INTERNATIONAL POLAR YEAR 2007-2008:
THE OPPORTUNITY OF A GENERATION

Statement of

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Good afternoon. Thank you very much for inviting me to speak about International Polar Year 2007-2008. The International Polar Year (IPY) is the scientific opportunity of a generation for our nation, for our society, and for our planet.

My name is Robin E. Bell, PhD from Columbia University's Lamont-Doherty Earth Observatory, where I am a Doherty Senior Research Scientist. I am a geophysicist by training and at Columbia I lead major geophysical programs on the stability of ice sheets including subglacial lakes. I also direct Columbia's NSF sponsored ADVANCE program, aimed at recruiting and retaining women in science. I was the first women to lead a major aerogeophysical program from the Antarctic continent, and this has been the focus of much of my research for the past two decades.

In addition to my research, I chair the National Research Council's Polar Research Board, which acts as the national coordinating committee for IPY. The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, chartered by Congress in 1863 to advise the government on matters of science and technology. I served as the Co-Chair of the International Council for Science's (ICSU) initial IPY Planning Group and I currently serve as a member of the ICSU-World Meteorological Organization (WMO) Joint Committee for IPY, the main international planning group.

Today I will provide an overview of why IPY is happening and why it's important to us here in the United States. What has motivated more than 5000 scientists from some 63 nations to decide to participate in a year devoted to polar studies and education? I'll highlight the major science questions that will be addressed, outline the role that US scientists and science managers have been playing developing IPY, and conclude with thoughts on the many societal benefits that can result from the IPY.

In this era of instant communications and global connectivity, it might seem surprising that the global scientific community is so excited by a scientific strategy that was developed more than 100 years ago. Because it was indeed back in 1882-1883 that the idea of holding a focused, internationally-coordinated year of polar research – an International Polar Year – was first developed. At that point in history, the poles were blank white spaces on maps and the cutting edge communications technology was the

telegraph. The decision to coordinate with other nations rather than compete, and to focus on research to understand polar phenomena rather than acquisition of territory, was something new and exciting. That first IPY in 1882-83 and subsequent ones in 1932-33 and the International Geophysical Year (IGY) in 1957-58, drew great minds and generated great leaders; these "international years" set a precedent of cooperation in science that, while innovative at the time, is considered the norm today.

Today's scientists are similarly motivated by society's need for integrated global knowledge. There is still a fundamental human need to push the limits of our understanding about polar phenomena. The polar regions are integral components of the Earth system. As the heat sinks of the climate system, they both respond to and drive changes elsewhere on the planet. While environmental change and variability are part of the natural pattern on Earth, the environmental changes currently witnessed in the polar regions are in many cases more pronounced than changes observed in the mid-latitudes or tropics. The Arctic sea ice cover is decreasing; some ice shelves in Antarctica are retreating and thinning; glaciers are shrinking; and ecosystems are changing, for instance, with plants flowering at earlier times. These changes are having human impacts: some Alaskan villages have been moved to higher ground in response to rising sea levels, and thawing of permafrost is undermining roads and buildings in northern communities around the world. We must understand the implications of environmental change for the future of our global society.

Although we've made tremendous progress in all science over the past 100 years, the polar regions are still at the frontiers of human knowledge. The maps aren't quite as blank, but the frontiers and unknowns have actually increased, and range from the molecular, to the ecological, to the continental. How is it that certain microbes can survive at minus 2 degrees Fahrenheit, that certain nematodes live even when ice forms in their cells, that polar fish species have evolved with an antifreeze protein in their blood? What will happen to the unique under-ice ecological communities of the Arctic, which are the base of the Arctic food web, as ice conditions change and new species arrive from southern waters? In just the last 10 years we discovered more than 150 subglacial lakes that exist under the ice in Antarctica. These range in size from something similar to the reflecting pool on the Mall to a lake the size of Lake Ontario.

Why are these lakes important? They are thought to contain exotic ecosystems; the water in these lakes is part of the subglacial plumbing system that can be thought of as the lubricant that makes the ice sheet flow faster.

At its most fundamental level, IPY 2007-2008 is envisioned to be an intense, coordinated field campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation. IPY will provide a framework to undertake projects that normally could not be achieved by any single nation. It allows us to think beyond traditional borders—whether national borders or disciplinary constraints—toward a new level of integrated, cooperative science. A coordinated international approach maximizes both impact and cost effectiveness, and the international collaborations started today will build relationships and understanding that will bring long-term benefits. Within this context, IPY will seek to galvanize new and innovative observations and research while at the same time building on and enhancing existing initiatives. IPY will serve as a mechanism to attract and develop a new generation of scientists and engineers with the versatility to tackle complex global issues.

In addition, IPY is clearly an opportunity to organize a range of education and outreach activities designed to excite and engage the public, with a presence in classrooms around the world and in the media in varied and innovative formats. The IPY will use today's powerful research tools to better understand the key roles of the polar regions in global processes. Automatic observatories, satellite-based remote sensing, autonomous vehicles, Internet, and genomics are just a few of the innovative approaches for studying previously inaccessible realms. IPY 2007-2008 will be fundamentally broader than past international years because it will explicitly incorporate multidisciplinary and interdisciplinary studies, including biological, ecological, and social science elements.

IPY 2007-2008 is an opportunity to deepen our understanding of the polar regions and their global linkages and impacts, and to communicate these insights to the public. IPY planners have identified five broad scientific challenges

- Assess large-scale environmental change in the polar regions, with questions looking at both the physical and human dimensions of change and its impacts.
- Conduct scientific exploration of "new" frontiers, whether these are once

inaccessible places beneath the ice sheet, or areas of inquiry that are now open because of advances in technology, such as how the tools of genomics now allow exploration of previously unanswerable questions about biological adaptation.

- Observe the polar regions in depth, with adequate coverage of the vast and challenging landscape, to provide a description of current conditions and allow for better future understanding of variability and change.
- Understand human-environmental dynamics in a region where the connections are intimate and where the impacts of change are clear.
- Create new connections between science and the public, using these regions that are inherently intriguing.

Previous IPY efforts were characterized by very top down planning and generally driven by the military. For example, under the oversight of Abraham Lincoln's son, Robert Todd Lincoln, then head of the Department of War, the US participation in the first IPY in 1882-83 was led by the Army. The science priorities for our upcoming IPY, on the other hand, emerged from grass roots planning, international scientific groups, US agency input, and help from the US National Academy of Sciences and National Academy of Engineering.

Beginning in 2002, the National Academies became involved in a serious dialog about whether there should be another International Polar Year (following in the tradition of the year held in 1882-83, 1932-33, and 1957-58) and whether it would be advantageous to participate. We began talking with colleagues around the world to judge international interest, as well. Here in the US, the chair of that first planning effort was Dr. Mary Albert of the Army's Cold Regions Research and Engineering Laboratory. She led a committee that sought wide input on whether the US should participate in IPY and, if so, what we should hope to accomplish. The committee led a series of web discussions, gave talks at numerous professional meetings, wrote an editorial for Science magazine (included as an attachment), met with agency leaders, hosted a multi-day workshop, and compiled contributions from 13 federal agencies into an initial planning document. The report, "A Vision for International Polar Year 2007-2008" was released in 2004 and came to be the foundation for much of the international planning as well. (A

summary of this report is attached to my testimony.) This early involvement put the US in a leadership role in planning the IPY internationally.

One of the major differences between the first two IPYs and IGY and our upcoming IPY 2007-2008 is the recognition that the physical world and the biological world and human society are intimately interrelated. This upcoming IPY is inherently about not just science, but science in support of human interests. It includes work in engineering, medicine, sociology, and human-environment interactions. The so-called "honeycomb diagram" (attached) highlights some 225 large groupings of projects that illustrate the geographic and disciplinary breadth of IPY 2007-2008. Each cell represents a major program with many participating projects involving international teams of scientists. Working together, this research will produce a tremendous leap forward in our understanding of polar processes (physical, biological, and social) and their global connections.

Of the 225 projects, the US plays a leadership role in 52 projects (20%) and is participating in 80%. Right now, everything is still conceptual – what will actually happen on the ground is still being determined, both here and in other nations. Significant planning efforts are occurring in each of the participating nations; in addition, there is an international IPY Programme Office, staffed by Dr. David Carlson and hosted in Cambridge, England, by the British Antarctic Survey. There is also an international planning committee, called the Joint Committee, of which I am a member, and subcommittees devoted to data management, observation systems, and education and outreach.

Although planning for IPY started with the scientific community, all the federal agencies with cold regions responsibilities are having roles in implementation. When the National Academies hosted a workshop to encourage agency coordination in 2004, 13 agencies participated. At the request of the White House, the National Science Foundation is serving as the lead federal agency. (In Alaska, the University of Alaska Fairbanks has stepped forward as the state-wide leader.) NSF has shown real leadership in its role, holding interagency planning meetings, creating a multi-agency website, and starting the process of soliciting proposals for the actual on-the-ground research and education and outreach activities. (In fact, last week NSF announced the first of the

education and outreach activities to be funded, and these provide an excellent first glimpse at the kinds of exciting activities that will occur.)

The National Academies continues to provide coordination through the Polar Research Board, which acts as the US National Committee for IPY. The Polar Research Board focuses on communication and coordination, in particular interacting with other nations and the international Programme Office, communicating what's happening in the US science community, encouraging US agencies to participate, and looking for ways to bring other partners into IPY. For instance, as part of its coordinating role, in early October, the Polar Research Board will host a meeting of the heads of IPY secretariats so that the staff working behind -the -scenes on IPY have an opportunity to coordinate.

Planning for IPY is advancing at a continued rapid pace, with the official kick-off coming in March 2007. But there are some potential requirements that must be met if the IPY is to meet expectations.

(1) Broaden and deepen the participation of the agencies. NSF is doing a stellar job leading and coordinating efforts, but other key agencies with polar interests remain less engaged.

(2) Increase the level of funding. The programs outlined in the Vision document require a significant investment of funds both to NSF and other federal agencies.

(3) Enhance coordination nationally and internationally. Early IPYs were directed by the military. Today's grass-roots approach provides great flexibility and innovation, but frankly is more difficult to coordinate.

(4) Foster multi-disciplinary work. While in the 1950s science was very discipline-based and that met the needs of the times, today's biggest scientific and societal challenges require a more complex, systems-based approach.

These issues must be addressed to ensure a vibrant and successful International Polar Year.

In conclusion, I want to think ahead about the societal benefits of the International Polar Year. Just as the IPY and the emerging science programs are multifaceted and multidisciplinary, the benefits of the IPY will be multifaceted and multidisciplinary. The IPY will advance our fundamental understanding of our planet – from polar ecosystems

to subglacial terrains. The IPY will improve our understanding of the processes of change and that complex double-edged sword of how society is influencing change and how change is influencing society – especially the inhabitants of the north. The IPY will inspire a spirit of discovery across all ages and help us develop the next generation of our nation's leaders in science, engineering, education, industry, commerce, and government. At the international level, IPY will again show that even in the most difficult times, science can be an arena of international cooperation. IPY will foster the continued peaceful use of the polar regions, engage new partners in the global science community, and leverage precious scientific and logistical resources so that, in essence, we get more from our investments.

Why should the vast majority of us, who live in the warmer regions of the Earth, care about IPY? The polar regions, while physically distant, are critical links in the global climate system. Does this matter for the rest of the planet? Imagine holding an ice cube between your thumb and your forefinger. Beneath your fingers a pool of water forms quickly. The water will drip down your arms and down the ice cube. The changes at the end driven by the warmth of your fingers are transferred across the entire ice cube. The relationship between the poles to the rest of the globe are the same. The polar oceans play a critical role in maintaining ocean currents that keep coastal Europe much warmer than it would be otherwise, and the sea ice cover modifies Earth's surface temperature by reflecting solar energy. Melting ice sheets will raise sea levels, threatening coastal communities around the world. The polar regions are integral components of the Earth system that both respond to and drive changes elsewhere on the planet.

The polar regions also hold unique information of Earth's past climate history, and they are growing in economic and geopolitical importance. They are a unique vantage point for studies that will help scientists understand environmental changes in the context of past changes, which in turn will help us make informed choices for our future. The exploration of new scientific frontiers in the polar regions also will lead to new discoveries, insights, and theories potentially important to all people.

In summary, International Polar Year 2007-2008 will leave us the following important legacies:

- an improved understanding of environmental status and change,

- more comprehensive data and the ability to understand trends in the future,
- improved observation systems to capture future environmental change,
- a continued spirit of exploration into new frontiers of science,
- a new and inspired generation of scientifically literate citizens and leaders,
- an enhanced level of international cooperation to address global scale issues.

Thank you for your time. I'd be happy to answer any questions.

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