



***Adapting to Climate & Energy
Challenges: Options for US
Maritime Forces***

Introduction
Dr. L. Dean Simmons, JHU/APL

29 March 2011

*Welcome to the 2011
Symposium on*

ADAPTING TO

CLIMATE



ENERGY

CHALLENGES

OPTIONS FOR
U.S. MARITIME
FORCES

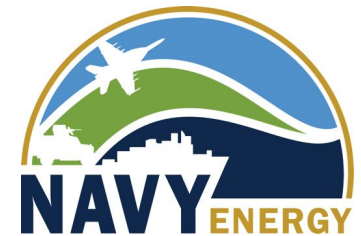
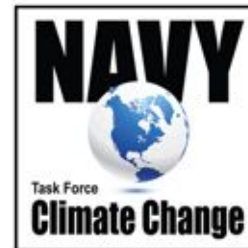


So, Why Are We Here?

- **March 2010 Symposium examined Climate and Energy Implications for Future Naval Forces**
 - Provided updates on global climate change and energy supply and demand
 - Focused on implications for specific US geographical combatant commands
 - NORTHCOM and SOUTHCOM
 - EUCOM and AFRICOM
 - PACOM and CENTCOM
- **Afterwards, met with staff at Navy Task Force Climate Change and Navy Task Force Energy**
 - To determine advisability of scheduling a follow-on event, and if warranted
 - To select most appropriate topics to cover

What's Different Than Last Year?

- Based on Task Force input, JHU/APL and CNA invited the active participation of
 - Navy Task Force Climate Change
 - Navy Task Force Energy
 - Marine Corps Expeditionary Energy Office
 - Coast Guard
 - JHU/APL GAIA Internal Research and Development (IRAD) effort
- At co-sponsors urging, symposium focuses on operational aspects of accommodating climate and energy challenges



Climate and Energy Challenges

OPTIONS FOR U.S. MARITIME FORCES

Climate

- Reduction in Arctic sea ice opens new sea routes and provides increased access to natural resources
- Rising sea levels will affect
 - 40% of world population who live within 60 miles of the sea coast (~3 billion people)
 - Installations used by Navy, Marines, and Coast Guard
- Changes in frequency and severity of storms will affect demand for humanitarian assistance
- Navy's Task Force Climate Change established to address such concerns

Energy

- Navy, Marine Corps, and Coast Guard devote significant resources to securing U.S. access to energy resources, especially petroleum
- Maritime forces consume large amounts of increasingly expensive petroleum products to carry out their missions
- Navy's Task Force Energy and Marine Corps' Expeditionary Energy Office established to address such concerns

Major 2010 Climate Events

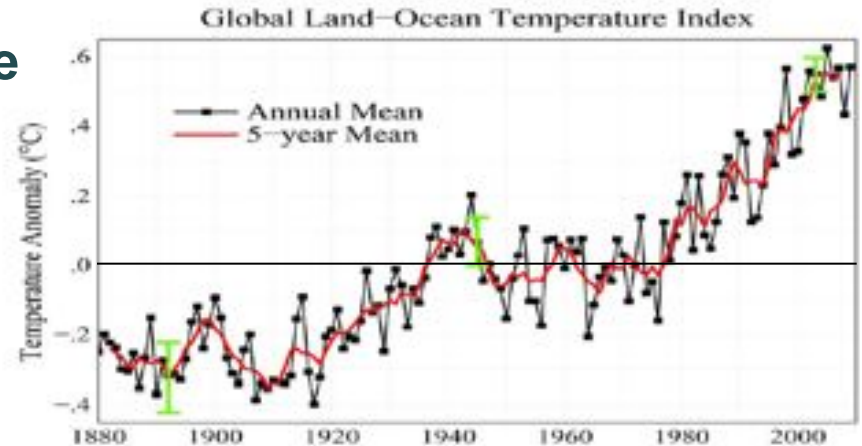
OPTIONS FOR U.S. MARITIME FORCES

- Arctic sea ice – 3rd lowest extent
- Warmest year on record in Canada, Russia, and India
- Unusually cold winter weather in US, northern Europe, Mongolia & southern South America
- Heavy rainfall in Mexico, Colombia, Peru, Brazil, equatorial Africa, Australia

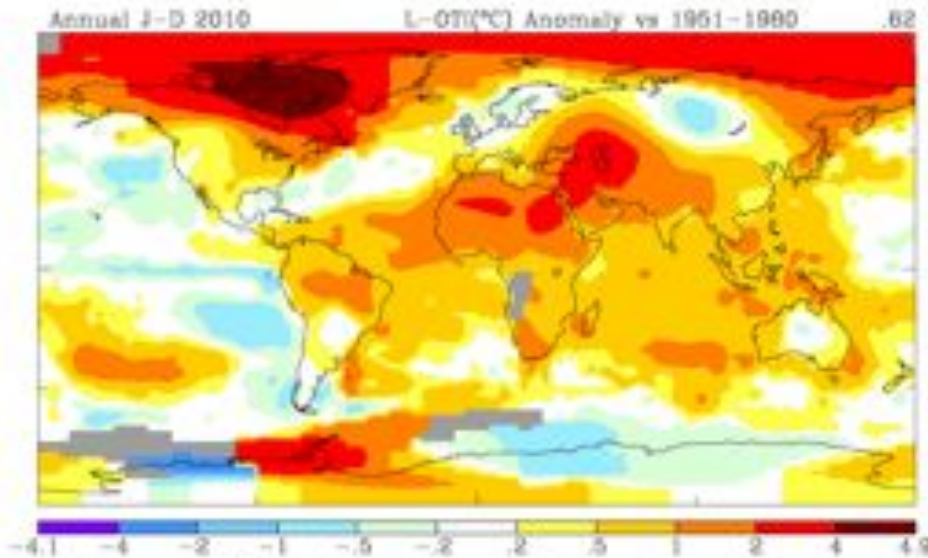


Global Temperatures Remain High

- Over Jan-Dec 2010 period, average global land-ocean temperature was 2nd highest ever recorded (exceeded only by 2007)
- 14 “hottest” years on record have occurred since 1990



Source: NASA Goddard Institute for Space Studies, Global Land-Ocean Temperature 1880-2010



Source: NASA Goddard Institute for Space Studies, Surface Temperature Analysis

- However, higher temperatures are not uniformly distributed
- Changes at high latitudes (i.e., Earth’s poles), are substantially higher
 - Nearly 5-deg C (9-deg F) over parts of the Arctic

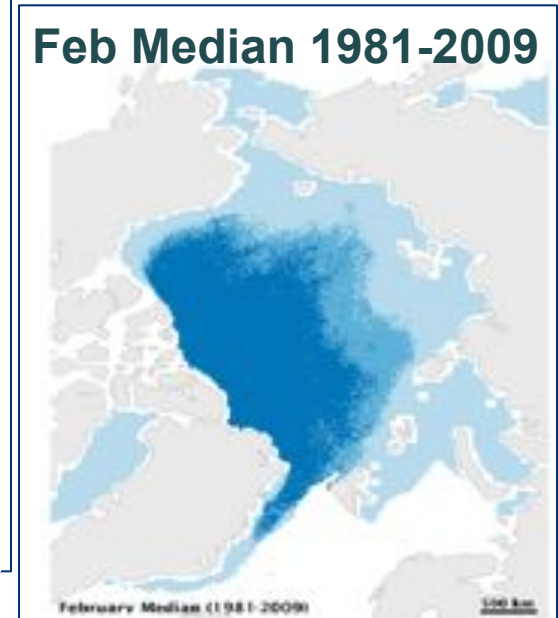
Climate Change in the Arctic

OPTIONS FOR U.S. MARITIME FORCES

- Given the substantial temperature anomaly in the Arctic, multi-year ice is shrinking and thinning
 - As of Feb 2009, only 10% of ice cover was made up of ice older than 2 years



■ Multi-year ice



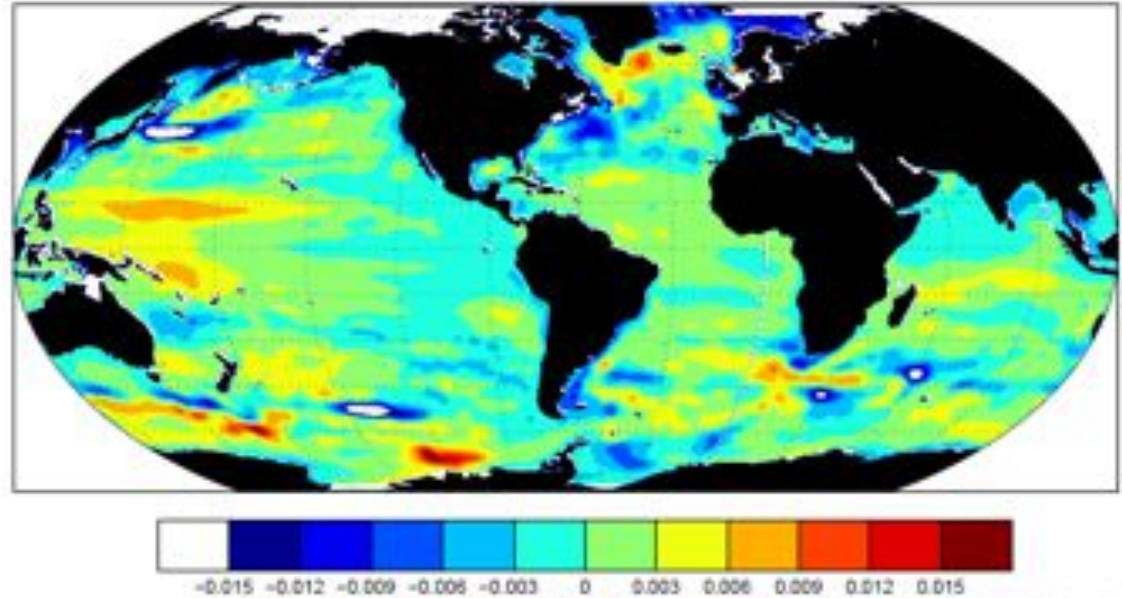
Source: J. Maslanik & C. Fowler, Colorado Center for Astroynamics Research, University of Colorado

- As a result, greater summer access and longer navigation seasons are expected
 - Major international maritime passages in summer expected to be accessible by 2030
 - Exploitation of significant natural resources (oil, natural gas, and nonfuel minerals) may become increasingly accessible

Sea-Level Rise

Sea-Level Change (m/yr) 1993-2004

- Global average sea-level rise of 0.4 to 2 meters expected by 2100; although sea-level change varies considerably from region-to-region



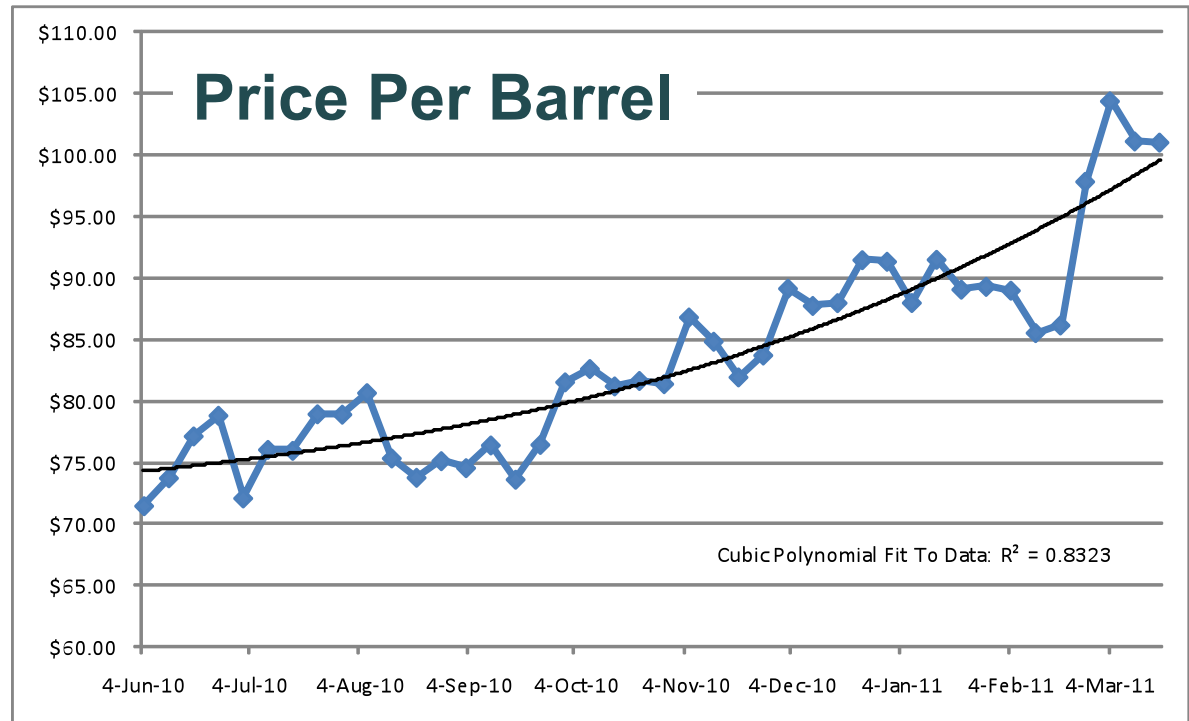
Source: NASA/JPL "Decadal Trends in Sea-Level Patterns: 1993-2004"

- Principal concern, however, is increased vulnerability from extreme events (storm surges), which can depend on:
 - Regional sea level
 - Tidal amplitudes
 - Nature of extraordinary meteorological forces

Source: Naval Studies Board, "National Security Implications of Climate Change on U.S. Naval Forces"

Price of Petroleum: On the Rise

- Since June 2010, price of petroleum has increased by ~\$30 per barrel, or about 40%
- Each \$1 increase in per-barrel price of petroleum imposes additional cost on US military:
 - Navy ~\$30 million/yr
 - DoD ~\$130 million/yr
- At current price, powering our military over the next year will cost substantially more:
 - Navy ~\$900 million
 - DoD ~\$3.9 billion



Source: www.nyse.tv/crude-oil-price-history.htm

Navy Energy Objectives

Navy Energy Objectives

- Improve combat capability
- Assure mobility
- Green the Navy's footprint

To Be Achieved Through

- Energy efficiency improvements
- Consumption reduction initiatives
- Aggressive adoption of alternative energy and fuels



Source: FY 2012 Department of Navy Posture, 1 March 2011

Navy Energy Initiatives

- **Surface Ships**

- Hybrid propulsion
- Hybrid electric drive
- Marine gas turbine engine
- Advanced hull and propeller coatings
- Solid state lighting
- Smart Voyage Planning

- **Aircraft**

- Alternative fuels
- Flight simulators

- **Installations & Facilities Ashore**

- Energy efficiency building upgrades
- Energy management systems
- Sustainable building standards for new construction and major renovations
- Advanced metering and energy audits
- Alternative fuel vehicles

Source: FY 2012 Department of Navy Posture, 1 March 2011

Gen James Conway on Activating the USMC Expeditionary Energy Office

- **Expeditionary means:**
 - Rapid deployment by air or sea to respond to crisis
 - Being efficient and effective while operating in an austere environment
 - Providing a task-organized force that is manned and equipped no larger or heavier than necessary to accomplish the mission
- **Opportunities exist to**
 - Reduce the demand for supply convoys
 - Generate power more efficiently
 - Make better use of alternative and renewable energy resources

From This



To This



Symposium Objective



- **What options are available to our nation's maritime forces as they seek to adapt to climate and energy challenges?**



- How will strategy, plans, and operations be affected by climate challenges?
- How will aircraft and ship operations be affected by energy challenges?
- How will installations and facilities ashore be affected by climate and energy challenges?
- How will expeditionary capabilities be affected by energy challenges?
- How will research priorities be affected by climate challenges?



Symposium Agenda

29 March

- **0800-0815: Introduction**
- **0815-0915: Keynote**
- **0915-1030: Roundtable: Adapting Strategy, Plans, and Operations to Climate Challenges**
- **1045-1200: Roundtable: Adapting Air Operations to Energy Challenges**
- **1200-1300: Lunch**
- **1300-1400: Navy Task Force Energy: An Update**
- **1400-1515: Roundtable: Adapting Ship Operations to Energy Challenges**
- **1530-1645: Roundtable: Adapting Maritime Infrastructure to Climate Challenges**
- **1645-1800: Social Hour**
- **1800-1900: Dinner**
- **1900-2000: Dinner Speaker**

30 March

- **0800-0815: Introduction**
- **0815-0930: Roundtable: Adapting Basing and Facilities Ashore to Energy Challenges**
- **0945-1100: Roundtable: Adapting Expeditionary Capabilities to Energy Challenges**
- **1100-1200: Navy Task Force Climate Change: An Update**
- **1200-1300: Lunch**
- **1300-1415: Roundtable: Adapting Research Priorities to Climate Challenges**
- **1415-1600: Roundtable: Adapting to Climate and Energy Challenges – A Maritime Force Perspective**
- **1600-1615: Closing Remarks**

Symposium Logistics

- **Open to the public; press participation**
- **Check-in required both days**
- **Audio recording of speakers, moderators, panelists, and Q&A sessions**
- **Questions and comments**
 - Open microphone
 - Question cards
 - Electronic systems
 - ✓ Instructions in your program
- **Symposium Proceedings available in Aug-Sep timeframe**
 - Distributed to all symposium participants and attendees
- **Presentations will be posted soon, subject to authors' restrictions**



QUESTIONS