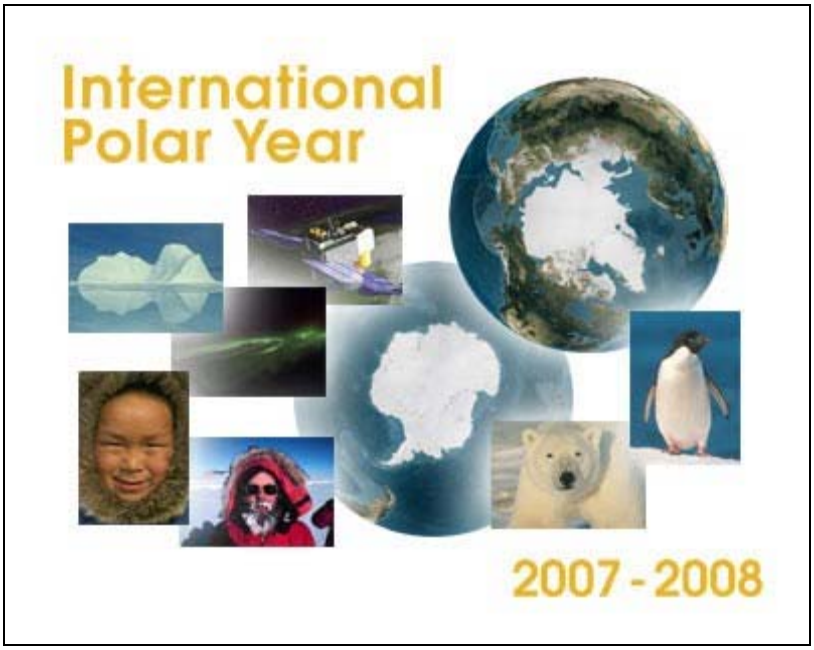

INTERNATIONAL POLAR YEAR 2007-2008

OUTLINE SCIENCE PLAN

The ICSU IPY 2007-2008 Planning Group
www.ipy.org

Version 5.2 15th September 2004

EXECUTIVE SUMMARY

This document summarises the current state of progress of the ICSU Planning Group (PG) for the International Polar Year 2007-2008 (IPY). The PG is an international, multidisciplinary group of polar scientists, which was established by the International Council of Science (ICSU) in June 2003 following a proposal from the US Polar Research Board (US-PRB), the European Polar Board (EPB), and the Scientific Committee on Antarctic Research (SCAR).

The concept of the International Polar Year 2007-2008 is of a time-limited international initiative comprising coordinated, interdisciplinary scientific research and observations in the Earth's polar regions. The purpose is to explore new scientific frontiers, to deepen our understanding of polar processes and their global linkages, to increase our ability to detect environmental and societal changes, to more fully involve Arctic residents with research activities, to attract and develop the next generation of polar scientists, engineers and logistics experts, and to capture the interest of schoolchildren, the public and decision-makers.

The official period of the IPY will be from 1st March 2007 until 1st March 2009 to allow observations during all seasons, and the possibility of two summer field seasons, in each polar region. The geographic focus will extend over latitudes from approximately 60 deg to the pole, both north and south.

The IPY will include a broad range of activities organized around a select number of scientific themes. On the basis of a substantial input of ideas regarding the content of the IPY submitted by scientists and organisations from around the world, the Planning Group has defined the following six main themes:

(1) To determine the present environmental status of the polar regions by quantifying their spatial and temporal variability.

(2) To quantify, and understand, past and present environmental and human change in the polar regions in order to improve predictions

(3) To advance our understanding of polar - global teleconnections on all scales, and of the processes controlling these interactions.

(4) To investigate the unknowns at the frontiers of science in the polar regions.

(5) To use the unique vantage point of the polar regions to develop and enhance observatories studying the Earth's inner core, the Earth's magnetic field, geospace, the Sun and beyond.

(6) To investigate the cultural, historical, and social processes that shape the resilience and sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship

Six observational initiatives have been advanced by a broad spectrum of scientists which emerge from the scientific themes:

(1) A synoptic set of multidisciplinary observations to establish the status of the polar environment in 2007-2008

(2) The acquisition of key data sets necessary to understand factors controlling change in the polar environment

(3) The establishment of a legacy of multidisciplinary observational networks

(4) The launch of internationally coordinated, multidisciplinary expeditions into new scientific frontiers

(5) The implementation of polar observatories to study important facets of Planet Earth and beyond

(6)

This document is the ICSU International Polar Year Planning Group's synthesis of input from the polar community to identify the overarching research themes and possible implementation activities. This Initial Outline Science Plan and the process that led to it will be presented at a variety of international science venues beginning with the Arctic Science Summit Week in Iceland April 2004. The plan is

available on the Web at www.ipy.org. The goal of these presentations will be to elicit feedback from major polar stakeholders such as national committees, funding agencies, operational groups, scientific coordination bodies and satellite agencies and to encourage these stakeholders to begin to develop truly international, multidisciplinary plans to address the themes identified. The ICSU International Polar Year 2007-2008 Planning Group will use the various discussions, and the written feedback to formulate a final version of the Outline Science Plan to be delivered to the ICSU Executive Board with its final report in October 2004.

The ICSU IPY 2007-2008 Planning Group
DRAFT SEPTERMBER 8, 2004

INTERNATIONAL POLAR YEAR 2007 2008

INITIAL OUTLINE SCIENCE PLAN
AN INTERIM REPORT OF THE ICSU PLANNING GROUP FOR THE INTERNATIONAL POLAR YEAR 2007-2008

1. PURPOSE OF THE DOCUMENT

This document summarises the current state of progress of the ICSU Planning Group (PG) for the International Polar Year 2007-2008 (IPY). The PG is an international, multidisciplinary group of polar scientists, which was established by the International Council of Science (ICSU) in June 2003 following a proposal from the US Polar Research Board (US-PRB), the European Polar Board (EPB), and the Scientific Committee on Antarctic Research (SCAR). The PG was tasked to begin the process of planning the IPY. In December 2003 ICSU invited a representative of the World Meteorological Organisation (WMO) to become an *ex officio* member of the group.

This summary describes ICSU's charge to the PG and subsequent deliberations and actions of the Planning Group to generate wide international discussion and involvement of the science community in the formulation of the IPY. From this foundation, the document defines a set of objectives for the IPY and outlines a science plan that provides the starting point for the next phase of IPY planning and implementation. During this stage of planning, the broad vision will be widely discussed, debated, and refined for incorporation in the PG's report to ICSU due in October 2004. In November 2004, the PG will be superseded by a new, joint ICSU-WMO Committee, responsible for the oversight and coordination of the IPY implementation.

2. INTRODUCTION

The concept of the International Polar Year 2007-2008 is of a time-limited international initiative comprising coordinated, interdisciplinary scientific research and observations in the Earth's polar regions. The purpose is to explore new scientific frontiers, to deepen our understanding of polar processes and their global linkages, to increase our ability to detect environmental and societal changes, to more fully involve Arctic residents with research activities, to attract and develop the next generation of polar scientists, engineers and logistics experts, and to capture the interest of schoolchildren, the public and decision-makers.

The IPY will include a broad range of activities organized around a select number of scientific themes. On the basis of a substantial input of ideas in response to solicitation of the international science community regarding the content of the IPY submitted by scientists and organisations from around the world, the Planning Group has defined the following six main themes:

(1) To determine the present environmental status of the polar regions by quantifying their spatial and temporal variability.

(2) To quantify, and understand, past and present environmental and human change in the polar regions in order to improve predictions

(3) To advance our understanding of polar - global teleconnections on all scales, and of the processes controlling these interactions.

(4) To investigate the unknowns at the frontiers of science in the polar regions.

(5) To use the unique vantage point of the polar regions to develop and enhance observatories studying the Earth's inner core, the Earth's magnetic field, geospace, the Sun and beyond.

(6) To investigate the cultural, historical, and social processes that shape the resilience and sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship

These themes, plus related science questions and associated measurements, are discussed in detail later in this document.

Overall, the IPY seeks to foster new observations and research exploiting innovative, modern technology, whilst building on and enhancing polar initiatives already planned or underway.

The official period of the IPY will be from 1st March 2007 until 1st March 2009 to allow observations during all seasons, and the possibility two summer field seasons, in each polar region. The geographic focus will extend over latitudes from approximately 60 ° to the pole, both north and south. The aim is to establish a number of high profile, interdisciplinary and truly international core activities, within a much broader set of associated initiatives.

3. RATIONALE FOR IPY 2007-2008 (IPY CONCEPT)

The Planning Group has considered carefully the motivation for organizing an International Polar Year. The history of significant contributions from past coordinated international science campaigns (see Box 1) demonstrates that there is considerable benefit to be gained.

Box 1: History of Past International Polar Years

The idea of nations organizing to conduct a coordinated effort to study the polar regions originated some 125 years ago. The scientific goals of the first International Polar Year (1882-1883), sponsored by the International Meteorological Organisation (a predecessor of the World Meteorological Organization), were to explore geophysical phenomena that could not be surveyed by any one nation alone. There were 15 expeditions (13 to the Arctic and 2 to the Antarctic) and 12 nations participated. In addition to important science activities and exploration of new terrain, this first IPY set a precedent for international cooperation in the realm of science.

The second International Polar Year was held in 1932-1933. This effort was also proposed by the International Meteorological Organization and it accomplished significant advances in meteorology, magnetism, atmospheric science, and the understanding of ionospheric phenomena. About 40 nations participated in related activities, although the overall effort was somewhat diminished by the financial constraints internationally of the Depression years.

Fifty years after the second International Polar Year, the world came together again but this time to focus on geophysical processes world-wide. The International Geophysical Year of 1957-1958, sponsored by ICSU and WMO, celebrated the 75th and 25th anniversaries of the first and second international polar years, and brought together 67 nations around the idea that the many technologies developed during World War II could be focused to the benefit of science. The accomplishments of IGY are too numerous to list but include discovery of the Van Allen Radiation Belt encircling the Earth, the first estimates of the size of Antarctica's ice mass, and confirmation of the theory of continental drift. There were geopolitical benefits as well, including development of, and ultimately the ratification of, the Antarctic Treaty. It continued the legacy that scientists from around the world can work together, even in tense political and economic times, for the betterment of humankind.

Indeed, the justification for an intense focus on the polar regions is many faceted. The polar regions have great scientific importance: they are integral components of the Earth system, intimately linked to the global climate system, sea level, biogeochemical cycles, marine, freshwater and terrestrial ecosystems, and human activities, both regional and global. Given these connections, the polar regions respond to, amplify, and drive changes elsewhere in the Earth system. The interplay of the ocean, atmosphere, cryosphere, biosphere, geosphere and human activities in the polar regions makes these zones especially influential in the behaviour of climate on decadal and human time scales. So although the polar regions may seem distant from the lives of the majority of the world's people, they are in practice relevant in tangible ways. Given our existing knowledge and understanding about the Earth as a system, the potential of new technologies especially in the areas of electronic communications and information dissemination and processing, and the potential to marshal the expertise and capabilities of the world's polar research community, IPY 2007-2008 offers a unique opportunity to catalyse internationally coordinated, interdisciplinary research activities and to explore the human dimensions of these scientific questions to an unprecedented degree.

The rational for the IPY can be summarised as follows:

Why International?
- Polar processes extend across national boundaries
- The science challenge exceeds the capabilities of any one nation
- A coordinated approach maximizes outcomes and cost effectiveness
- International collaboration shares benefits and builds relationships

Why Polar?
- Polar regions are active, highly connected components of the planet
- Significant changes are occurring in the polar regions
- Polar regions hold unique information on the past behaviour of the Earth system
- Polar regions having growing economic and geopolitical importance, especially the Arctic
- The harsh conditions and remoteness of the polar regions have hampered scientific inquiry compared to mid- and low-latitudes
- There is a need to re-establish and enhance operational observing systems in the polar regions
- The polar regions offer a unique vantage point for a variety of terrestrial and cosmic phenomena

Why a "Year"?
- An intensive, coordinated burst of effort will accelerate advances in knowledge and understanding
- A defined period polar "snapshot" will provide a crucial benchmark for detecting and understanding change in comparison with past and future data sets
- It provides an opportunity for observations in both polar regions throughout all seasons
- The legacy of enhanced observing systems generated by IPY will provide an improved foundation for ongoing monitoring

Why 2007-2008?
- The anniversaries of past IPY and the IGY set a firm deadline
- There is a pressing need to capture contemporary information on change
- A 3-4 year planning horizon is challenging but feasible
- The timescale allows advances in technology and logistics to be exploited to address new issues and access new areas

4. SHORT DESCRIPTION OF THE PLANNING PROCESS

Although numerous discussions about possible ways to celebrate the IPY and IGY anniversaries have taken place in a variety of nations and venues over the past few years, focused planning began in early 2003 when the International Council for Science appointed a small group of scientists to serve as a central planning group. The Terms of Reference and membership of the ICSU IPY Planning Group (PG) are given in Appendices I and II.

To date the PG's efforts have focused mainly on
- gathering, summarising and making widely available information on existing ideas for an IPY
- serving as a clearinghouse for ideas
- stimulating, encouraging and organising debate amongst a wide range of interested parties on the objectives and possible content of an IPY
- formulating a set of objectives for an IPY, and
- developing an initial high level science plan.

This has included close cooperation with the International Union of Geodesy and Geophysics (IUGG) concerning their IGY+50 initiative and in particular their electronic Geophysical Year (eGY), the International Union of Geological Sciences (IUGS) concerning their International Year of Planet Earth initiative (IYPE) and the proposed International Heliophysical Year (IHY).
In a little more than a year, the science community has progressed from its earliest discussions of why such a campaign should be held to serious planning of what IPY might accomplish and what resources

are needed. Scientists from twenty-four nations have provided input. Nineteen nations have established either IPY National Committees or National Points of contact (Appendix III). In addition more than thirty ICSU and non-ICSU science coordinating bodies with an interest in polar research have provided strong endorsements of the IPY and often detailed scientific input to the PG (Appendix IV).

From the beginning, the goal of the ICSU Planning Group was to develop a planning process that was both driven by cutting edge science and by the view of global science community. Thus through ICSU the PG invited the science community to contribute ideas on the pressing scientific issues which should form the content of the IPY. The objective was twofold; (i) to measure the level of interest in the community in an IPY, and (ii) to map out the range and scope of the scientific domain within which an IPY might operate.

The response to the call was very strong, with more than 350 ideas received to date, and with the list continuing to grow (Summary given in Appendices V(a) – V(c)). Some have been provided by individuals, some by National Committees, some by other science coordinating bodies, and some by groups of scientists who organized themselves around common questions. Members of the PG, especially the Chair and Vice-chair, have promoted and discussed the IPY at a variety of high profile scientific meetings. In addition the PG arranged an IPY Discussion Forum held in Paris on 31st April 2004, to present the IPY concept and gather feedback on how best to proceed. These inputs have been critical to the IPY planning.

The PG met four times. These meetings provided a forum for the free flow of ideas, for consideration of the input submitted by the science community, and for the development of various documents to advance IPY 2007-2008, including a May 2003 initial proposal to ICSU, a September 2003 letter to ICSU nations and unions calling for input, a January 2004 further letter to ICSU nations and unions reporting on the initial response and requesting further input, a February 2004 Progress Report to ICSU, and the Outline Science Plan released in April 2004, numerous public presentation of the Outline Science Plan including at the IAASC sponsored Arctic Summit Week (April 2004) and the SCAR sponsored Science Meeting (August 2004). Open Discussion forums were convened prior to both the April and September 2004 Planning Group meeting to ensure ample input from the international science community. I

5. OBJECTIVES OF THE INTERNATIONAL POLAR YEAR 2007-2008 AND CHARACTERISTICS OF THE CORE ACTIVIES

On the basis of its own considerations and various inputs received as part of the IPY consultation process, the PG has defined the following objectives for an IPY. The IPY should utilise the vantage point of the polar regions to carry out an intensive and internationally coordinated burst of high quality, important research activities and observations that would not otherwise be undertaken. The result of the IPY will be to lay the foundation for major scientific advances in knowledge and understanding of the nature and behaviour of the polar regions and their role in the functioning of the planet
in addition to leaving a legacy of observing sites, facilities and systems to support ongoing polar research and monitoring The IPY will require in creased international coordination of research efforts strengthening and enhancing international collaboration and co-operation in polar regions for both research and monitoring. Given the present understanding of the poles a key components of a global system the IPY programs must address both polar regions and their global interactions. Since interdisciplinary work is fundamental to building this global understanding, the IPY will link researchers across different fields to address questions and issues lying beyond the scope of individual disciplines. The IPY programs willcollect a broad-ranging set of samples, data and information regarding the state and behaviour of the polar regions to provide a reference for comparison with the future and the past and data collected under the IPY are made available in an open and timely manner.
The IPY will also provide a unique opportunity to intensify the recovery of relevant historical data and ensure that these also are made openly available. The IPY programs will attract, engage and develop a new generation of polar researchers, engineers and logistics experts and must engage the awareness, interest and understanding of schoolchildren, the general public and decision-makers worldwide in the purpose and value of polar research and monitoring Building on existing and potential new funding sources, programs developed as part of the IPY must optimise exploitation of available polar observing systems, logistical assets and infrastructure, and develop and embrace new technological and logistical capabilities.

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In the 1950's the International Geophysical Year Steering Group articulated a focus and prioritization for the programs:

"*During the IGY the regular scientific facilities of the world must be supplemented by additional observations suitably distributed in space and time as needed for the solution of the selected problems.*

- *Highest priority should be given to problems requiring concurrent synoptic observations at many points involving co-operative observations by many nations*
- *The extraordinary efforts that could be generated during the IPY in these relatively inaccessible regions of the Earth mean that the observations there should preferably cover all major geophysical phenomena, in order to augment our basic knowledge of the Earth and solar and other influences acting upon it*

IGY should also include epochal observations of slowly varying terrestrial phenomena to establish basic information for subsequent comparison at later epochs"

Building on the IGY approach and given the present day
practical limitations on available assets, effort, infrastructure and funds, the PG adopted the following view framework for program prioritization. The characteristics of the core activities of the IPY beginning in 2007 have been defined as follows:

- *High quality science, addressing an important question or issue capable of resulting in major advance*
- *Fit to IPY Scientific Themes and "Issues"*
- *Intensive, time-limited burst of activity during IPY timeframe*
- *Addresses one or both polar regions and their global interactions*
- *Contributes to international collaboration / coordination*
- *Logistically and technically feasible within IPY timeframe*
- *Avoids unnecessary duplication or disruption of established initiatives and plans*
- *Provides open and timely access to data*
- *Maximises effective utilisation of available logistical assets*
- *Explicitly addresses roles and tasks for young scientists, technical and logistics experts*
- *Includes specific outreach activities*

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Additional desirable characteristics are :

- *Leaves a legacy of observing sites, facilities and systems to support ongoing polar research and monitoring*
- *Builds on existing or planned activities – adding value*
- *Interdisciplinary or with potential for interdisciplinary synthesis*
- *Provides international access to field sites to support additional science and monitoring activities*
- *Catalyses a broader involvement of nations in polar research*
- *Addresses training / capacity building including opportunities for individuals to convert to polar science and monitoring*
- *Provides opportunities for regional scholarship within broader international activities*
- *Readily communicable to the public*

6. THEMES FOR THE INTERNATIONAL POLAR YEAR 2007-2008

The six scientific themes have been developed from extensive input from the polar science community and are intended to provide a framework for the specific activities comprising the International Polar Year 2007-2008. (see section II).

Each theme is presented below along with several key related questions that the IPY 2007-2008 activities will make significant contributions towards answering, along with some possible activities

proposed by the community. Following a discussion of each of the five major themes, we present an emerging vision describing an integration of possible IPY activities.

Theme #1 *To determine the present environmental status of the polar regions by quantifying their spatial and temporal variability.*

Previous International Polar Years and the International Geophysical Year brought the international scientific community together to obtain an integrated assessment of the polar regions and polar processes. Today, rapid environmental change underway in the polar regions has increasingly significant global ramifications. As our planet changes, well planned synoptic observations of the environmental status of the polar regions will be serve as a necessary benchmark for scientists and decision-makers globally. Consequently a key output of the IPY 2007-2008 will be to document the contemporary environmental status of the polar regions, quantifying their spatial and temporal variability and characterizing present day processes.

Determining the spatial and short-term temporal variability of the climate and environment in the polar regions will address questions such as:

a. What is the status of the high latitude ocean circulation and composition?

b. How do polar ecosystem structure and function vary through space and time and how much of this variation can be attributed to anthropogenic change?

c. What are the contemporary factors of social cohesion and values for polar societies?

The activities proposed to capture the modern environmental status of the poles and to document the modern spatial variability include physical, biological and social programs. Achieving such synoptic and multidisciplinary observations will involve transects of ice sheet, land and ocean; an enhanced observational network for annual time series measurements; new technologies such as robotic and autonomous observational systems; and enhanced use of satellite observations. Physical processes targeted should include the sea ice thickness distribution and its development, snow cover, ice sheet and glacier mass balance, the polar hydrological cycle, key ocean atmospheric exchanges, and ice shelf – ocean interaction. Key variables and processes to be targeted should include sea ice thickness and extent, snow cover, ocean circulation and stratification, water mass formation, ocean-atmosphere-ice interaction, ice shelf - ocean interaction, carbon storage and export, ecosystem response to physical and chemical forcing, and biodiversity. Questions concerned with polar biodiversity require biodiversity surveys including modern genomic techniques; attribution of functional diversity; spatial and temporal sampling at a variety of scales. Quantitative food-web relations are also important elements in order to understand polar marine ecosystem structure and function. SCAR has proposed a programmed entitled Evolutionary Biology of Antarctica (EBA) focused on mapping the biodiversity of the continent. The programs emphasizing the status of the polar inhabitants require a network of social observatories, comparative case studies and databanks of social realities.

SCAR has proposed that a multinational, multidisciplinary, collaborative dataset will be collected to validate and analyse current physiological, public and occupational health and psychosocial observations, and to provide an ongoing standardized dataset that can be referenced against prior and future research endeavour. Efficient and innovative eHealth and telemedicine technologies will be used and enhanced in the collection and support of this snapshot of human health in polar regions during the IPY.

In addressing this theme it will be critical to develop an integrated, interdisciplinary plan for synoptic observations. The planning process must serve to integrate these activities building a truly multidisciplinary programme and optimizing limited logistical capability. We envision the acquisition of a synoptic set of multidisciplinary observations as a key component of the IPY 2007-2008.

Theme #2 *To quantify, and understand, past and present environmental and human change in the polar regions in order to improve predictions*

Physical, chemical, biological and social processes in the polar regions act together to produce a dynamically changing environment: an environment which has seen major environmental shifts in the past. To provide a framework for interpreting the synoptic observations made during the International Polar Year 2007-2008 it is imperative that significant advances are made in our understanding of the

factors which drive environmental change in the polar regions. It is also imperative that the abilities to both monitor and predict changes in the environment are developed and implemented during the International Polar Year 2007-2008. The target must be to quantify past changes, understand the ongoing changes and improve out ability to monitor and predict future changes. Major questions that will be addressed under this theme include:

a. How are climate, environment, and ecosystems in the polar regions (including high latitude oceans) changing?

b. How has polar diversity responded to long-term changes in climate?

c. What are the inter-hemispheric connections in these changes?

d. How has the planet responded to multiple glacial cycles?

e. What critical factors triggered the cooling of the polar regions?

The activities proposed to quantify, monitor, understand, and predict environmental change were represented by four distinct methodologies. These are the recovery of key paleoclimatic records; documenting the physical factors which controlled past climate change; enhancing modeling capability through reanalysis and improved parameterization; and the development of a long-term observation system.

A primary focus of the climate research strategy for the IPY is to understand, interpret and predict climate variability and change in the polar regions and its impact on processes. The activities undertaken to provide the synoptic snapshot will also deliver the understanding of climate processes needed to improve our ability to predict future change. The enhanced effort to observe the Southern and Arctic Oceans during the IPY will leave a legacy of a long-term observing system capable of documenting change. A well-integrated modeling effort will be necessary. Paleoclimate records are required to document natural variability in the past.

Recovery of key paleo-climatic records was advocated as an activity necessary to quantify the magnitude and to understand mechanisms controlling past environmental changes, and to identify inter-hemispheric connections. The proposed activities cover time scales ranging from tens of million of years (sediment cores in the Arctic Ocean) through hundreds of thousands of years (planning for deep ice cores) and thousands of years (lake cores and circum polar shallow ice cores) to hundreds of years (borehole temperatures and permafrost studies). The recovery of strategic circum polar paleoclimatic records will enable a comprehensive analysis of the polar environment.

A number of proponents advocated the geophysical mapping of key ocean gateways in both the polar regions as well as East Antarctic subglacial features. These features each played important controlling roles in the cooling of the polar regions and represent fundamental boundary conditions for the polar environment today. To understand recent change, proposed activities include meteorological and sea-ice reanalyses, establishment of a comprehensive database of polar climate data, intensification of polar climate studies addressing the role of cryospheric processes and feedbacks, and parameterization of the hydrological cycle of cold regions. This is especially important in the light of recent evidence that the hydrological cycle may be accelerating. Finally, to monitor and predict future change, a combined effort of monitoring and modeling was widely advocated.

Concepts advocated include improvement and further development of the World Weather Watch Global Observing System in the polar regions, including space-based component, enhanced monitoring of the ozone layer and transport of greenhouse gases and aerosols, and the establishment of the Arctic Ocean and the Southern Ocean Observing Systems as well as the Arctic hydrologic cycle observing system**.**

Theme #3 *To advance our understanding of polar - global teleconnections on all scales, and of the processes controlling these interactions.*

Although the polar regions are frequently omitted from political maps of the world, their global influence is profound and far reaching. The polar regions remain the largest source of water capable of causing significant global sea level rise, represent the largest sinks in the global carbon cycle and are

home to some of the world's major fisheries. Just as the polar regions influence global processes the global processes are impacting the poles. Examples include the formation of the ozone hole, the accumulation of pollutants in the Arctic system, and the influence of global satellite communication connectivity on polar residents. The questions which must be addressed in the IPY 2007-2008 teleconnection theme include:

a. What role do the polar regions play in the global carbon cycle?

b. What is the stability of the Earth's major ice masses and what will be their impact on global mean sea level?

c. What are the linkages between the physical, chemical and biological systems in the polar regions?

d. What are the interactions between the polar regions and lower latitudes including linkages through climatic, social, ecologic, and hydrologic processes?

e. How do actors, institutions, relations explain changes at a variety of levels both globally and within the polar regions?

The programs proposed to enhance our understanding of the polar/global connections include physical, biological and social ones. Activities proposed to address these issues include measurements of carbon fluxes in both marine and terrestrial polar ecosystems, improvement of polar meteorological networks and the establishment of an enhanced ocean observing system, analysis of climate indices and data sets, modeling, social surveys**,** and comparative case studies and investigations of living conditions. This theme clearly links with the Antarctica and the Global Climate System (AGCS) focus advanced by SCAR.

Key phenomena to be addressed include the Southern Annular Mode and its impact on the underlying ocean and sea ice; the Antarctic Dipole; the impact of ENSO on Antarctica and the Southern Ocean; the potential for feedback from the polar regions on lower latitude climate; the influence of ACC variability on regional and global climate; and the response of marine ecosystems and carbon fluxes to changes in the physical and chemical environment driven by low-latitude forcing.

Although the activities proposed to the ICSU IPY Planning group were focused on the polar regions, it is clear that coordination with global programs will be necessary to achieve an advanced understanding of the polar - global teleconnections. As the planning progresses increased coordination with WCRP, IGBP and IHDP will be required to achieve this target. An appropriate step forward is collaboration on further developing human dimension themes and the observational initiatives that serve the themes, with a view to ACIA, AMAP and AHDR in order to co-ordinate the overall social science effort in the science plan.

Theme #4 *To investigate the unknowns at the frontiers of science in the polar regions.*

Humans have probed the polar regions, investigating the frontiers of the planet since the people began fishing and hunting in the Arctic as the ice sheets retreated thousands of years ago. Although few geographic frontiers remain on the earth's surface, scientific frontiers remain to be investigated beneath the polar ice sheets and under the ice-covered oceans. Today the new scientific frontiers in the polar regions rest at the intersection of disciplines and are ideally suited as an IPY 2007-2008 theme. Many major questions on the interactions between the icy polar domains and sub-ice ecosystems and the underlying solid earth were raised. The questions which must be addressed by IPY investigations at the scientific frontiers are:

a. What are the characters of the sub-ice and deep ocean polar ecosystems?

b. What is the pattern and structure of polar marine and terrestrial biodiversity, at all trophic levels?

c. How does phylogenetic and functional diversity vary across extreme environments, and what are the evolutionary responses underpinning this variation?

d. What are the nature, composition and morphology of the sea floor and earths crust beneath the polar ice cover?

e. What effect does the solid earth have on ice sheet dynamics?

A diverse range of activities was proposed to address these questions such as the study of sub-glacial lakes and other unknown terrain beneath the Antarctic ice sheet using airborne geophysics, marine geophysical and biological exploration of the Gakkel Ridge and the exploration of Dome A, Antarctica. Tools to support these activities will include seismic and hydrophone networks, rapid access drilling, remotely operated vehicles, sample recovery and genomic studies.

Theme #5 *To use the unique vantage point of the polar regions to develop and enhance observatories studying the Earth's inner core, the Earth's magnetic field, geospace, the Sun and beyond.*

The unique position of the poles on the planet makes them an ideal site for observation of diverse processes. Improved understanding of many processes, such as the rotation of the inner core, the strength of the earth's magnetic dipole, geospace, cosmic ray detection and astronomy, is uniquely benefited by polar observations. A number of well formed proposals were received from disciplinary based groups aiming to use the polar regions as observing platforms. These were complemented by interest in developing broader science agendas for new polar research stations proposed by several National Committees. Questions that can be addressed by polar observations include:

a. How does the neutral atmosphere interact with geospace at the polar regions and what are the consequences?

b. What is the influence of solar processes at the polar regions on earth's climate?

c. What is the state of the earth's magnetic dipole?

d. Is the inner core rotating differentially?

Resolution of some of these issues will require extended (up to 6-month) uninterrupted time-series observations in solar, planetary and stellar astronomy. The proposed activities for the polar observatories were generally mono-disciplinary but reflected well-developed concepts. They included the concept of the International Heliophysical Year, presently supported by an international steering group and the Inter-hemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research (ICESTAR) proposed by SCAR.

Theme #6 *To investigate the cultural, historical, and social processes that shape the resilience and sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship*

Our understanding of the human dimensions of the polar regions—historical, social, and cultural—is immensely greater today than it was in the early days of polar science. Contemporary concepts, methods and theories provide a sound and rigorous basis for the social science community to make key contributions to the outcomes of the International Polar Year 2007/08. Areas of particular importance include issues of partnership and public involvement, both in research and policy formulation, socio-economic development, governance, cultural viability, and the human rights of aboriginal peoples and residents. These societal issues are central to the IPY objective of enhancing the understanding of human-environmental interactions in the polar systems.

Polar societies have been agents of change in their own cultural, socio-economic, and physical environments for millennia, and are instrumental in shaping these changes. The diversity of polar living conditions, along both human and physical dimensions, continues to challenge the capacity of both residents and researchers to assemble and synthesise their knowledge and experience. The multiple functions of knowledge have become increasingly apparent, as our understanding of the Arctic and Antarctic regions has grown more complex. It is recognised that social issues operate at a range of scales, from the local to the global. The need exists to explore and understand better how data are interpreted in multiple and diverse ways, how humans and the environment operate and interact in polar regions, and how internationally coordinated research projects can simultaneously be useful to different constituencies ranging from disciplinary experts to policymakers and local communities.

The forthcoming IPY 2007/08 offers an unprecedented opportunity to examine data from the human environment, past and present, to identify emerging paradigms of development in the Arctic and Antarctic. The well-being of polar peoples has always been closely linked to their understanding of, and adaptation to, their environment. One of the key challenges for the

social sciences and humanities is to conceptualise and understand interdependent human-environmental relations. Research in the social sciences and humanities has changed significantly during the last few decades as social and political conditions have undergone remarkable changes. There is now an inclusion of polar aboriginal peoples as scientific partners in research. The IGY of 1957/58 resulted in the creation of an innovative model of Antarctic governance based on international scientific and political agreements focusing on the continuing presence of humans in that region. The IPY 2007/08 offers a comparable opportunity to advance and facilitate international cooperation in Arctic affairs and, specifically, to recognise the diverse processes that underwrite the ethics of co-operation and partnerships in research.

The social sciences and humanities study the social, cultural, and ethical complexity inherent in diverse human populations. Research goals are defined around the principle of social inclusion focusing on the wide sphere of human activities ranging from local indigenous governance, coordinated environmental research, cultural and linguistic diversity, and national policy-making. Priority issues to be addressed in the IPY 2007/08 under this theme include:

a. How can the "well-ness" of different polar environments be studied in terms of changing socio-political conditions?

b. How can models of governance respond to the divergent and rapidly evolving cultural and socio-economic systems of the polar regions?

c. What research methodologies are best suited to an interdisciplinary understanding of the fundamental links between biological and cultural diversity? How can social sciences, humanities, and fine arts communicate this understanding to diverse audiences?

d. How can historical studies and records of the polar regions enable a better understanding of contemporary social and cultural problems?

e. How can polar residents become more instrumental in shaping the research activities taking place in and around their communities?

The activities proposed to study the viability and sustainability of polar human societies and will be implemented through networks of researchers and experts, both locally and internationally. Methodologies will include structured and semi-structured interview techniques, questionnaire surveys, participant observation, participatory research approaches, archival studies, discourse analysis, and reception theory.

Box 2 WMO Co-sponsorship of IPY 2007-2008

At Fourteenth World Meteorological Congress in May 2003, the WMO approved the concept of an International Polar Year as a means to achieve a broad set of research objectives. This activity was independent of the initial ICSU effort to plan an IPY, but communication was quickly established and at the second Planning Group meeting of the ICSU committee, a suggestion was made by WMO to merge interests in an IPY. The Planning Group recommended this arrangement to the ICSU Executive Board which agreed in February 2004 and a joint ICSU-WMO IPY Organising Committee will be convened following the submission of the Science Plan to the ICSU Executive Board in October 2004.

There are many advantages to this co-sponsorship besides the historical fact that both bodies spawned the IGY. WMO is a leading international scientific organization in many countries and its endorsement of IPY greatly facilitates the involvement of the National Meteorological and Hydrological Services and scientists from those nations in IPY. WMO's political structures connect to the governments of many countries, increasing the possible pool of resources to support IPY. WMO and ICSU already

share in bridging organizations, such as WCRP that have expressed a broad set of programs suitable for IPY.

In their planning, WMO had already set forth many activities intended for IPY (listed in Appendix VI). These activities are particularly relevant to Themes #1, #2 and #3 set out in Section VI of this document. It is expected that these will change as WMO takes advantage of the heightened potential for expanded observations and for establishing new observational networks throughout the polar regions. Such enhancements to their programs serves as an excellent example to other existing or planned programs to view IPY as a means to improve what already exists, to recover what has been lost, and to expand what has been planned. It is the intent of IPY to neither degrade nor diminish any of the excellent programs addressing issues of the polar regions, but to be an enabling and enhancing activity enriching them all and to accelerate research initiatives that would otherwise be slow to emerge.

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7. NEW OBSERVATIONAL SYSTEMS

Like the previous IPY's and the IGY, the International Polar Year 2007-2008 will be limited in time. This fact encourages activities that focus on data collection and that utilize the potential of increased coordination of logistic assets. Many submitted ideas recognized this and incorporated it in their inputs in various ways. Often similar activities, sampling strategies and field programs were proposed by different discipline based groups. At the same time, similar activities were advocated by a several national or even different multinational groups. Observational systems or observational programs emerged to address each scientific theme. We hope our view of observations that serve multiple disciplines will prompt groups with a more disciplinary focus to consider and discuss how to make their observational needs more interdisciplinary and thus increase the overall value of their possible IPY contribution. Similarly, we hope the overlapping national and multinational groups will be able to build an effective interdisciplinary, international program achievable within the IPY timeframe. The linkage between time-limited research campaigns and long-term monitoring is often problematic for funding agencies in many countries. Yet some of the key scientific questions facing mankind in our time can only be properly addressed if long-term funding of cost-effective observational networks is secured. Thus, one of the main contributions of the IPY could be to serve as a framework for development and testing of a range of modern observational technologies, accompanied by science addressing integration and interpretation of observations.

Below we present the emerging observational systems that serve the scientific themes. We hope this synthesis stimulates the next level of discussion, debate and planning.

A synoptic set of multidisciplinary observations to establish the status of the polar environment in 2007-2008

This synoptic set of multidisciplinary observations is targeted at establishing the status of the polar environment during the International Polar Year 2007-2008, providing future generations with a benchmark for future change and furthering our understanding of the recent changes. These activities may include coordinated polar transects, deployment of instrumentation in inaccessible regions, collection of satellite data and collection of records of changing polar environments. As programs are designed for the IPY, high impact, interdisciplinary activities, incremental to the main focus of a program must continuously be considered. For example, it will be useful to encourage the making of bird counts from ships, to provide the data needed for a comparison with the 20-year old BIOMASS data set, as the basis for a study of the variability of diversity with time., wide use of continuous plankton recorders to obtain comprehensive coverage of upper ocean plankton around in the polar regions, single beam and multi-beam echo-sounders are essential for marine geological studies and for defining the shape of the seabed for ocean modeling and, multiple use should be made of proposed trans-Antarctic traverses, for integrated geological, glaciological, geophysical, atmospheric and biological data collection.

Internationally coordinated field transects supported by ships, aircraft and traverse vehicles were proposed by a broad range of disciplinary based scientists from biologists interested in the Census of Marine life and genetic diversity of polar organisms to oceanographers interested in the state of polar sea ice and water masses to geodetic scientists interested in the form of post-glacial rebound at the

poles. Bipolar comparative biological studies are also likely to significantly improve our understanding of how severe climatic constraints have shaped life both on the organismal and the ecosystem level, particularly in partially isolated polar environments. Transects of the atmospheric and oceanic conditions were proposed by several groups. A focused international coordinated program is being advanced by Southern Ocean Clivar targeting several new frontiers. The strategy outlines an integrated, interdisciplinary plan for synoptic observations of the Southern Ocean environment during the IPY. The program will document temporal and spatial variability of Southern Ocean climate, ecosystems, and their interactions. The goals will be to obtain the first circumpolar snapshot of the Southern Ocean environment, including physical, ecological and biogeochemical properties, measure the circumpolar volume (extent and thickness) of Antarctic sea ice through an annual cycle for the first time and observe the sub-ice ocean circulation, water mass properties and biological distributions. New technologies such as autonomous underwater vehicles, acoustically-tracked floats and gliders, and ice-tethered platforms make it possible to tackle these challenges during the IPY. These marine programs were complemented by the concept of installing instrumentation along the ice divides of the Antarctic continent by traverses and the expansion of the WMO meteorological network. A number of groups advocated establishing baseline observation of polar ecosystems which we have reflected with the concept of mapping polar biodiversity along transects.

The cryosphere is an important element of the Earth System, but probably its most undersampled part. Through several feedbacks it has a large effect on the predictability of weather and climate change. It plays an important role in generating and mediating the conditions for possible abrupt climate change. It is one of the factors of largest uncertainty in determining contributions to mean sea level rise. A framework is needed for improved coordination of cryospheric observations, and for improving the generation of the data and information needed by the research and operational forecasting and climate forecasting communities. The community needs, in particular: (i) validated remote sensing and in situ observations of the land-based cryosphere that are capable of providing a complete picture of precipitation and accumulation; (ii) comprehensive observations of sea-ice characteristics; and (iii) a significantly enhanced monitoring system for ice sheets, ice caps and glaciers.

Complementing the programs of underway observations along set transects were a series of proposals to deploy permanent or semi-permanent instruments in inaccessible regions. In general, these proposed deployments were very discipline based. Some efforts clearly would benefit by bringing together the discipline-based proposals. For example, there were proposals to install polar oceanographic moorings and a polar seismometer network. Merging these efforts would optimize logistics and enhance interdisciplinary work. Similarly meteorological instrumentation could be merged with geodetic instrumentation.

The third prime measurement strategy that will be a critical facet of the International Polar Year 2007-2008 is a coordinated satellite imaging of the polar regions. Existing satellites obtain information across much of the electromagnetic spectrum and provide high spatial and temporal resolution data over the polar regions**.** A number of additional missions under development, such as Cryosat, have a specific polar mission. Coordination of satellite observations from this international suite of sensors, and additional focus by higher-data rate sensors that do not collect data continuously would secure valuable benchmark data sets and advance the effort to assess the environmental status of the polar regions.

The fourth measurement strategy that was highlighted in the presentation of polar year ideas was the collection of key proxies for changes in climate. These proxies include circumpolar ice cores in high accumulation regions to track the spatial variability in recent change in climate, systematic measurement of borehole temperatures in the polar regions and study of permafrost boreholes.

The acquisition of key data sets necessary to understand factors controlling change in the polar environment

A number of concepts were advanced for internationally coordinated mapping of key marine and continental sites that have played important roles in controlling the nature of polar environments including marine studies of the Antarctic and Arctic Gateways. On the continental side, a wide range of aerogeophysical surveys were proposed both to support the acquisition of a long palaeoclimate record as advocated by the International Ice Core Working Group and to determine the controlling topography of the onset of Antarctic Glaciations as suggested by several international groups. These surveying

efforts were complemented by proposals for internationally collection of targeted paleoclimatic data sets such as drilling in the Arctic Ocean and the Cenozoic Antarctic Climate Evolution (CACE) advanced by SCAR.

The establishment of a legacy of multidisciplinary observational networks

The intensive activity of the IPY 2007-2008 will extend measurements to include observations of linked physical, biological, and chemical observations of the atmosphere, oceans, ice, and land, and will improve spatial and temporal coverage to provide a critical benchmark data set for assessing the state of the polar environment. The infrastructure developed during the IPY 2007-2008 will provide for long-term, spatially distributed interdisciplinary observing networks to understand the polar regions in the coming years and decades. The development and installation of international, long-term, multi-disciplinary observing networks could be a particularly significant legacy of the IPY. These observing systems would provide scientists and decision-makers with real time information on the evolving state of the poles for decades to come. Stations that remain relatively fixed in place, such as on land or on stable ice sheets, as well as stations moving with the ice and the seas, should be developed to integrate physical, biological, and chemical measurements.

The past polar years targeted intensive observational periods and many of the measurements begun in the 1950's during the International Geophysical Year now form the basis for our understanding of how the Earth is changing. The widely articulated vision for the IPY 2007-2008 is for the intensive observation period to be followed by the establishment of both Arctic and Antarctic multidisciplinary observing networks. These observation networks range from the meteorological stations in the Arctic to the installation of seismometers in a pinwheel array in Antarctica. Our vision is that the jointly sponsored ICSU-WMO International Polar Year 2007-2008 will leave a legacy observation network which will leverage the critical communication and power infrastructure which form the backbone of any permanent observation site to underpin a wide variety of observation from a broad range of disciplines. The net results will be collocated observation measuring such diverse features as the earth's atmospheric, oceanographic, magnetosphere, seismic structure of the lithosphere and mantle and isocratic rebound. These permanent stations will enable future scientists to isolate short-term variability from long-term change from climate to the earth's magnetic dipole. In the same way that IGY "opened" Antarctica for science, the IPY 2007-2008 can be envisaged as potentially a vehicle to provide an upward shift in science access to the Arctic.

International coordination has already started by the development an Arctic Ocean Observatory System (AOOS) that would be articulated around four main components: (1) a space component based on remote sensing, satellite data transmission and precise geolocations, (2) a surface component based on ice-tethered platforms (ITP) equipped with sensors for meteorological, sea ice and oceanographic observations, (3) an underwater component based on autonomous underwater ballast controlled floats equipped with ice profiling upward looking sonars (ULS), gliders equipped with CTD and acoustic transceivers for navigation and ocean thermometry, and (4) an integrated component dedicated to data analysis and data integration in numerical models to bridge gaps and develop interactions and synergies between observations and models. In combination with several initiatives for synoptic surveys of the Arctic Ocean and the Nordic Seas, monitoring of gateways and studies of processes like shelf-basin interaction could be a core project of IPY

The launch of internationally-coordinated, multidisciplinary expeditions into new scientific frontiers

Many proposals for the IPY 2007-2008 addressed new scientific frontiers. In earlier IPY and IGY research programs, science-driven exploration of new geographical regions was a major activity. In the IPY 2007-2008, only limited regions of the earth's surface, such as parts of East Antarctica, remain unexplored in the traditional geographic sense. Yet new scientific frontiers and challenges have emerged taking advantage of new disciplines and technologies unknown in the previous IPYs and the IGY.

Several major expeditions to new frontiers were proposed by the international community. These include an expedition mapping the biodiversity of the Gakkel Ridge, an interdisciplinary study of the Gamburtsev Mountains, and exploring the extremophiles of the Antarctic subglacial environments. The exploration of subglacial lakes has been advanced by SCAR as a major focus for the IPY through the SALE group. The IPY offers the opportunity to focus geological attention on areas that are still

unknowns, like the Gamburtsev Mountains. There is no continent on Earth other than Antarctica that has a huge central mountain range for which an explanation in terms of plate tectonics does not exist. SCAR geoscientists propose during IPY to investigate the subglacial highlands of the Gamburtsev Mountains that are hidden beneath the East Antarctic Ice Sheet through satellite remote sensing, airborne geophysical survey and overland traverses and ice drilling. This challenge will not be met without the pooling of resources, international collaboration and impetus provided by IPY. It will challenge and capture the imagination of a new generation of Antarctic scientists, provide a legacy for future generations of climatic modellers, and provide ample opportunities for human capacity building and incorporation of scientific personnel from countries not usually involved in polar research

The implementation of polar observatories to study important facets of Planet Earth and beyond

Many of the proposals highlighted facets of the earth, the geospace, the Sun, the solar system and beyond which can be best studied from the polar regions. Simultaneously several groups indicated the development of new polar stations. The establishment of new stations and enhanced activity at existing stations presents a unique opportunity for the International Polar Year to establish a new suite of observatories at polar stations. Ideally the implementation of these observatories would be coordinated to optimize the use of logistics and encourage the sharing of data. The proposed observatories ranged in focus from the inner core to atmospheric physics to the heliosphere and studies of neutrinos. This effort would embrace the developing initiative to have an International Heliosphere Year during 2007. SCAR is organizing an intitiative entitledInter-hemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research (ICESTAR) which could play a major role in the implementation of polar observatories. This program would take exploit of large arrays of observatories are already in place for upper atmosphere and geospace measurements enabling very effective comparisons between the two hemispheres. Synergies facilitiated throught the IPY planning have the potential to assess the viability of Dome A for a large diameter telescope capable of exploration into deep space.

The creation of datasets on the changing conditions of circumpolar human societies from the First IPY 1882-83 to the present.

The approach to datasets in the social sciences and humanities aspires to many of the same requirements that apply to the natural sciences, such as, calibration, standardisation, geographic transects and inter-comparisons, time series, etc. Social observations are, similarly, conducted at different scale levels, from community to the entire circumpolar region; co-operation and data transparency are essential parts of research design. The IPY 2007/08 presents an opportunity for researchers in the social sciences and humanities to transcend national boundaries through international cooperation and coordination, and thereby creating new datasets that document and characterise the most important transitions in polar societies. Social observation offers the most opportune means to engage polar residents in the IPY research and data collecting process.

Efforts will be made to ensure that data collected during the IPY 2007/08 are useful to multiple disciplines and to wider audiences. Some datasets will aim to be circumpolar in their domain, particularly those where cultural, socio-economic, and historical indicators can be measured at a macro scale. Others will be comparative at the regional and local scales, in order to give attention to the processes on the national, regional, and local levels. Resident experts and their communities will be active partners in building the IPY datasets to be shared with the polar peoples at all levels. The creation of compatible and internationally shared datasets will ensure that the data are relevant and useful to multiple audiences, including researchers, indigenous peoples, policymakers, and the public at large.

To enhance the public awareness and understanding of scientific work, IPY projects will use technologies and engage in practices that enable the data to be widely used in outreach programmes, education, and efforts of 'knowledge repatriation'. These activities will expand scientific literacy among students, the general public, and polar residents.

SCAR proposes that a multinational, multidisciplinary, collaborative dataset will be collected to validate and analyse current physiological, public and occupational health and psychosocial observations, and to provide an ongoing standardized dataset that can be referenced against prior and future research endeavour. Efficient and innovative eHealth and telemedicine technologies will be

used and enhanced in the collection and support of this snapshot of human health in polar regions during the IPY.

8. AN EMERGING VISION: THE POTENTIAL IMPACT OF IPY ON POLAR SCIENCE

The IPY 2007-2008 concept has tapped a powerful vein of enthusiasm and excitement within the scientific community. We believe that this in part derives from the universal awareness that IGY was a seminal event in geophysics. The IGY, and past IPY's, are an inspiring heritage. The IGY, in particular, fundamentally changed how earth and space science is conducted and resonated far beyond the initial years of exploration and research**.**

The IPY aspires to the same goals of improving our knowledge of earth, space and culture, advancing technology and international science, and engendering a new awareness of our planet. The IPY aims to provide scientists with the opportunity to go where they could not go before, to collect data in ways they have not done before, and to establish monitoring systems where none existed before. Breakthroughs and insights will follow.

Logistic capabilities and funding have limits, but the innovation and imagination of the polar science community do not. It is through the creativity of the individuals who are stimulated by the IPY concept that the potential impact of IPY will be determined. The stage is now set to make significant and enduring advances in polar science. It is the intent of IPY to foster new research ideas and methods including accelerating initiatives that would otherwise be slow to emerge.

Many of the hindrances to cooperation, understanding and knowledge are of our own making. IGY succeeded at the height of Cold War tensions and in an era when international bodies to coordinate science were few and far between. IPY 2007-2008 will be implemented in the age when the world is confronting new and different tensions, and with need to work with a dizzying number of international organizations, both scientific and political, each with a mandate to foster and guide internationally coordinated polar science. Shared involvement in the design, development and placement of innovative observing systems can provide a basis to establish key roles for these organizations to realize the extraordinary promise of IPY.

While we encourage the increase of interdisciplinary research, we explicitly seek to lower the boundary between social science and natural science. The polar regions are home to residents many of whom live in very close contact with their environment. Environmental change impacts them directly and rapid change can be destructive. Our aim is to engage those peoples and high latitude peoples more generally in the purpose and execution of the Polar Year from an early stage.

Polar regions are less remote to the rest of the planet than is commonly assumed. Humans, both polar residents and others, impact the polar regions leading to both environmental and climatic consequences, some understood, some not. For everyone's sake, we must accelerate our understanding of these linkages and consequences.

By focusing our collective attention on IPY, we have begun to focus the attention of the world on the polar regions. This opportunity has abundant potential to impress upon people in all walks of life the multitude of ways that the polar regions are important to every person on Earth. Youth that are inspired to scientific or technical careers or that come to appreciate the importance of the polar regions and its stewardship as part of a closely linked climate and cultural system will give the IPY enduring impact.

We can plan for what we determine is most essential to accomplish during the relatively brief 24-month formal period of IPY, but it is expected that IPY will leave a scientific legacy that will extend well beyond the lifetime of the project itself. Among these will be detailed, comprehensive multidisciplinary data sets for the IPY period that will provide both a base-line against which to assess future change and a resource for validation of a hierarchy of developing models.

IPY activities will also contribute to future operational earth observation and ongoing monitoring in polar regions through enhancement of the long-term monitoring network, definition of an optimal and

most cost effective data collection strategy, and improved calibration and interpretation of satellite data.

There are also likely to be benefits that are entirely unplanned and that become clear only after the formal IPY period has ended. We foresee that polar science in the post-IPY era will be vastly improved. Well-thought out and coordinated investments in time, technology, money, and logistics will create a research environment where fresh ideas seeded by existing, recovered and new data drive newly enlightened researchers to new discoveries about the polar regions and our world. It is this final legacy - the next generation of polar scientists, trained and enthused during IPY 2007-08 – that will be one of the most important.