



# ***The U.S. Navy's Arctic Roadmap: Adapting to Climate Change in the High North***

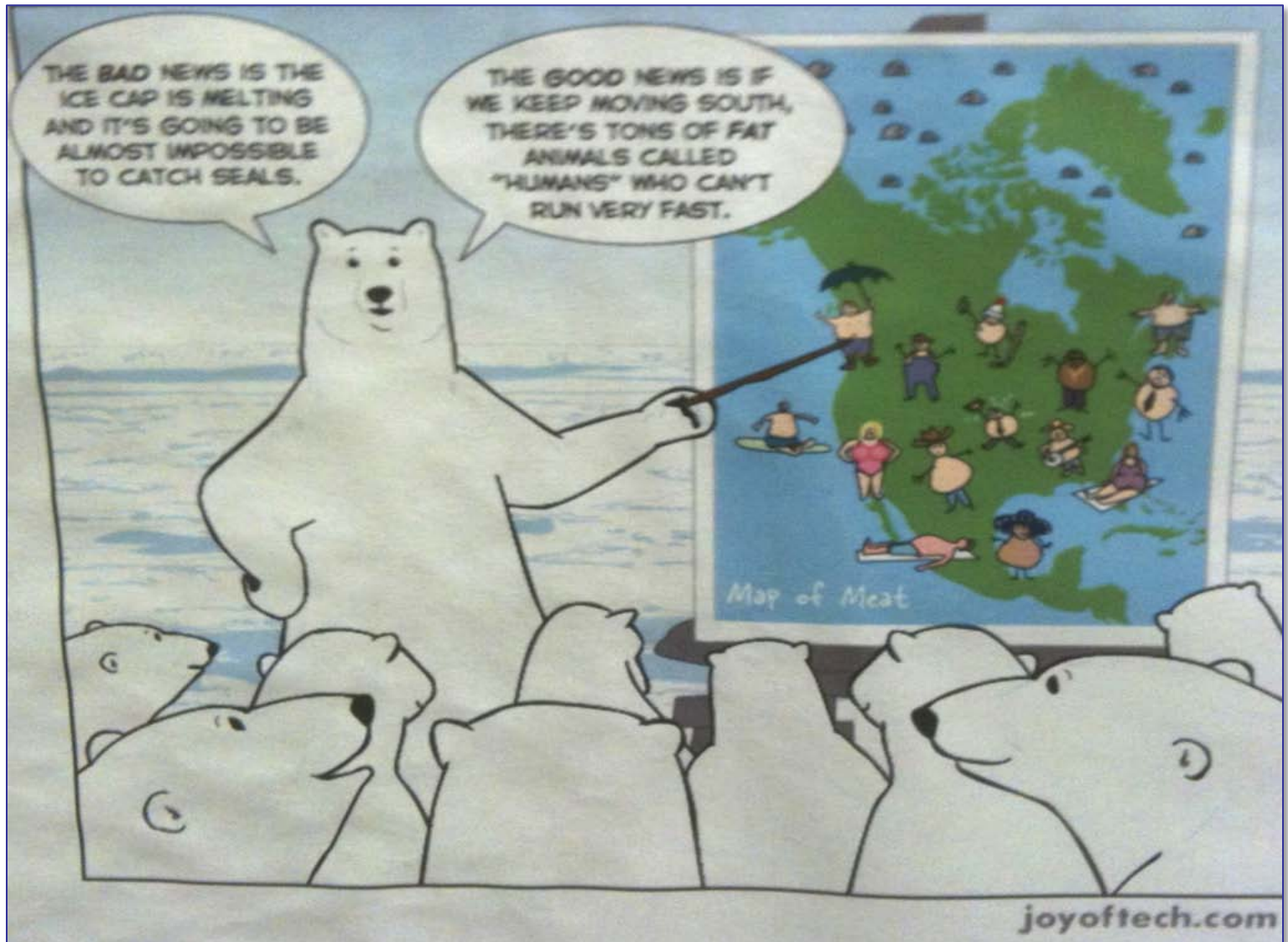


**Captain Tim Gallaudet, U.S. Navy  
Deputy Director, Task Force Climate Change /  
Office of the Oceanographer of the Navy  
May 2011**

| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                           | Form Approved<br>OMB No. 0704-0188                  |                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------|-----------------------------------------------------------|-----------------------------------------------------|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. |                                    |                                     |                                                           |                                                     |                                 |
| 1. REPORT DATE<br><b>MAY 2011</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    | 2. REPORT TYPE                      |                                                           | 3. DATES COVERED<br><b>00-00-2011 to 00-00-2011</b> |                                 |
| 4. TITLE AND SUBTITLE<br><b>The U.S. Navy's Arctic Roadmap: Adapting to Climate Change in the High North</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                           | 5a. CONTRACT NUMBER                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5b. GRANT NUMBER                                    |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5c. PROGRAM ELEMENT NUMBER                          |                                 |
| 6. AUTHOR(S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                           | 5d. PROJECT NUMBER                                  |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5e. TASK NUMBER                                     |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5f. WORK UNIT NUMBER                                |                                 |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>Chief of Naval Operations, Task Force Climate Change / Office of the Oceanographer of the Navy, 2000 Navy Pentagon, Washington, DC, 20350-2000</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                     |                                                           | 8. PERFORMING ORGANIZATION REPORT NUMBER            |                                 |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                     |                                                           | 10. SPONSOR/MONITOR'S ACRONYM(S)                    |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 11. SPONSOR/MONITOR'S REPORT NUMBER(S)              |                                 |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release; distribution unlimited</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                     |                                                           |                                                     |                                 |
| 13. SUPPLEMENTARY NOTES<br><b>Presented at the NDIA Environment, Energy Security &amp; Sustainability (E2S2) Symposium &amp; Exhibition held 9-12 May 2011 in New Orleans, LA.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                     |                                                           |                                                     |                                 |
| 14. ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                           |                                                     |                                 |
| 15. SUBJECT TERMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                     |                                                           |                                                     |                                 |
| 16. SECURITY CLASSIFICATION OF:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     | 17. LIMITATION OF ABSTRACT<br><b>Same as Report (SAR)</b> | 18. NUMBER OF PAGES<br><b>20</b>                    | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b> |                                                           |                                                     |                                 |



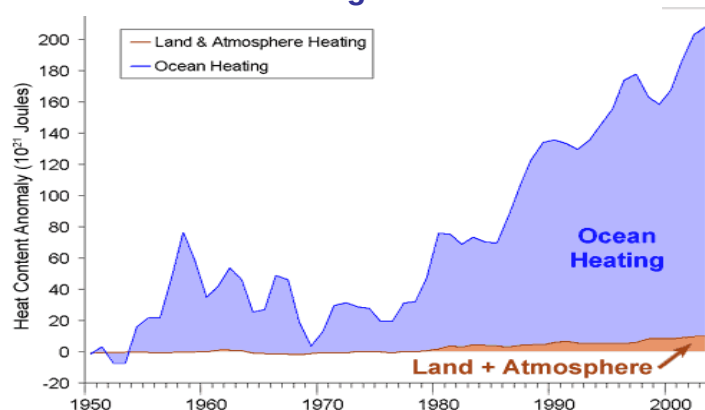
# *In Case You Have Not Heard ...*





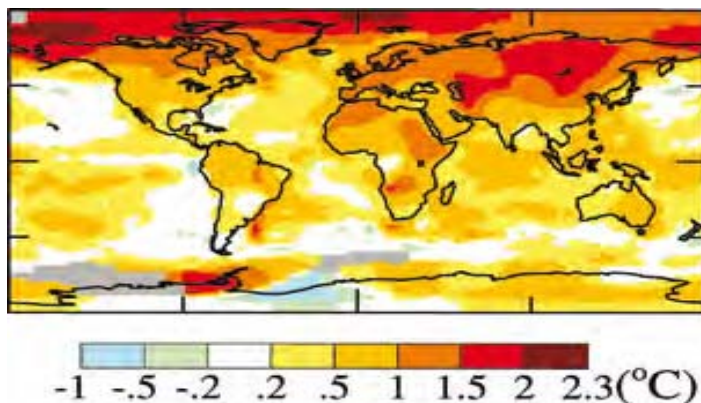
# Climate Change Update

## The Ocean is Storing Most of the Heat



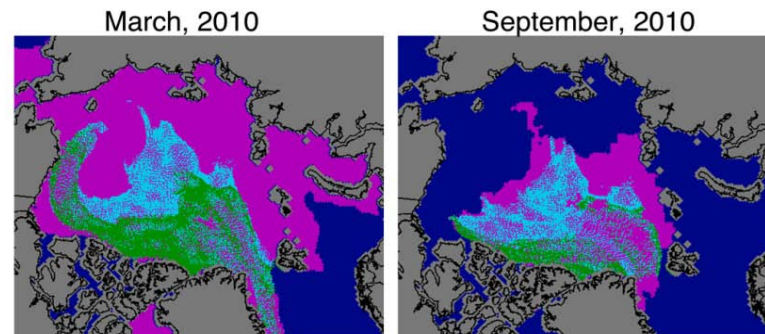
Total Earth Heat Content from 1950 (Murphy 2009). Ocean data taken from Domingues et al 2008

## Arctic Warming is 2 x the Rest of the World



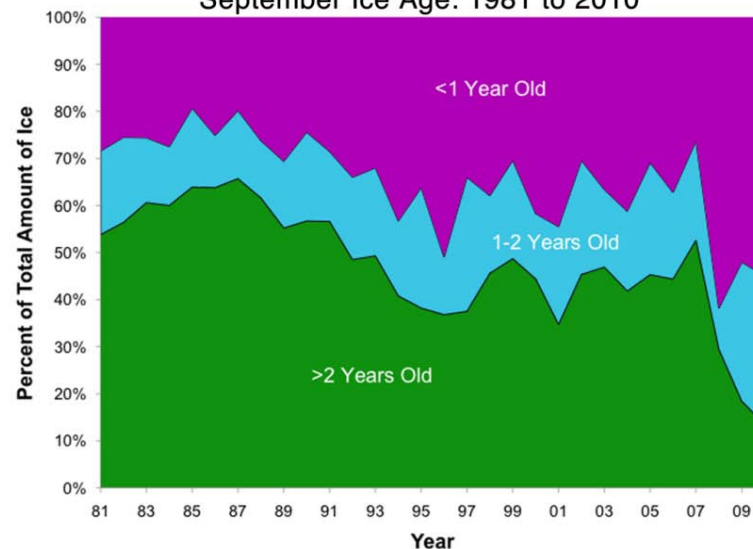
Mean surface temperature 2001-2007 relative to baseline period 1951-1980, from: The Copenhagen Diagnosis, 2009

## Arctic Sea Ice Continues to Melt & Thin



First-year ice (<1 year old) Second-year ice (1-2 years old) Multiyear ice (>2 years old)

## September Ice Age: 1981 to 2010



NSIDC courtesy J. Maslanik and C. Fowler, CU Boulder



# Why the Navy Cares

## Near-term

- Increasing Arctic maritime activity
- Partnership opportunities
- Energy security initiatives



## Mid-Term

- Sea level rise impact on installations
- Water/resource challenges
- Potential increase in Humanitarian Assistance/Disaster Response



## Wild-cards

- Ocean acidification
- Abrupt climate change
- Geoengineering

*Challenges and opportunities exist*



# Task Force Climate Change

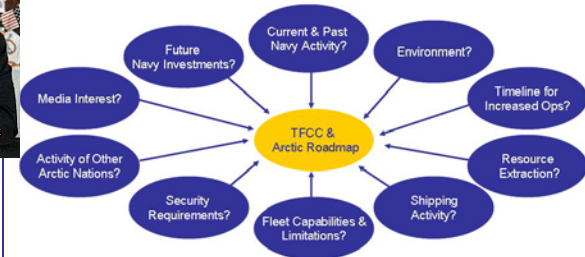
## Establishment

Chief of Naval Operations  
Executive Board on May 15, 2009



### Key Questions

Chief of Naval Operations Executive Board  
May 15, 2009



6

## Composition

Navy, NOAA, USCG in core group with  
Joint, interagency, international support



## Charter

Global climate change impacts with near term Arctic focus



# The Team...

## INTERAGENCY



## NATIONAL



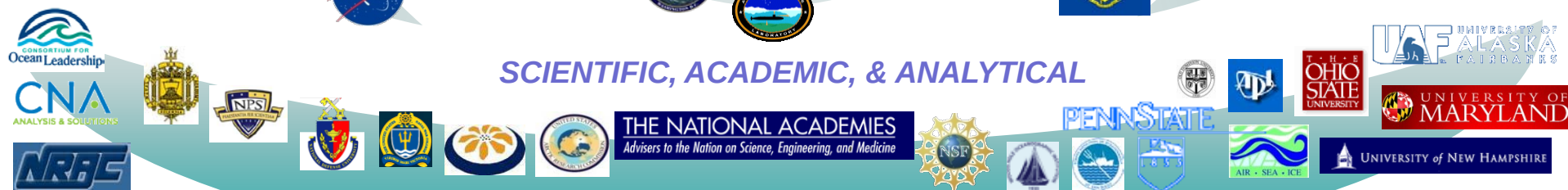
## DOD



## INTERNATIONAL



## SCIENTIFIC, ACADEMIC, & ANALYTICAL

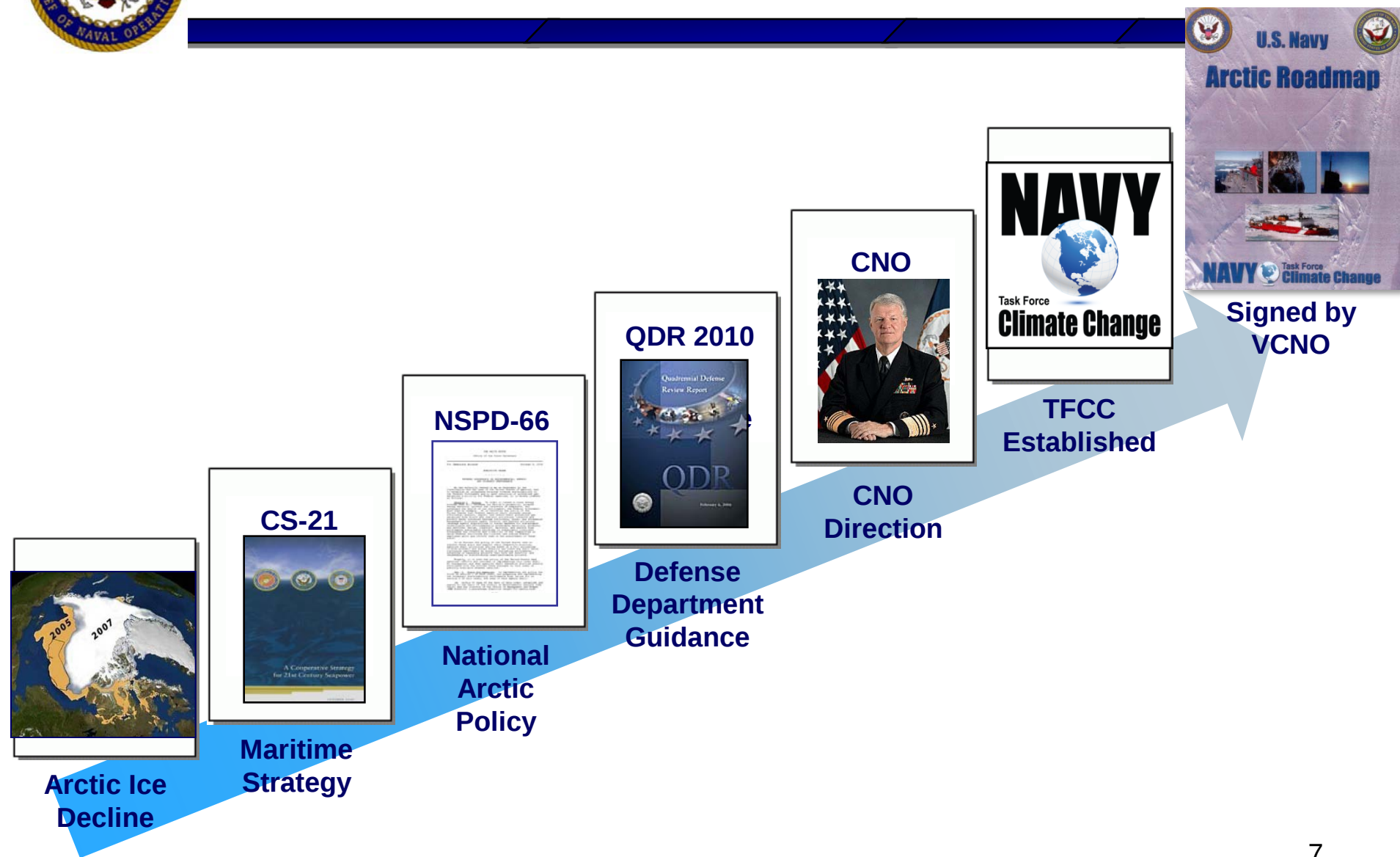


Engaged nearly 600 individuals from over 175 organizations

UNCLASSIFIED



# Arctic Drivers





# Arctic Considerations

**Poorly Charted**

**Limited Infrastructure**

**Harsh Operating Environment**

**Security Concerns**

Maritime boundary Disputes  
US-Canada  
Russia-Norway

Allied Perspective

Opportunities  
Russia & China

**Transportation Access**

Shipping industry requirements

- > 8+ weeks of ice-free conditions
- > Not anticipated for at least 40 years

Concerns

- > Insurance
- > Charts
- > SAR
- > Governance
- > Reliable sea-ice forecasts
- > Ice-strengthened hulls
- > Environmental compliance

## Native Perspectives

Gulf Coast, 2005



Unalakleet, 2040



## One Scenario



+



=

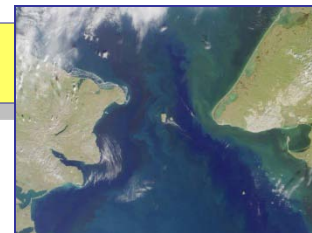


**The Arctic is an ocean, a challenge, but NOT a vacuum**



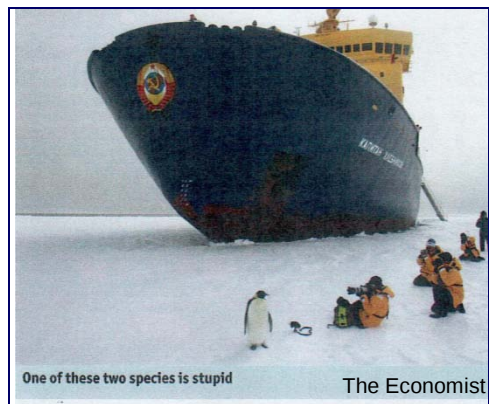
# Arctic Trends Assessment

*Commercial activity remains limited through 2030*



*..but after 2050?*

- Shipping, oil, & gas extraction to grow after 2030
- Tourism & maritime research will increase the most
- Fishing to grow but only gradually

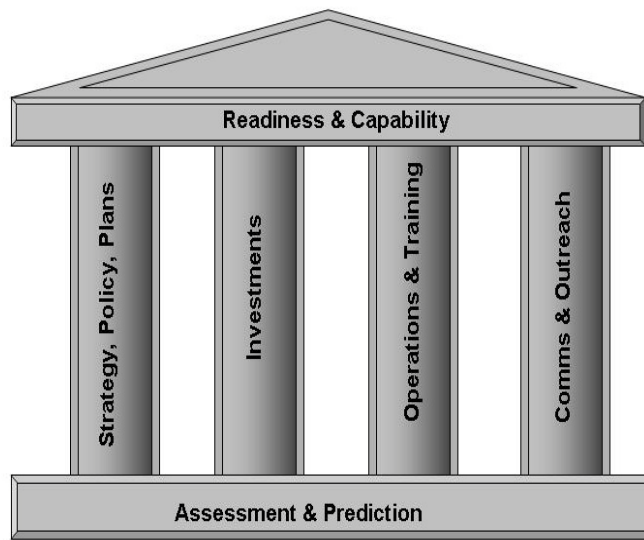


*Harsh operating environment will remain the greatest limiting factor*



# Navy Arctic Roadmap

## Framework



## Execution

### Phase 1 (FY10)

Fleet readiness assessment, external studies, strategic implementation plan



Monitor Polar SATCOM Program<sup>stake</sup>



Arctic TTX & LOE



POM-12 investments for air-ocean-ice numerical prediction



Advocate for UNCLOS<sup>stake</sup>

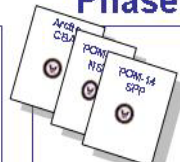


Innovative Readiness Training (IRT)<sup>stake</sup>



Cooperative Navy-NOAA Bering Strait Hydrographic Survey

### Phase 2 (FY11-12)



POM-14 CBA, NSP, & SPPs address the Arctic



Formalize expanded / new cooperative partnerships



Arctic SAREX, Arctic Edge, Northern Edge NANOOK<sup>stake</sup>



ICEX-11



Environmental assessments



Support National Ocean Policy / Marine Spatial Planning Implementation For Arctic<sup>stake</sup>

Interagency partnership for air-ocean-ice numerical prediction

### Phase 3 (FY13-14)



Execute POM-14



Implement expanded / new cooperative partnerships



Arctic UUV operations



ICEX-13

Update roadmap ICW QDR



Navy recognized as a valued joint, interagency, & international partner in the Arctic

<sup>stake</sup> Indicates recurring action



# Recent Arctic Activity

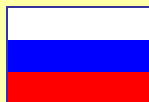
## About the Arctic



Finland  
Arctic  
Strategy



Canada National  
Arctic Policy



Russian  
Arctic  
Strategy



Arctic Council  
Reaffirms  
UNCLOS



Arctic Council  
SAR MOU Draft

## Within the Arctic



Chinese  
research  
cruise



US & Other  
International  
Research



Vigilant Eagle 2010



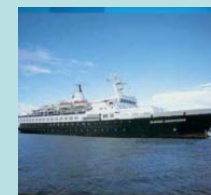
Arctic Crossroads 2010



Multiple NSR transits



US-CAN ECS survey



NWP cruise  
Ship & Oil Tanker  
groundings



Russian Oil  
Tankers Collide



*Navy is engaging with Arctic & non-Arctic countries*



# Navy Accomplishments: April 2010 – April 2011

## Education



Naval Post Graduate  
School Arctic Science  
& Security theses



Arctic science  
& security  
Study topics  
at US Naval  
Academy



Naval War College  
courses address  
Arctic Science &  
Security Topics

## Studies & Assessments



Naval Arctic  
Mission Analysis



Naval Studies  
Board study



Naval Arctic  
Capability Based  
Assessment

## Outreach & Engagement



NSS  
Interagency  
Policy  
Committee



State  
Department  
Arctic Policy  
Group



Conferences,  
Symposia,  
Media events



Leadership  
visits &  
staff talks

## Policy, Strategy, & Plans



Support  
Arctic Section  
In 2010 UCP



Navy  
Arctic  
Strategic  
Objectives

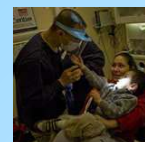


USN-USCG  
Arctic Activity  
Plan

## Operations & Training



Navy-NOAA  
Bering Strait  
Survey



Arctic Care 2010



ICEX 2011



USS Taylor Port  
Visit to Murmansk



Pacer Goose



Operation  
NANOOK/NATSIQ

## Science & Research



NRL  
Kara Sea  
Research cruise



Interagency partnership  
For air-ocean-ice  
numerical prediction



Science Ice  
Exercise Plan

*Improve understanding*

*Ensure readiness (resilience)*



# Navy Arctic Strategic Objectives

*Signed by CNO on 21 May 2010*



**I. Contribute to safety, stability, & security in the region**



**IV. Strengthen existing & foster new cooperative relationships in the region**

**II. Safeguard U.S. maritime interests in the region**



**V. Ensure Navy forces are capable and ready**

**III. Protect the American people, our critical infrastructure, & key resources**



***Towards the desired end state: a safe, stable, and secure Arctic***



# Navy Activity On and Under the Ice

## Technology Demonstrations – ICEX-11



Aerial resupply



SSN 778 surfaced



Ice-mining



VIP visit

## Interagency Research Efforts – Operation Ice Bridge 2011



Greenland Ice Sheet





# NANOOK/NATSIQ

## Environment

- Daily fog, air temp 30s-40s °F
- PPE required but expensive

## Engineering

- Water production reduced

## Logistics:

- No in-port replenishment north of St. Johns



HMCS  
MONTREAL



USS PORTER



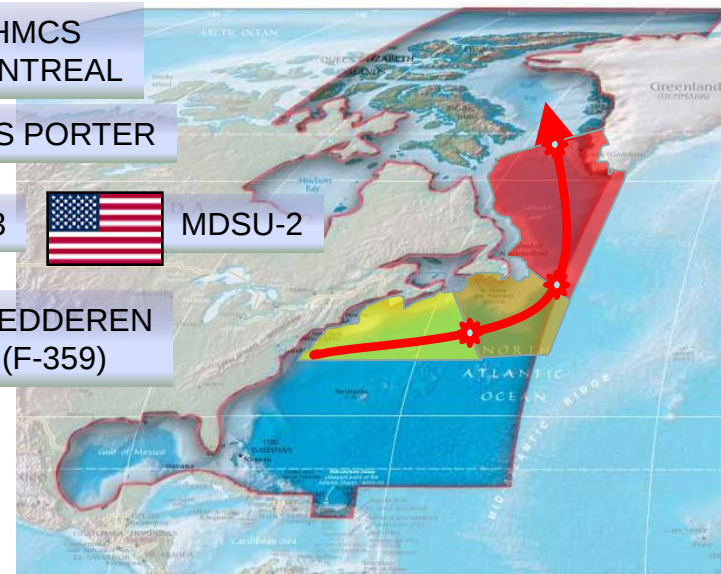
P-3



MDSU-2



VAEDDEREN  
(F-359)



## Training

- Ice module for ship simulator is vital

## Communications

- Intermittent
- Data transfer rate significantly reduced

## Recommendations

- Include replenishment ships



# Naval War College

## Global Shipping Game - Arctic Results



### Change is Gradual

- *But preparing for the challenges (hardening vessels, logistics facilities) has long lead time (>10 years)*



### Arctic economic viability

- *Understanding this is essential to identifying regional security implications*
- *Resource extraction will continue to be the priority*
- *Destination shipping will predominate over global trade*

### U.S. Accession to UNCLOS



- *National imperative (players were unanimous)*
- *U.S. risks being marginalized if actions, policies & investments don't keep pace with economic development in the Arctic*
- *Alternative opinion: U.S. power provides enough leverage to secure national interests*



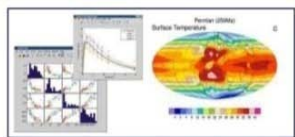
# Improving Understanding

## ONR Initiatives

### More Interagency Collaboration

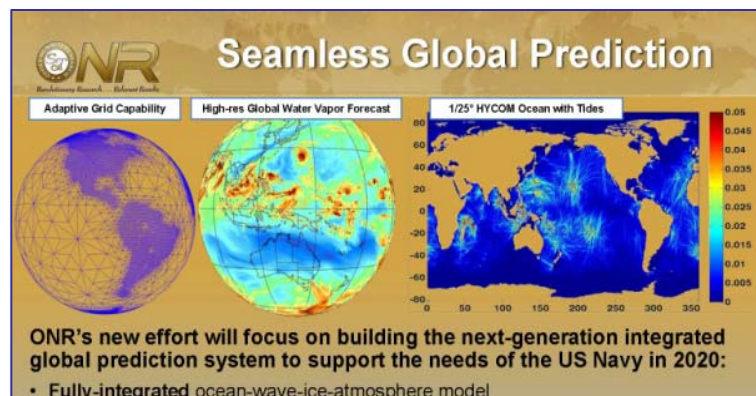
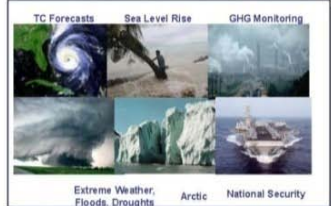
#### Earth System Prediction Capability

Recapitalize aging suite of global atmospheric models



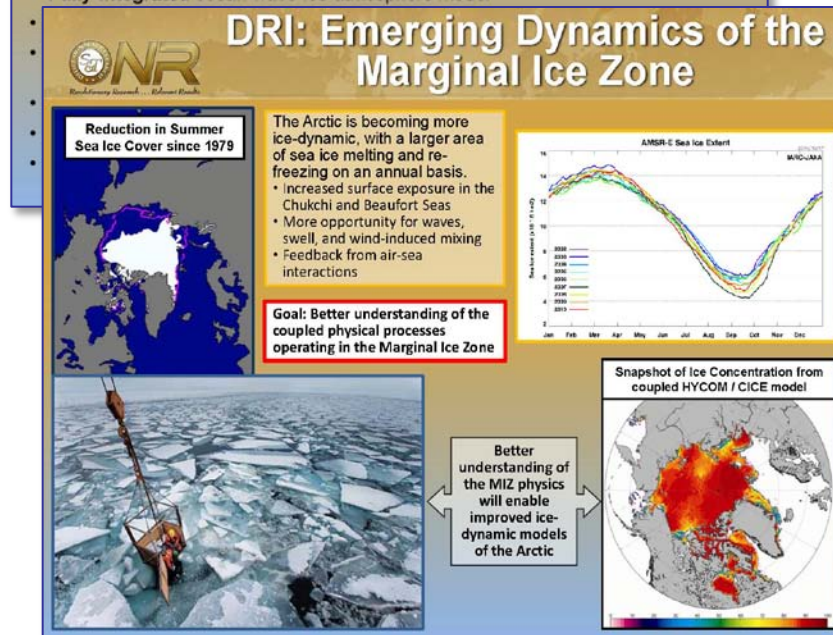
Implement interagency collaboration

Revolutionary advancement National predictive architecture



ONR's new effort will focus on building the next-generation integrated global prediction system to support the needs of the US Navy in 2020:

- Fully-integrated ocean-wave-ice-atmosphere model





# Navy Engagement

## Defense



Coordination & support  
to multiple OSD offices



USEUCOM / SACEUR  
Flag-level meetings



USPACOM  
Environmental  
Security Conference



USNORTHCOM  
Flag-level Meetings

## National



National Ocean Policy  
Implementation



National Security Staff's  
Arctic Interagency Policy  
Committee



US Global Change  
Research Program

## Congressional



US-UK Statement to US CODEL



House sub-committee  
testimonies



Multiple briefings to HAC-D,  
SAC-D, HASC, and SASC staffs

## International



Operation NANOOK/NATSIQ



USS Taylor Port Visit to  
Murmansk



Conferences & symposia



US – Foreign Navy Staff Talks

## Media



Radio interviews



ClimateWire

On-line publications

The Washington Post  
The New York Times

Traditional printed outlets

## Demonstrating leadership



# Some Final Thoughts ...



*"There's a lot of water where there used to be ice,  
and now I'm responsible for it."*

Admiral Thad Allen, USCG (ret)



*"We have not got the money,  
so we have to think."*

Sir Winston Churchill



*"If anyone invades Canada from the North,  
my first job would be to rescue them."*

Admiral McFadden, Canadian Navy



# Questions?

