Executive Summary
March 2004 IPICS Workshop

Society would benefit greatly from the ability to efficiently allocate resources to minimize disruptions caused by climate change. This requires the ability to predict the response of future climate to natural and anthropogenic forcing on time scales of months to centuries. To do so we need to understand how the sun, ocean, land, atmosphere, and cryosphere interact to create the climate that controls so many aspects of our daily lives. One of the ways the science community develops this understanding is to study the earth's climate history. By learning how and why the climate changed in the past, we will be able to make better predictions of how the climate will change in the future.

Ice sheets and glaciers contain well-ordered accumulations of ancient ice that fell as snow years to millions of years ago. The dust particles, soluble chemicals, and gases trapped in the ice are routinely used to study how the climate system operated in the past, and how it will operate in the future. To sample this ice, an international community of scientists and engineers drill into ice and collect ice cores. The information from ice core programs helps explain how climate changes occur throughout the world, not just at the site at which the core was drilled. This is possible because most of the material in the core, such as dust and gases, is representative of large regions. Ice coring projects range in size from a single investigator working for a single field season, to multi-national, multi-year efforts. Investigations using ice cores have documented how climate varied naturally before anthropogenic influences, and have shown there is a tight link between temperature and the atmospheric concentrations of greenhouse gases.

Ice core data have become central to our understanding of past climate change, and to assessments of possible future climate change. Ice core investigations are now a major branch of climate research, and the complexity of ice core projects has increased accordingly. To meet the expectations of the climate research community, increasingly complex future ice coring projects will require international collaboration. In March 2004, representatives from the international ice coring research community convened a workshop to develop concepts for the projects that are needed to predict both natural and anthropogenic climate change. The International Partnerships in Ice Core Sciences (IPICS) Workshop was supported by the U.S National Science Foundation. Fifty-five scientists, engineers, and funding agency representatives from Australia, Canada, China, Denmark, France, Germany, Italy, Japan,

Russia, Switzerland, the United Kingdom and the United States attended the workshop. The major recommendations of the workshop are:

Continue the Dialogue

Representatives of the international ice coring community should meet in 2005 to discuss implementation of current plans, and then continue to have regular meetings that include the exchange of information on ice core science and drilling that will be helpful to future and ongoing projects. Heinz Miller, on behalf of the European Polar Board, stated that Europe would like to host a follow-up IPICS meeting during 2005.

Retrieve Longest Possible Antarctic Ice Core Climate Record

A program should be initiated to collect an Antarctic ice core climate record longer than 1.2 million years. This program will provide insights into the way future climate will respond to changes in the distribution of solar heating, by examining how natural changes, driven by changes in the earth's orbit, evolved over this long time frame. Initially this will require a multi-year effort to locate the optimal drilling locations for the collection of cores to address this topic. Ice cores should be collected from at least two locations in East Antarctica. The site selection work should be initiated during the International Polar Year. Additional workshops should be held to develop a framework for this program.

Longest Possible Arctic Ice Core Climate Record

A program should be initiated to collect the longest possible Arctic ice core climate record, with the specific goal of completely penetrating ice deposited the last time the earth was in a warm (interglacial) state like today. This program will provide critical insights into the natural variability of our current climate and, by elucidating how the last warm period ended, may yield information on how the current warm period will end. The optimal location for this project has been narrowed down to a small area in northwest Greenland. A minor amount of additional site selection work, which could occur early in the International Polar Year, is required before drilling can proceed. Preparations for the drilling could be completed by the end of the International Polar Year. Additional workshops should be held to develop a detailed plan for this program.

Spatial Array of Ice Cores

A program should be initiated to collect a spatial array of ice cores on time scales ranging from centuries to millennia. Many climate questions can only be answered if there is a well-designed spatial

array to investigate how hemisphere-scale climate phenomena interact to create climate, and a coordinated effort is required to develop such an array. The individual coring projects that make up the array should be facilitated, but not directed, at the international level. This program would include polar sites with records extending into the last glacial period, and a worldwide distribution of sites with higher time resolution records extending through the last millennium. Some of the smaller individual projects that make up this program could be completed during the International Polar Year. The site selection for some of the larger individual projects that make up this program could be initiated during the International Polar Year. Additional workshops should be held to develop a planning document for an international body to facilitate the development of this global array.

Improve Ice Coring Methods

An ongoing international effort to improve ice coring methods should be initiated. This effort would focus on improving drilling fluids, core quality, drilling efficiency, and replicate coring methods. This effort could be facilitated with annual workshops and international exchanges of drilling staff.

To reach the objective of being able to predict future climate variations, a new international approach to ice coring is required. Implementing these recommendations is a necessary step towards reaching that objective.