Climate Change in the Arctic and its Implications for U.S. National Security

Beth Chalecki, PhD ‘07
Fletcher School of Law & Diplomacy

The World as Seen from the Northern View

The superior man, when resting in safety, does not forget that danger may come.
When in a state of security he does not forget the possibility of ruin.
When all is orderly, he does not forget that disorder may come.
Thus his person is not endangered, and his States and all their clans are preserved.
-- Confucius

Hidden on the roof of the earth, far away from the din and tendentiousness of the trafficked world, lies an area with a unique ecosystem and a unique mythology. From legends of Valhalla to the Canadian poet Robert Service to the TV hit *Northern Exposure*, the far North has been a cold and quiet place of mystery. It is the home of fur-clad indigenous peoples, charismatic megafauna like polar bears and caribou, and a wealth of natural resources, and has been referred to the as Mediterranean of the Future (Theutenberg 1988, 303) for its many nations are learning to cooperate around one body of water.

Ever since the development of the long-range bomber and the ICBM, the Arctic has also been regarded as a place of Cold War strategic importance, when Distant Early Warning Line radar stations were placed along the 66th parallel to warn the United States and Canada of an incoming Soviet nuclear attack (Jakonen 1988, 100). In addition to its nuclear dimension, political strategists in 1985 were advising that the Arctic take a place of greater prominence in security affairs due to its fossil fuel energy resources (Young 1985, 166). In 1983, during the height of the Cold War, the Reagan Administration issued National Security Decision Directive 90, entitled "United States Arctic Policy." NSDD 90 [see Appendix A for full text] states that, "the United States has unique and critical interests in the Arctic region, related directly to national defense, resource and energy development, scientific inquiry, and environmental protection."

However, with the end of the Cold War, nuclear tensions between the United States and Russia have ebbed, and the focus of American strategic military forces has shifted southward away from the Arctic to the Middle East, where we are securing approximately one-quarter of our imported oil (EIA 2004a). And while the occasional national strategic scenario may take into account the effects of climate change (Schwartz & Randall 2003), none of them focus specifically on the Arctic (Carman 2002, 173). However, oil and gas removal, increased ocean access and resurgent legal concerns make this area worthy of consideration in long-range U.S. policy formation, and merit bringing the Arctic back into prominence in American strategic thinking.

Anthropogenic Climate Change and its Effects on the Arctic

In 2003, the United States alone burned 84,338 quadrillion Btu of fossil fuels (EIA 2004a) and put over 5,788 million metric tons of carbon dioxide, methane, and other greenhouse gases into the atmosphere (EIA 2004b). This accumulation of greenhouse gases is causing the earth's temperature to rise, a phenomenon known as global warming. In and of itself, global warming is not a destructive phenomenon: without the warming effect of the atmosphere, there would be no life on earth at all, since the surface would be the same temperature as outer space. However, human emissions of greenhouse gases are pushing this effect further than at any time in recorded history.

Anthropogenic climate change, graphically represented in Appendix B, will be felt more strongly in the Arctic than anywhere else on the globe. First, the warming potential of the Arctic is more significant than the rest of the globe because snow and ice melt will change local albedo levels from high to low. This means that surface area that used to be reflect sunlight will now absorb it,

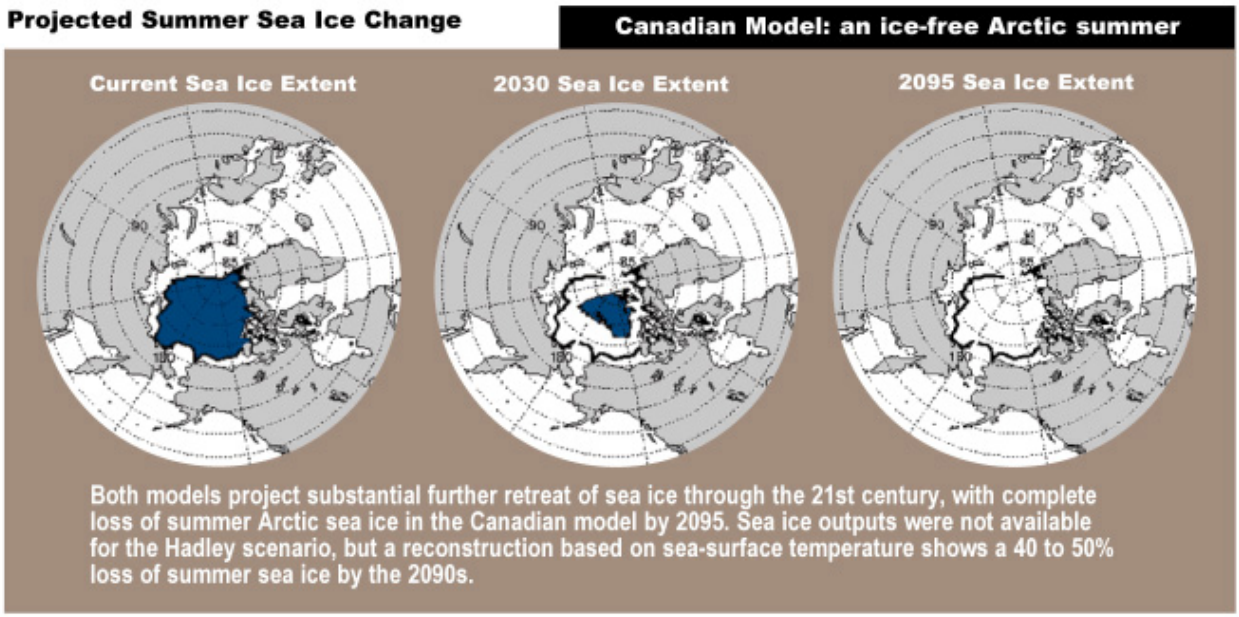
and the resulting energy is radiated back from the earth as heat. Second, since the atmosphere is shallower toward the poles, the volume of air that must be warmed in order for the surface to begin warming is less. Third, as sea ice retreats, heat that is absorbed by the oceans in summer is readily transferred to the atmosphere in winter (ACIA 2005, 15). Since much of the Arctic's environment is close to 32 ºF, a relatively small increase in the ambient air temperature can result in large environmental changes and feedbacks (Weller et al 1999, 23). The Intergovernmental Panel on Climate Change's Third Assessment Report (2001) has estimated a 5 ºC warming over extensive Arctic land areas, with a small cooling occurring off Canada's eastern coast (IPCC 2001, 56). These changes mean that the Arctic will experience wide-ranging impacts, from increasing ambient air temperature to glacier and sea ice melting to permafrost thaw. These physical changes lead to changes in species composition and disruptions for polar peoples who live traditional lifestyles. Permafrost thaw and land subsidence will have detrimental impacts on buildings, transportation and defense infrastructure.

The IPCC is not alone in reaching this conclusion. In November of 2004, the Arctic Council published a summary of their 2-year assessment of the impacts of climate change in the Arctic.[1] The results were alarming beyond even the IPCC's predictions. While regional variations exist, the evidence shows a clear and significant warming trend across most of the Arctic. Up from an observed temperature increase of 5-7 ºF over the past 50 years, the ACIA predicts an increase in ambient air temperatures of 5-9 ºF over land and up to 13 ºF over ocean within the next 100 years. Wintertime averages over land and sea for the same time period will increase 7-13 ºF and 13-18 ºF, respectively (ACIA 2005, 2).

[1] The Arctic Council is a high-level intergovernmental forum consisting of six Indigenous Peoples organizations and the eight circumpolar nations: the United States, Canada, Russia, Greenland/Denmark, Norway, Sweden, Finland, and Iceland. Unfortunately, the full version of the report will not be available until 2005.

Significant climate change in the Arctic will result in increasing loss of sea ice cover, and thinning ice where it does form (Weller et al 1999, 23). Over the past 30 years, annual average sea ice cover has declined by 8%, and the melting trend is accelerating, as indicated in Figure 1. Additional declines in average annual sea ice cover have been predicted at 10-50%, with some computer models speculating complete summer loss of arctic sea ice by approximately 2100 (ACIA 2005, 3).

Figure 1: Projected Extent of Sea Ice Melting

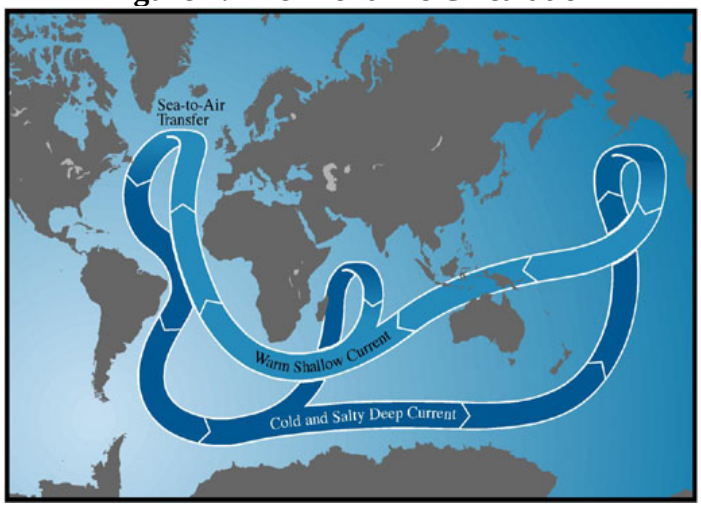


(source: USGCRP 1999)

Concomitantly with loss of sea ice cover, the trend in sea level rise is also accelerating. Global average sea level has risen approximately three inches in the past 30 years due to thermal expansion and melting of land-based ice. In this century, global average sea level is predicted to rise between four inches and *three feet*, with the rate of rise increasing toward the end of the century (ACIA 2005, 4).

Finally, changes in thermohaline circulation may flow from increasing Arctic ice melt. The ocean is a delicate balance of salt and fresh water, and this balance, sometimes referred to as the Great Ocean Conveyor and shown in Figure 2, allows specific currents to carry warm and cold water to specific places, as pictured below. Added freshwater runoff from melting glaciers may alter or shut down this circulation, resulting in widespread regional climatic changes such as colder European winters and changing fish migration patterns (USGCRP 1999).

Figure 2: Thermohaline Circulation



(Source: USGCRP 1999)

Oil and Gas Infrastructure

With the Arctic well on its way to becoming an ice-free area, a new raft of security concerns comes forward. Unlike the Antarctic, its nearest climatic compatriot, the Arctic is primarily an oceanic realm, and oceanic effects and capabilities will determine how securely we can operate within this realm. One challenge the United States and all circumpolar nations will face is the viability of its oil and gas infrastructure in the Far North. The Arctic contains as much as 40 percent of world oil and gas reserves (Theutenberg 1988, 303); the United States for one has expended billions of dollars in energy infrastructure to bring Arctic crude oil and natural gas from

Prudhoe Bay down the Trans-Alaska Pipeline to Valdez and the rest of the country. Both Canada and Russia have similar hydrocarbon extraction projects, and estimates predict severe levels of erosion due to sea level rise on the Arctic coasts (USGCRP 2000, 113).

With an ice-free Arctic, we are likely to see increased fossil fuel exploration and production from this area. Siberia alone is estimated to hold petroleum reserves equal to the Middle East, and the only barrier to its exploitation by oil and gas companies is economic; it is difficult and expensive to move oil and gas out over land via Russia's aging infrastructure. Climate change will make their task easier and more economical by allowing regular sea transport. Consequently, oil and gas industries such as Lukoil, Gazprom, Statoil, and Norsk Hydro have already ordered ice-capable tankers in anticipation of easier Arctic transit (Carman 2002, 175). In addition, Denmark, Russia, Norway, Canada and the United States have all used various interpretations of the Law of the Sea to stake territorial claims to parts of the Arctic seabed, in order to exploit their considerable oil and natural gas reserves (Revkin 2004).

Ironically, however, the warming effect of this very fossil fuel burning will make it that much more difficult to get at the hydrocarbons we want. Pumps, pipelines, infrastructure buildings and workers' housing are all built on permafrost, and since the bearing capacity of permafrost decreases with warming (IPCC 2001, 821), when it thaws, the land will subside considerably, resulting in shifting ground, erosion, landslides, and land subsidence (USGCRP 2000, 76). Structural damage, such as that pictured in Figure 3, will reduce oil companies' ability to extract oil economically by forcing them to sink additional costs into infrastructure preservation and operation. The Trans-Alaska pipeline (see Appendix C) carries 20% of domestic oil from the Alaskan North Slope, and

significant thawing of permafrost could require shutdown and expensive re-engineering of sections of the pipeline (Weller et al 1999, 21). A stoppage of North Slope oil can imperil U.S. energy security by foreshortening our supply and forcing us to either conserve oil, a politically unpopular choice for the current Administration, or import the shortfall from other nations. If we choose to do so from the Middle East, our soldiers face extended tours of duty in Iraq, Saudi Arabia and other oil-producing countries in the region.

Figure 3: Structural Damage in Siberia

(photo: S. Yu. Parmuzin, from Weller et al 1999, 34)

Also, permafrost thaw will affect buildings, transportation, and defense infrastructure such as airport runways, roads, and radar installations at the 35 active U.S. military facilities located in Alaska, and at other military facilities in each of the circumpolar nations (NATO 1998), requiring costly fixes or possibly leading to abandonment of the facilities.

Increased Arctic Ocean Access

Another security challenge is increased access to and through the North. An open-water Arctic is a more accessible Arctic for the international community and that means that more ships will inevitably cross both the Northwest Passage (above Canada) and the Northeast Passage (above

Russia). Naval vessels, merchant ships, recreational boats, cruise liners, and especially submarines will find an accessible Arctic to their advantage. The Northwest Passage alone can shave more than 4,000 nautical miles off commercial voyages from Europe to Asia by bypassing the expensive (and narrow) 90-year old Panama Canal and the treacherous Cape of Good Hope (CNN 2002). This will make it irresistible to transoceanic shippers around the world.

But while an ice-free Northwest Passage may translate into more trade and material wealth, it may have a negative effect on the area itself. Increased ship traffic will most likely result in an increase in vessels from hostile nations or non-state actors. These vessels will have no incentive to obey internationally-accepted laws regarding U.S. or Canadian national waters or even notify either country of their presence. This means that the United States will likely feel compelled to increase its military presence in the Arctic, to monitor shipping and military traffic through its adjacent waters.

Complicating the access issue further are Canada's claims of territoriality. In 1977, Canada declared the Northwest Passage to be Canadian internal waters. While they have not yet used armed force to turn back any ship wishing to transit the Passage, they request to be notified when a ship proposes to do so. This may not sound like a compelling method for Canada to defend its sovereignty, but the number of ships transiting has been extremely low so far because of the extent of the ice, so the issue has not really been tested either in court or by show of Canadian force.

Interestingly, legal scholars have not supported this position explicitly, though most would concede that an assumption shared and acted upon by many nations becomes a form of customary

international law, even though there is no formal instrument to codify it. The legal concepts of *mare liberum* (open sea) and *mare clausum* (closed or territorial sea) have been in customary use since the publication of *De Jure Praedae* by Hugo Grotius in 1604, though the exact point at which a particular area of *mare* goes from *liberum* to *clausum* is not specified. In the past, the Arctic has been frozen over and the Northwest Passage has been impassable for most of the time, so the issue was never put to the test on a large scale. Now, however, as climate change melts the Arctic ice, more surface ship traffic will force the Canadians to either defend their claim or abandon it. This situation may strain the relationship between the United States and Canada if we continue to send, as we did in 1985, ships to cross the Passage without their permission. Alternatively, if the United States, concerned about increasing traffic to the north, thinks that Canada can't adequately patrol its Arctic waters, it might take on the job itself, treading on Canadian sovereignty (Figure 4).

Figure 4: U.S. Coast Guard Ice Breakers Escorting a Merchant Ship

(photo credit: U.S. Coast Guard)

The Northeast Passage, also called the Northern Sea Route, will also become ice-free for a greater part of the year, and it is likely that the United States may try to take advantage of that new mobility. Russia, therefore, will find itself in the same position the Canadians are in with regard to

"territorial waters". However, the Northeast Passage has not faced the same tribulations that its sister waterway has. Russia has also declared the Northeast Passage to be internal waters, but they have a much more ice-capable navy and have indicated an interest in allowing transit through the Passage for commercial ships. Since World War II, they have maintained a regular highway for Soviet shipping along the Passage through the development of new ports and the exploitation of resources in the interior. A fleet of Russian icebreakers, aided by aerial reconnaissance and by radio weather stations, keeps the route navigable from June to October (ESA 2004). A great boon to shippers, the Northeast Passage cuts the distance between northern Atlantic and northern Pacific ports in half. But the Russian Arctic faces the same climate change-induced problems the U.S./Canadian Arctic does, including permafrost thaw, disruption of traditional peoples' lifestyles and incursions on national sovereignty.

In addition, increased oceanic activity across the Arctic will bring forward the problem of "creeping jurisdiction": as nations begin to operate with greater frequency in ice-free waters, areas of limited national sovereignty will become areas of exclusive national jurisdiction through repeated use (Theutenberg 1988, 305). In 1926, the then-Soviet Union established the "sector principle," under which all Arctic areas between the eastern and western boundaries of the Soviet Union up to the North Pole were said to be under Soviet control, including the seabed. Again, due to the mostly frozen-over state of the Arctic, this sector principle was never formally challenged. However, projection of Russian sea power, and hence its superpower status, depends on a Russian-controlled Arctic, and they might be willing to go to great military lengths to keep it that way. Creeping jurisdiction thus becomes every nation's security concern, as the line between *mare liberum* and *mare clausum* becomes increasingly unclear.

New Missions and Operational Capabilities

Naval Arctic missions for the United States in a globally-warmed world would result as a response to security challenges from hostile nations or from opportunities to exploit operational efficiencies offered by peacetime Arctic transit. The Office of Naval Research (2001, 36-37) has identified the ten "most likely" missions that the United States would face in an ice-free Arctic:

1. Law enforcement operations
2. Ensure freedom of navigation
3. Protection of natural resources
4. Transit of forces
5. Homeland defense
6. Forward presence, intelligence, surveillance and reconnaissance (ISR)
7. Scientific exploration
8. Maintain/improve capability to operate in the Arctic
9. Uphold allied commitments

More specifically, the United States might face Russian naval incursions into its waters, requiring a military show of force. Alternatively, large-scale disruption of the traditional Arctic way of life might lead to armed unrest on the part of native peoples. Although seemingly unlikely,

this sort of internal security situation has occurred before in other places where the environment was destroyed and the traditional way of life was no longer viable[2].

In order to be able to execute these new missions, the United States will need to start planning for Arctic operability now (ONR 2001, 43). Should the United States decide to take advantage of upcoming changes in the Arctic, its operational capabilities will have to change as well. Currently, the U.S. Coast Guard has only three icebreakers, while the U.S. Navy has none (Carman 2002, 181). U.S. naval ships would have to be ice-strengthened, soldiers and sailors would have to be Arctic-trained, and weaponry and machinery built to withstand Arctic conditions if we are to maintain a consistent and capable presence in the far North. In addition, the United States will need to invest time, money and goodwill in bilateral and multilateral alliances in the region in order to maximize its efficiency in the area. Military experts have suggested fruitful grounds for cooperation, such as a joint U.S/Canadian search and rescue operation (Carman 2002, 180).

Finally, all of these security concerns are based upon the assumption that the effects of climate change will be linear – what if they aren't? Non-linear effects or threshold events such as sudden temperature changes, shifts in global ocean currents or extreme weather events in unusual places are one of the great bugaboos of climate modeling. We can only guess at the likelihood and severity of these events, yet if they are significant enough, they can overwhelm society's adaptive capacity and leave all U.S. plans of strategic superiority in the dust.

---

[2] University of Toronto scholar Thomas Homer-Dixon has conducted studies linking environmental degradation and violent conflict, most notably in Rwanda, Pakistan and the Philippines. While none of these countries is an Arctic nation, the underlying conditions are the same: rent-seeking actions by a political elite causes environmental collapse and disruption of the civil order, resulting in armed insurrection by the displaced segment of the population. It is very possible that the same might occur in the Arctic and provide a growing security concern for the United States, Canada, or Russia.

Possible Future Institutions and Trends

Some scholars have posited that the ongoing environmental change in the Arctic is one of the clearest indicators of the need for new geopolitical thinking. Multinational organizations such as the Arctic Council have gone a long way towards bringing the scientific realities of the Arctic to the attention of policymakers around the northern hemisphere. The creation of the University of the Arctic[3] facilitates Northern studies as a field. Franklyn Griffiths, a well-known Canadian Arctic scholar, argues that scientific collaboration can help reinforce military cooperation in the area (Griffiths 1988, 6), and already Norway, Russia and the United States have launched the Arctic Military Environmental Cooperation (AMEC) for contact and cooperation on military environmental issues. The overall goal of AMEC is to support sustainable military use of the Arctic (Palosaari & Möller 2004, 268). Taken one step further, the creation of a new defense institution might help to further international security in the Arctic in the face of ecological and economic changes brought about by global warming. The United States and Canada have long cooperated over Arctic issues such as the DEW Line, but a permanent standing bilateral body (not unlike the International Joint Commission that oversees the Great Lakes and other boundary waters) could institutionalize the Far North as an area of legitimate joint concern. Staffed with Arctic experts and possessing its own budget, it could ensure that Arctic matters were high in the pantheon of defense concerns we face. In a bold move, a trilateral institution could include Russia, thus ensuring that the major Arctic powers had a forum to resolve access disputes and to discuss and act upon security concerns in concert.

[3] The University of the Arctic is a virtual university, with faculty based in Canada, the United States, Sweden, Denmark and Russia, and which offers a Bachelor's Degree in Circumpolar Studies. Their website is www.uarctic.org.

But perhaps joint Arctic defense isn't enough. What else could the United States do to ensure its Far North security? Most of the territory, both land and oceanic, of the larger circumpolar nations (the United States, Canada, Russia) lies outside the Arctic, and they have historically considered the Arctic to be their northern backyard, a place devoid of any meaning unless they assign it meaning (Dalby 2003, 184). A common "Arctic" identity could help to build commonality in the region. Though not foolproof (witness the ethnic and economic divisions between Mediterranean states) and not addressing the sovereignty concerns faced by circumpolar states, a regional identity would allow the Arctic to be more self-identified and stable.

Conclusion

Security planners and policymakers tend to believe, a common human failing, that the future will resemble the past. We assume that the important problems of the day will remain important into the future, and our policy planning reflects this. However, the Arctic melt will thrust policymakers and planners physically into a world that has literally never existed before.

On Friday, December 17, the Bush Administration released a "U.S. Ocean Action Plan" for coordinating and directing U.S. ocean policy for the next decade. The plan says nothing about the Arctic. Yet if the United States is to remain secure, we must embrace the concept of environmental security, especially as it applies in the Arctic, for there is the first laboratory of climate change. The empirical evidence of global warming is one of the clearest indications that we need to change our strategic and geopolitical thinking, from the solely military viewpoint to one that includes military, environmental, economic, and human aspects. Already Inuit peoples have discovered commonalities with Pacific Islanders as they see their homes and traditional ways of life eroded by

climate change (Doyle 2004), victims of diminished adaptive capacity. The United States, a wealthy country with a robust adaptive capacity, may yet see its way of life erode if we don't respect the links between the climate and national security.

You who this faint day the High North is luring
Unto her vastness, taintlessly sweet;
You who are steel-braced, straight-lipped, enduring,
Dreadless in danger and dire in defeat:
Honor the High North ever and ever,
Whether she crown you, or whether she slay;
Suffer her fury, cherish and love her--
He who would rule must learn to obey.

-Robert Service "Men of the High North"

Appendix A

National Security Decision Directive 90: United States Arctic Policy (full text)

The Interagency Arctic Policy Group's report on United States Arctic policy has been reviewed. It is clear that the United States has unique and critical interests in the Arctic region related directly to national defense, resource and energy development, scientific inquiry, and environmental protection.

In light of the region's growing importance, it warrants priority attention by the United States. I have decided that U.S. Arctic policy will continue to be based on the following major elements:

- Protecting essential security interests in the Arctic region, including preserving the principle of freedom of the seas and superjacent airspace;

- Supporting sound and rational development in the Arctic region, while minimizing adverse effects on the environment;

- Promoting scientific research in fields contributing to knowledge of the Arctic environment or of aspects of science which are most advantageously studies in the Arctic; and

- Promoting mutually beneficial international cooperation in the Arctic to achieve the above objectives.

The Interagency Arctic Policy Group (IAPG), reporting to the national Security Council, will be responsible for reviewing and coordinating implementation of this policy and U.S. international activities and programs in the Arctic. These responsibilities will not include purely domestic matters. In discharging its responsibilities, however, the IAPG will ensure close consultation with agencies concerned with those domestic matters.

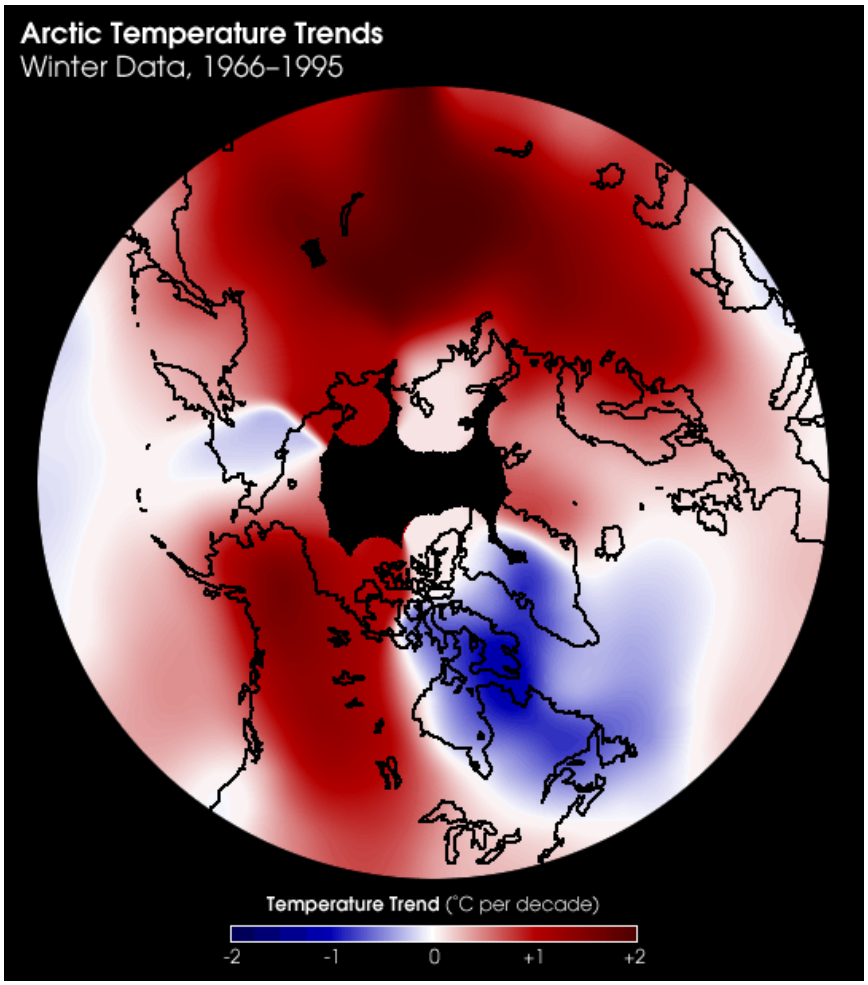
The IPAG will give priority attention to the following reviews:

- How should U.S. activities in the Arctic region be coordinated with those of other countries bordering on the Arctic to serve best U.S. Arctic interests? This will include consideration of possible actions for increased cooperation.

- What federal services may be necessary for the United States to provide in the Arctic region over the next decade and what are their relative priorities? This will take into account projected developments in the Arctic that could have an important impact upon federal agencies with statutory responsibility for areas such as search and rescue; protecting life, property, resources and wildlife; enforcing U.S. laws and international treaties; and promoting commerce. This review will also recognize that resource development is primarily a private sector activity.

These reviews should be completed and forwarded for consideration by March 15, 1984.

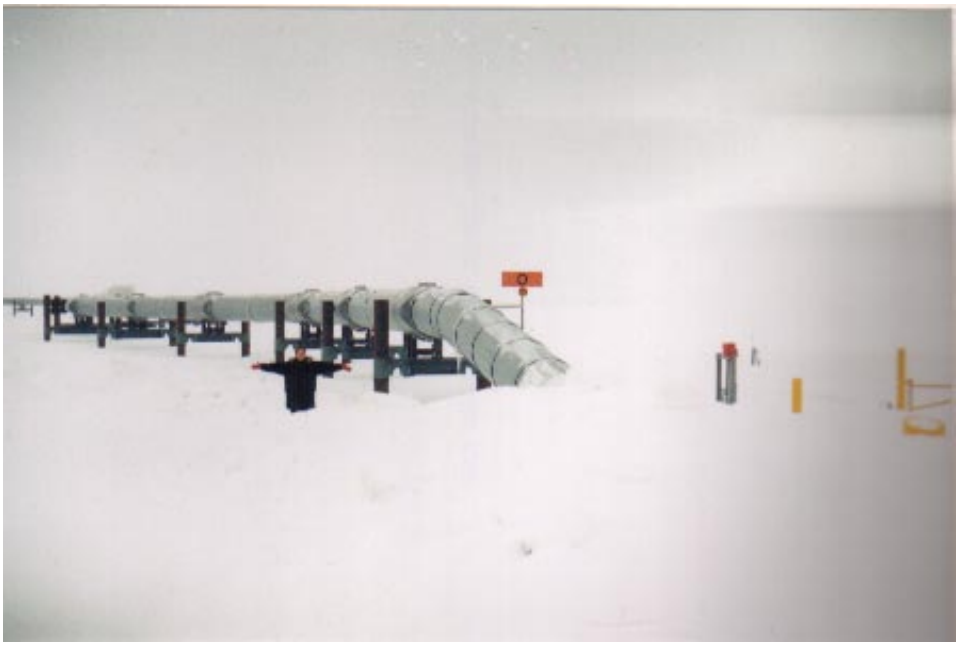
Appendix B



(source: NASA Earth Observatory)

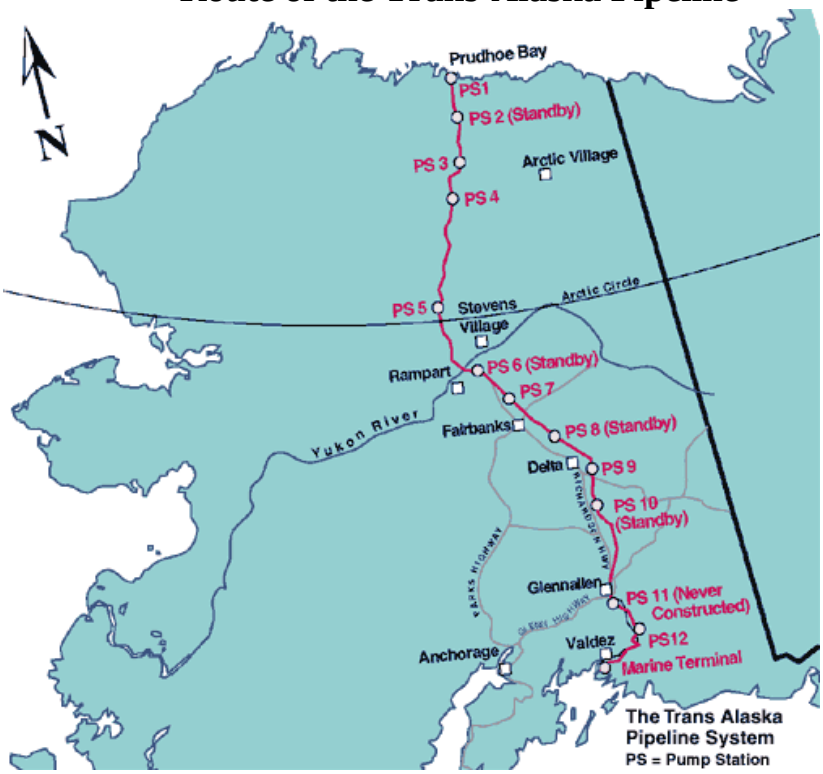
The black area at the North Pole represents gaps in data coverage.

Appendix C



Beth standing at Mile Marker Zero of the Trans-Alaska Pipeline, May 4, 2000.

Route of the Trans-Alaska Pipeline



(Source: Wikipedia.org)

References

ACIA. *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. 2005. Arctic Monitoring and Assessment Program Secretariat. New York: Cambridge University Press, 140 pp.

Carman, Jessie C. 2002. "Economic and Strategic Implications of Ice-Free Arctic Seas" Chapter 9 in Globalization and Maritime Power. Tangredi, Sam J., ed. Washington, DC: Institute for National Strategic Studies, National Defense University, 612 pp.

CNN. 2002. "Will ice melt open fabled Northwest Passage? Researcher say Arctic route could thaw in next decade." August 29, 2002, posted at http://archives.cnn.com/2002/TECH/science/08/29/northwest.passage/

Dalby, Simon. 2003. "Geopolitical Identities: Arctic Ecology and Global Consumption" *Geopolitics*. Vol. 8, No. 1, Spring 2003, pp. 181-202.

Doyle, Alister. 2004. "Arctic People Seek Tropical Team on Global Warming" Reuters, November 25, 2004. As found at http://news.yahoo.com/news?tmpl=story&u=/nm/20041125/lf_nm/environment_arctic_dc_18

EIA, Energy Information Administration. 2004a. "Energy Consumption By Source: 1949-2003" as found at http://www.eia.doe.gov/emeu/aer/txt/ptb0103.html.

EIA, Energy Information Administration. 2004b. "U.S. Carbon Dioxide Emissions from Energy Sources, 2003 Flash Estimate" as found at http://www.eia.doe.gov/oiaf/1605/flash/flash.html.

ESA, European Space Agency. 2004. "The Northern Sea Route – ICEWATCH" as found at http://earth.esa.int/applications/data_util/hrisk/ice/ice.htm.

Griffiths, Franklyn. 1988. "The Arctic as an International Political Region" Introduction in The Arctic Challenge: Nordic and Canadian Approaches to Security and Cooperation in an Emerging International Region. Möttölä, Kari, ed. London: Westview Press, 335 pp.

Homer-Dixon, Thomas. 1994 "Environmental Scarcities and Violent Conflict: Evidence from Cases" *International Security*. Vol. 19, No. 1, Summer 1994, pp. 5-40. As found at http://www.library.utoronto.ca/pcs/evidence/evid2.htm

Huebert, Rob. 2003. "The Shipping News Part II: How Canada's Arctic Sovereignty is on Thinning Ice" *International Journal*. Vol. 58, No. 3, Summer 2003, pp. 295-308.

IPCC, Intergovermental Panel on Climate Change. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. Summary for Policymakers and Technical Summary of the Working Group II Report. Washington: U.S. Global Change Research Information Office, 89 pp.

Jakonen, Olli-Pekka. 1988. "The Strategic Significance of the Arctic" Chapter 7 in The Arctic Challenge: Nordic and Canadian Approaches to Security and Cooperation in an Emerging International Region. Möttölä, Kari, ed. London: Westview Press, 335 pp.

NATO. 1998. "Hazardous Materials and Defence-Related Activities in the Arctic" NATO/CCMS Pilot Study on Cross-Border Environmental Problems Emanating from Defence-Related Installations and Activities, Sup-Topic I Report. Drammen, Norway: North Atlantic Treaty Organization Committee on the Challenges of Modern Society, 80 pp.

ONR, Office of Naval Research. 2001. "Naval Operations in an Ice-Free Arctic. Symposium Final Report." 17-18 April 2001. 67 pp.

Palosaari, Teemu, and Frank Möller. 2004. "Security and Marginality: Arctic Europe After the Double Enlargement" *Cooperation and Conflict*. Vol. 39. No. 3,pp. 255-281.

Revkin, Andrew C. 2004. "Jockeying for Pole Position" New York Times. October 10, 2004, p. A4.

Schwartz, Peter and Doug Randall. 2003. "An Abrupt Climate Change Scenario and Its Implications for United States National Security" Washington: Office of Net Assessment, DoD, October 2003, 22 pp.

Theutenberg, Bo Johnson. 1988. "Development and Cooperation in the Arctic" Chapter 14 in The Arctic Challenge: Nordic and Canadian Approaches to Security and Cooperation in an Emerging International Region. Möttölä, Kari, ed. London: Westview Press, 335 pp.

"U.S. Ocean Action Plan: The Bush Administration's Response to the U.S. Ocean Commission on Policy." 2004. As found at http://ocean.ceq.gov/actionplan.pdf

USGCRP, U.S. Global Change Research Program. 2000. "Climate Change Impacts on the United States: Overview. National Assessment Synthesis Team. New York: Cambridge University Press, 154 pp.

_____. 1999. "Global Change Issues: Highlights of Recent and Ongoing Research" as found at http://www.gcrio.org/ocp99/ch2.html.

Weller, Gunter, Patricia Anderson, and Bronwen Wang, eds. 1999. The Potential Consequences of Climate Variability and Change: A Report of the Alaska Regional Assessment Group. Fairbanks, AK: Center for Global Change and Arctic System Research, University of Alaska Fairbanks. 42 pp.

Young, Oran. 1985. "The Age of the Arctic" *Foreign Policy*. No. 61, Winter 1985-86, pp. 160-179.

Further Reading

Arctic Council. http://www.arctic-council.org

"Arctic Sea Ice: Changes Causes and Implications" USGCRP Seminar, 20 April 1999. As found at http://www.usgcrp.gov/usgcrp/seminars/990412FO.html

"Climate Change From the 14th – 20th Centuries: Evidence from the Subsurface and the Arctic." USGCRP Seminar, 20 January 1998. As found at http://www.usgcrp.gov/usgcrp/seminars/980112DD.html

Haines, Tom. 2004. "Degrees of Separation" *Boston Globe*. December 19, 2004, p. M1 ff. An account of Haines' trip across the Bering Strait.

Tower, William E., III. 1999. *Creeping Jurisdiction: Are International Straits in Jeopardy?* U.S. Naval War College. 19 pp.

"USGCRP Participating US Agencies. Principal Areas of Focus – Department of Defense" As found at http://www.usgcrp.gov/usgcrp/agencies/defense.htm

University of the Arctic. http://www.uarctic.org