of impacts that others in the government have identified and used them to paint a very powerful picture. However, he did not paint the same picture that General Engel painted. The General said that climate change alone is highly unlikely to trigger failure in any state. If you look at General Sullivan's declaration about the Earth being a system-of-systems, that the challenges are all interlinked and interconnected and reinforcing each other, then what John is saying becomes very, very powerful. You have powerful upheavals in America, Australasia, and Africa.

If you were to go down the list that I just did with the near term, by extrapolating things that we know now, you could get to a very different policy-driving question: can the global system effectively respond and adapt? The threat is different too. The threat is no longer to be codified in terms of art that maintains the strategic environment. The threat is to a functioning world system itself. The response that we take is no longer management; it is about mitigation and it is about triage. It could be about human rationing.

The prognosis no longer is simply increased risk that just continues to increase and by definition, because it increases in small increments, we can manage it. No, now you have something like a crisis. In terms of geographical terms of art and focus, you are no longer looking at local nation states or failing states, you are looking at regional systems. You are looking at potential cascades where whole areas collapse.

I need not go through that with exemplars because I know they were brought up. You can look at the gigantic cities that are emerging in and around the Niger Delta and see the collapse of megaslums. Sudden water stress combined with all sorts of other things can create a giant crisis in the heart of the two Asian states, India and China. So this is a different kind of place that you are getting to. A key societal and governance issue is, how do you maintain and how do you approach what amounts to a shrinking global stability, a shrinking stability of humanity, and also literally a shrinking humanity that is part of our globalized system?

In other words, it is not globalization anymore; Earth's future is heading in a different direction. There is a whole other world emerging out there that is no longer part of our system. We do not know what that world will look like because our lens, our little framework on alternatives to western civilization and globalization, is simply in the context of failing states. Thus, we are unable to understand what happens to places left behind as they develop in different directions.

In that world, the new acronym will not be HA/DR, but some jumble of letters that are revolving around major rescues. The question is, when you get to the naval vehicle, it is no longer maritime cooperation; it is much more serious. It is really about the survival of cooperation. In a world of that level of stress, can the cooperative nature of the world that we inhabit now, to the extent that it is cooperative, continue? Or in fact, do things flip the other way, and do you see an emergence of a kind of global collective mobilization? That could happen too, but we do not know; we have not examined that as a possibility, and yet we can extrapolate to that point.

Now when it comes to the long term, I would refer, as Adam Siegel did several times, to Dr. Gulledge. You are now no longer able to extrapolate. You cannot see. But what you can do is assess possible high-risk outcomes. You can leap ahead, and you can get at it. That is important because that organizes—not the probability of risk—but it organizes your understanding of the limits of risk, how big, how bad, how devastating to humanity this could get.

The point that I like most about Dr. Gulledge's presentation is that although there are interventions that we cannot bound at this point, they could make the high risk super high. So a low probability is still a high risk. That point was the most important to me. We have always approached low-probability, high-risk outcomes. We did it all through the Cold War, and we really need to do that now, and I do not see that happening.

When it comes to the prognosis, we see increased risk in the near term; in the mid term, you have a sense of crisis. In the long term, what is it? I call it subsidence. The world network is subsiding.

While that network is actually many, many different networks, at the heart of that network is a network of critical nodes of cities, of which there are only about 40 in the world. Richard Florida wrote about this in *The Atlantic*. Those nodes are the heart of our world system. If those nodes begin to subside, how do we keep the network going? The geographical focus is global, and the societal governance node is the network—keeping the network going so the world does not subside to the level it did in the 7th century.

Well, this is a world where the naval vehicle is literally about the system surviving and the Navy is the most important tool that humanity has at that point in that low-probability, high-risk situation. It is not the destination, but it sure is out there. However, just because it is out there does not mean that we should not give it the kind of urgency we give things today. This is a situation where it is too late for mobilization and you are really trying to keep alive a subsidiary shrunken world network.

The reason for adopting this different kind of world view where you frame the significance of the future differently is simply to allow you to get to the point that Adam Siegel raised, I thought very powerfully: that we need to do the kind of analysis that our current framework of thinking will not encourage or even allow. We have to do this kind of analysis now because unless we do the analysis now, we will not be able to plan a few years down the road. A few years more down the road, we will not be able to procure and pre-position and develop the actual institutions and forces that we are going to need. Thus, when we finally get down there, and it is going to happen, or maybe it is not, we are prepared. Right now we are simply at the moment of recognition and we do not have any path ahead.

And the path ahead, and here I would echo Adam Siegel again, is to find a way to get started in the assessment process seriously—not necessarily in planning, but in assessment. We have to think about how long it takes for the Navy to actually get a ship after it starts a new ship program. Then once you get the ship, where are the other 800 ships that you want? We do not even know what kinds of ships those might be. All we can think of right now is, “Oh, HA/DR, maybe we need sea basing.” Yes, but until we go to the

end and figure out what this kind of low-probability, highest-risk situation could be, we will not really know what the outer boundaries of possibility are for the Navy as a whole.

I am going to stop there, but the essence here is fundamental. It is existential. To effectively approach the things we have been talking about, we have to change the boundaries of how we think about time, about ourselves, and about history.


Q&A SESSION WITH PANELISTS

Q: *I take Dr. Vlahos' observations very seriously. I find that the assessments he is talking about here also apply to the intelligence community, which is firmly transfixed with the present and the very near term. And I am sure a lot of other people find that in their communities as well. It is very hard to get traction for doing these sorts of assessments; the people needing current information are great champions, and they get the resources and the attention. What do we do to get the kind of attention and resources we need to really get this kind of analysis done as a properly resourced priority?*

DR. MICHAEL VLAHOS: Just from a historical standpoint, the tried and true method is what was called by French naval officers and thinkers in the 1870s and 1880s the *Jeune École* (“Young School”). That was a movement, actually something of a conspiracy, in which people got together and made things happen. The “young Turks” did something similar; they were not just a conspiracy, they were subversive. They were able to achieve their political goals of subverting the Ottoman regime. But if you have a progressive agenda in the sense that you need to change things at a deep level, you have to take risks.

And the biggest problem that we have institutionally in terms of corporate culture in the defense world, and I think also the corporate world as well, is risk aversion. People just do not want to take risks. Moreover, the system is huge; it is so gigantic. As a result, I am not sure that such an approach would work here. It might work

in a military like Britain's where people know each other; they work together, they can do stuff in small groups. I do not know how you would mobilize enough people to keep the spirit of the brotherhood of conspiracy alive. So that is the historical route, but I am not really persuaded that it will work here.

 **MR. ADAM SIEGEL:** It really was a culture shock to have the Commandant of the Marine Corps show up at 0645 and stay until 1900 at an energy conference last August. And then he did it again, and then he did it again, and then he did again. He has been in four meetings, and I think he has been physically sitting in the front row for more than 80% of the time. Actions like that send a pretty strong signal.

On the other hand, we are going to have a new Commandant, and we need to ask, will the new Commandant sit in the front of the room and keep on changing the culture? If that continues in the Marine Corps, that will, in my opinion, have a very significant impact. We also need to find a way to go past the point of saying that enhancing efficiency will mean that we have additional Marines available to do patrols. We need to be more specific about what that means; I think that Colonel Charette would end up being part of that discussion.

We also need to make certain that we truly understand the fully burdened cost of fuel. The discussion about that has been going on for well over a decade. And yet, none of DoD's major programs have energy requirements, although the Fiscal year 2008 National Defense Authorization Act requires consideration of energy use through an energy key performance parameter and the fully burdened cost of fuel. However, energy usage is not a design requirement for the littoral combat ship, the Joint Strike Fighter, or the F-22. Every single major piece of equipment that we are buying is more fuel intensive than the thing it replaces, and we expect them to last 40 or 50 years, or, in the case of the B-52, for 85 years. Unless it is in the request for proposal, industry cannot consider it. It is got to be part of the process, and that has not occurred yet.

A third thing that needs to occur is for those who are concerned about energy and climate issues to write articles that can be

published in the Proceedings, the Marine Corps Gazette, Defense News, and other publications. Right now, those topics are not being discussed in the professional literature. It seems that those of us who care about it are talking to each other an awful lot.

DR. ED MCGRADY: I think on the climate change side, not necessarily the energy side, the challenge is, how do you create the language and the environment and the structure that allow you to have this conversation about this long-term problem where things are going to get significantly worse without overselling the scenario? You do not want to create the end-of-the-world scenario because at that point, everybody just gives up.

But at the same time, you want to get everybody's attention and say, "Hey, there are some real organizational issues that you have to address." In reality, if you look at things, systems in the real world are fairly resilient. It seems that we tend to fail during the decision-making process, Katrina being an example, but New Orleans is still there, although the process of getting there was not very elegant or pleasant.

MR. JOHN BENEDICT: So I think the problem you have is like the boy who cries wolf. If you want to say that you are going to look at the tail and it is going to be 10°F warmer and all of the ice caps are going to melt and we are going to have all of these problems, then everybody is just going to say that is the apocalypse and we cannot do anything about that. At the same time, you want to energize the people and organizations that are typically only energized by things that are serious threats to national security. So, as we think about these issues and we try to do our analysis and work around in this variable space we are dealing with, we have to look for those issues and those items that very clearly link climate change and energy change to national security without overselling the scenario.

Q: *This is more of an observation than a question, but I hope you'll be able to talk about it. I found this symposium to be very interesting, but one of the things that I noticed is that there are not a lot of younger people here. And I think they are the ones who, as you are addressing the policies that are going to be needed in 2030 or 2040, need*

to be engaged in these types of meetings and be aware of what is going on. Is it possible to have a symposium like this that draws more young people to the meeting?

MR. ADAM SIEGEL: As I recall, last year's Power Shift conference brought in about 9500 young people for a conference. Generally, when I go to a military meeting I find that you can characterize the audience as "pale, male, and stale." I frequently am the youngest person in the room. However, when I go to meetings on renewable energy, I am the lone "pale, stale male." The audience is generally much younger, much more representative of the American public, both in terms of racial profile and in terms of the gender mix. I have found that in the climate and energy world, our nation's young people are heavily engaged.

MR. JOHN BENEDICT: Let me reinforce what you said about the need for youth participation. I did a research project recently where I was trying to get requirements, gaps, and potential solution paths for a number of irregular warfare-related challenges. I was amazed at how well the senior military leadership was able to define the requirements and identify the gaps. But I found that most of the solutions were being proposed by Navy lieutenants and lieutenant commanders. They put forward a lot of fresh ideas, many of them out of the box. So I think when you start to get into how you are really going to solve this thing, you need a lot of fresh thinking or you are really going to handicap yourself. I could not agree more with your comment.

DR. ED MCGRADY: I think that you have to differentiate awareness from decision making. My impression of this conference is that we were focusing on the decision-making process. As I see it, we are trying to develop a narrative that will involve the Navy's decision-making process in trying to figure out what it should be doing to prepare for the future. As a rule, the people who do that will not be our young officers. They are going to be the admirals. In fact, one thing you could ask is, "where are all the three stars" because those are the guys whom we really need to engage. We need people like John Benedict, Adam Siegel, and Mike Vlahos to do the analysis that sets the stage for what we need to do in the next 10 years.

In terms of building awareness, one of the things that the end analysis might say is that you need to train people and build up a core group in the Navy that is familiar with the effects of climate change, like HA/DR, and another that is familiar with the effects of energy change. That may be one thing that we want to do with respect to climate change and energy, to try to build that capability, but I think that is something that should come from analysis.