A Framework for the International Polar Year 2007-2008

Produced by the ICSU IPY 2007-2008 Planning Group

Strengthening international science
for the benefit of society

ICSU
International Council for Science

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ICSU's extensive membership network constitutes an international forum for scientific research and policy development.

In broader terms, because of its representative and diverse membership, the Council is increasingly called upon to speak on behalf of the global scientific community and to act as an advisor in matters ranging from ethics to the environment.

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Executive Summary

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. Within them lie frontiers of knowledge as well as unique vantage points for science.

Yet because of their remoteness and harsh nature, the poles remain insufficiently studied. With recent technological advances providing new scientific possibilities, and humankind's need for environmental knowledge and understanding ever increasing, the time is ripe for a coordinated international initiative to achieve a major advance in polar science.

For this reason, the International Council for Science (ICSU) decided to take the lead in organizing an International Polar Year (IPY) in 2007-2008. They did so by establishing an IPY Planning Group (PG) charged with developing the IPY 2007-2008 science plan and implementation strategy.

This report is the outcome of the PG's work. It is based on input from individuals, from over 40 governmental and non-governmental organizations that have endorsed or expressed support for IPY 2007-2008, and from the 32 IPY National Committees or National Points of Contact established so far. It is also results from discussions and debate at over a dozen international meetings covering the gamut of science disciplines, from a series of "town" meetings, and from two Discussion Forums hosted by ICSU and attended by representatives of the IPY National Committees and a variety of interested polar organizations.

In all, more than 490 "ideas" for the scientific content of IPY 2007-2008 have been received. These have been made available to the community worldwide via the IPY 2007-2008 website (www.ipy.org). The site currently receives an average of 2000 hits per day. Over 12,000 copies of earlier versions of this document have been downloaded, as have over 3000 copies of a PowerPoint presentation describing the planning of IPY 2007-2008.

The fundamental concept of the IPY 2007-2008 is of an intensive burst of internationally coordinated, interdisciplinary, scientific research and observations focused on the Earth's polar regions. The official observing period of the IPY will be from 1 March 2007 until 1 March 2009. The main geographic focus will be the Earth's high latitudes, but studies in any region relevant to the understanding of polar processes or phenomena will be encouraged.

The IPY aims to exploit the intellectual resources and science assets of nations worldwide to make major advances in polar knowledge and understanding, while leaving a legacy of new or enhanced observational systems, facilities and infrastructure. Arguably the most important legacies will be a new generation of polar scientists and engineers, as well as an exceptional level of interest and participation from polar residents, schoolchildren, the general public, and decision-makers, worldwide.

Six IPY research themes have been defined as follows:

1. *Status:* to determine the present environmental status of the polar regions;
2. *Change:* to quantify, and understand, past and present natural environmental and social change in the polar regions; and to improve projections of future change;
3. *Global Linkages:* to advance understanding on all scales of the links and interactions between polar regions and the rest of the globe, and of the processes controlling these;
4. *New Frontiers:* to investigate the frontiers of science in the polar regions;
5. *Vantage Point:* to use the unique vantage point of the polar regions to develop and enhance observatories from the interior of the Earth to the Sun and the cosmos beyond;
6. *Human Dimension:* to investigate the cultural, historical, and social processes that shape the sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship.

In pursuing these themes, IPY 2007-2008 will seek to exploit new technological and logistical capabilities, and to make major advances in knowledge and understanding. It aims to leave a legacy of new or enhanced observational systems, facilities and infrastructure, numerical Earth simulators, and research networks, as well as an unprecedented degree of access to the data and information it will generate.

To address the six major research themes, six interdisciplinary observational strategies have been advanced:

1. to establish a baseline for identifying future change, a synoptic set of multidisciplinary observations is proposed to establish the status of the polar environments in 2007-2008;
2. to quantify and understand past present and future change at the poles, plans have been proposed to acquire key data sets necessary to understand factors controlling change in the polar environment;
3. to enable future generations to better identify the global linkages between the poles and the rest of the planet will necessitate the establishment of a legacy of multidisciplinary observational networks;
4. to investigate the frontiers of science which will trigger the launching of coordinated, multidisciplinary and multinational investigations;

5. leveraging the unique vantage point of the polar regions will result in the implementation of polar observatories to study important facets of Planet Earth and beyond;
6. to investigate crucial facets of the human dimension of the polar regions which will lead to the creation of datasets on the changing conditions of circumpolar human societies.

The polar regions provide a powerful context for teaching and learning, attracting a wide and diverse audience. Education, outreach and communication with the media must be an integral component of each major IPY 2007-2008 activity and will be a required part of Polar Year projects. Some activities have global reach, such as synoptic measurements of the global environment, and others are nationally focused, such as educational activities woven into primary school curricula.

To be successful, IPY needs a sound organizational structure that promotes efficient communication, attracts excellent people, and makes effective use of existing polar organizations. The core participants of IPY 2007-2008 will be self-organizing groups of researchers, their parent organizations, existing bodies with a role in polar regions research and monitoring, and consortia of such bodies. Each IPY 2007-2008 project will have a Project Steering Committee (PSC) responsible for the detailed planning, execution and reporting of science, data and education activities. National Committees will coordinate participation and support at the national level. Existing international bodies, both governmental and non-governmental, established for coordination or support of international initiatives in the polar regions, are also significant for IPY 2007-2008. The potential exists for organizational arrangements to be established which imaginatively and cost-effectively draw upon the effort, funding and influence of these existing bodies to implement the IPY, while at the same time satisfying their specific interests in an IPY involvement and not compromising their current activities.

An IPY Joint Committee (JC), established by ICSU and the World Meteorological Organization (WMO), will be responsible for overall scientific planning, coordination, guidance and oversight of the International Polar Year 2007-2008, supported by an International Programme Office (IPO). A Consultative Forum (CF) will provide the means for dialogue amongst the wide range of IPY 2007-2008 stakeholders, and a vehicle for guiding the JC on IPY 2007-2008 development.

The Joint Committee will establish at least two Sub-Committees. Those already identified are the Education, Outreach and Communication (EOC) Committee and the Data Policy and Management (DPM) Committee. The DPM Committee will need to be complemented by a full-time, professional data and information unit to manage IPY 2007-2008 data. Free and open data exchange, as well as metadata standards and guidelines will be important data issues for IPY 2007-2008 to be successful. All IPY 2007-2008 endorsed projects and the respective participants must agree to an IPY data and information management policy and submit project information (metadata) and data to an agreed timetable.

Time is short for the planning of polar logistics, so the most pressing next step will be the Call by ICSU and WMO for expressions of intent for the IPY 2007-2008 science activities. The deadline for submission in this Call will be 14 January, 2005. The PG therefore recommends that this and the provision to the research community of information on the process to be adopted should be pursued as a matter of urgency.

1. Science Plan

1.1 CONCEPT OF THE INTERNATIONAL POLAR YEAR 2007-2008

The concept of the International Polar Year (IPY) 2007-2008 is of an intensive burst of internationally coordinated, interdisciplinary, scientific research and observations focused on the Earth's polar regions.

The research will address six themes as follows:

1. *Status:* to determine the present environmental status of the polar regions;
2. *Change:* to quantify, and understand, past and present natural environmental and social change in the polar regions; and to improve projections of future change;
3. *Global Linkages:* to advance understanding on all scales of the links and interactions between polar regions and the rest of the globe, and of the processes controlling these;
4. *New Frontiers:* to investigate the frontiers of science in the polar regions;
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In pursuing these themes, IPY 2007-2008 will seek to exploit new technological and logistical capabilities, and to make major advances in knowledge and understanding. It aims to leave a legacy of new or enhanced observational systems, facilities and infrastructure, numerical Earth simulators, and research networks, as well as an unprecedented degree of access to the data and information it will generate. Key objectives are to attract and develop the next generation of polar researchers and engineers, and to engage the interest and involvement of polar residents, and of schoolchildren, the general public, and decision-makers, worldwide.

The official observing period of IPY 2007-2008 will be from 1 March 2007 until 1 March 2009. The main geographic focus will be the Earth's high latitudes, but studies in any region relevant to the understanding of polar processes or phenomena will be encouraged.

1.2 HISTORY

The first internationally coordinated study of the polar regions took place some 125 years ago, sponsored by the International Meteorological Organization (IMO), a predecessor of the World Meteorological Organization (WMO). The scientific goals of the International Polar Year (1882-1883) were to address geophysical phenomena that were beyond the capabilities of any single nation. Twelve nations carried out 15 expeditions, 13 to the Arctic and 2 to peri-Antarctic islands, resulting in important scientific advances and the exploration of new terrain. The first IPY set a precedent for international cooperation in the realm of science.

The second IPY was held in 1932-1933, also with the sponsorship of the IMO. It accomplished significant advances in meteorology, magnetism, atmospheric science, and the understanding of ionospheric phenomena. Forty nations participated in spite of the economic constraints of the Great Depression.

The International Geophysical Year (IGY) of 1957-1958, sponsored jointly by the International Council for Science (ICSU) and WMO, brought together 67 nations to exploit the many technologies developed during World War II. The accomplishments of IGY are too numerous to list, but include the discovery of the Van Allen Radiation Belts encircling the Earth, the first estimates of the size of Antarctica's ice mass, and confirmation of the theory of continental drift. The IGY resulted in at least one major geopolitical advance, the Antarctic Treaty System. Taking place at the height of the Cold War, the IGY demonstrated that even in tense political and economic times, scientists from around the world could work together for the betterment of humankind.

1.3 RATIONALE

The polar regions are integral components of the Earth system. They couple to global climate, sea level, biogeochemical cycles, ecosystems, and human activities. Through these connections, the Earth's high latitudes respond to, amplify, and drive changes elsewhere. At a time when humans are exerting an increasing impact on the planet, and when the human condition is increasingly affected by global changes, the polar regions are especially important and relevant.

New technological capabilities offer the potential to make major advance in polar science. These include satellite remote sensing, autonomous instruments and platforms capable of operating in extreme conditions of cold and darkness, high bandwidth global communications systems, and high powered numerical Earth System Simulators. The time is ripe to exploit these to achieve significant scientific advances.

However, the scope and scale of the polar research challenges lie beyond the capabilities of individual nations or traditional scientific disciplines. Numerous bodies exist to stimulate and coordinate multinational and multidisciplinary polar research activities, but the current rate of advances do not fulfil the urgent needs of policy makers to be provided with key information to underpin sustainable economic development. By stimulating and guiding an intense burst of effort, IPY 2007-2008 aims to accelerate progress towards providing the required policy-relevant answers.

More generally, the rationale for IPY 2007-2008 can be

summarised as follows:

• Why International?

- Polar processes extend across national boundaries.
- The science challenge exceeds the capabilities of any one nation.
- An internationally coordinated approach maximizes cost effectiveness and the use of finite resources and assets.
- The new knowledge and understanding generated by IPY 2007-2008 will be of worldwide relevance.

• 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 (especially the Arctic) are of growing economic and geopolitical importance.
- 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 wide 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.
- An (extended) year provides an opportunity for observations in both polar regions throughout the seasonal cycle.

• 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.
- The timescale for preparations allows advances in technology and logistics to be exploited to address new issues and to access new areas.

1.4 VISION: THE POTENTIAL IMPACT OF THE IPY 2007-2008

The IPY 2007-2008 has tapped a powerful vein of enthusiasm and energy within the scientific community. This in part derives from the wide recognition of the seminal nature of the IGY. The IGY fundamentally changed how earth and space science is conducted and reverberated far beyond the initial years of exploration and research. The IGY of 1957-58 and its IPY predecessors provide an inspiring heritage.

At a time of significant change on the planetary scale, IPY 2007-2008 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, creativity and imagination of the polar science community do not. The stage is now set to make significant and enduring advances in polar science. It is the intent of IPY 2007-2008 to foster new research ideas and methods including accelerating initiatives that would otherwise be slow to emerge.

By focusing collective attention on IPY 2007-2008, the world's attention has begun to focus 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 of their stewardship as part of an intimately linked climate and cultural system will give IPY 2007-2008 enduring impact.

There are likely to be benefits that are entirely unplanned and that become clear only after the formal IPY period has ended. It is foreseen that polar science in the post-IPY 2007-2008 era will be vastly strengthened and improved. Fresh ideas seeded by examination of existing and new data will drive 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 2007-2008 – that will be one of the most important.

1.5 OBJECTIVES OF THE IPY 2007-2008

The ICSU Executive Board established the IPY 2007-2008 Planning Group (PG) in June 2003. Its Terms of Reference are given in Annex 1. It has consulted widely with the international research community and on the basis of those consultations and of its own considerations it has defined the objectives for an IPY 2007-2008 as follows:

The IPY 2007-2008 should be an intensive and internationally coordinated campaign of high quality research activities and observations in the polar regions that would not otherwise be undertaken. It will have an interdisciplinary emphasis, with active inclusion of the social sciences. The IPY 2007-2008 is intended 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, the IPY 2007-2008 should leave a legacy of observing sites, facilities and systems to support ongoing polar research and monitoring. The Polar Year will strengthen international coordination of research and enhance international collaboration and cooperation in polar regions. Given the present understanding of the poles as key components of a global system, the IPY 2007-2008

programmes 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 2007-2008 programmes will collect 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 IPY 2007-2008 will be made available in an open and timely manner. It 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 2007-2008 projects 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, projects developed as part of the Polar Year must optimise exploitation of available polar observing systems, logistical assets and infrastructure, and develop and embrace new technological and logistical capabilities.

1.6 CHARACTERISTICS OF IPY 2007-2008 PROJECTS

All IPY 2007-2008 activities are expected to be high quality science, judged by the standard peer review processes for normal scientific funding, with the potential to make significant advances in our understanding.

In addition, the PG defined the following characteristics of an IPY 2007-2008 activity:

1. addresses one or both polar regions and, where possible, their global relevance;
2. has the potential to make significant advances within one or more of the IPY themes;
3. is an intensive, time-limited burst of scientific activity that takes place primarily during the IPY timeframe;
4. contributes to international collaboration and coordination;
5. is logistically and technically feasible within the IPY 2007-2008 timeframe;
6. avoids duplication or disruption of established initiatives and plans;
7. provides open and timely access to data and encourages the long-term management of IPY data and information;
8. follows guidelines, as appropriate, to be ethically and environmentally sensitive;
9. maximizes effective utilization of available logistical assets, as appropriate;
10. explicitly includes roles and tasks for young scientists, and technical and logistics experts;
11. includes specific outreach activities.

Additional desirable characteristics are that it:

1. leaves a legacy of data, observing sites, facilities and systems to support ongoing polar research and monitoring, and to provide value to future generations. Builds on and adds value to existing or planned activities, where relevant;
2. incorporates an interdisciplinary approach or the potential for interdisciplinary synthesis;
3. facilitates international access to field sites;
4. catalyses the broader involvement of nations in polar research;
5. addresses training and capacity building;
6. provides opportunities for regional scholarship within broader international activities;
7. is readily communicable to the public.

1.7 THEMES FOR THE IPY 2007-2008

The six scientific themes for IPY 2007-2008 have been developed from extensive input from the polar science community and are intended to provide a framework for the specific activities comprising the IPY 2007-2008.

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

1.7.1 Theme #1: To determine the present environmental status of the polar regions

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 that is occurring in the polar regions has increasingly significant global ramifications. Well-planned synoptic observations of the environmental status of the polar regions will serve as a valuable benchmark for scientists and decision-makers globally. Consequently a key output of the IPY 2007-2008 will be to document contemporary natural and human environments of the polar regions, quantifying their spatial and short-term variability and characterizing present day processes.

Characterising the natural and human environments of the polar regions, and their short-term variability, should address questions such as:

1. What are the current composition and the patterns of circulation of the high latitude ocean-atmosphere-ice system; and what are the interactive processes that drive high-latitude circulation?
2. What is the present status of demography, health and educational conditions, language, economy, access to infrastructure, etc. of polar peoples, and how do these vary regionally and in time. What are the contemporary factors of social cohesion and values for polar societies?
3. How do the structure and function of polar ecosystems vary through space and time and how much of this variation can be attributed to anthropogenic causes?

4. How do human societies interact with the present natural environment of polar regions, and with its spatial and temporal variability?

This theme requires development of an integrated, interdisciplinary plan for synoptic observations that will capture the modern environmental status of the poles and document the current spatial variability. It must include integrated physical, biological and social observational programmes. Achieving such synoptic and multidisciplinary observations will involve social surveys; transects of ice sheets, land and ocean; an enhanced observational network for annual time series measurements and gradients; new technologies such as robotic and autonomous observational systems; and enhanced use of satellite observations.

Key variables and processes to be targeted should include sea ice thickness distribution and its development, ocean circulation and stratification, water mass modification, ocean-atmosphere-ice interaction, ice shelf-ocean interaction, ice sheet and glacier mass balance, snow cover, the polar hydrological cycle, carbon storage and export, ecosystem response to physical and chemical forcing, and biodiversity. Questions concerned with polar biodiversity require biodiversity surveys including those based on modern genomic techniques; attribution of functional diversity; and spatial and temporal sampling at a variety of scales. The further development of quantitative food-webs is required to enhance understanding of polar marine ecosystem structure and function.

Programmes emphasizing the status of the polar inhabitants require a network of social observatories, comparative case studies and databanks of social realities. Physiological, public and occupational health and psycho-social observations can utilize efficient and innovative health and telemedicine technologies to provide an IPY 2007-2008 snapshot of human health in polar regions that is a reference for prior and future research. Interactions between social and natural environments, for example the significant impact on indigenous hunting and on the economically important fishing industry that would occur with changes in sea ice and water temperatures, are an important component of this theme.

1.7.2 Theme #2: To quantify, and understand, past and present natural environmental and social change in the polar regions; and to improve projections of future change

Physical, chemical, biological and social processes in the polar regions together produce a dynamic environment: a natural environment which has seen major changes in the past and a social environment which is currently experiencing rapid change. To provide a framework for interpreting the synoptic observations made during IPY 2007-2008 we need to advance our understanding of the factors which drive natural environment and social change in the polar regions, and to develop and implement better systems to both monitor and predict future changes. The physical and chemical processes and interactions which determine change in the polar cryosphere, and their resultant impacts on the total Earth system, is one priority target. Also important are processes in the polar hydrological cycle, stratospheric processes, and socio-economic consequences of, and feedbacks on, environmental change. Our overall objectives must be to quantify past changes, understand present and ongoing changes and to improve out ability to monitor and predict future changes over a range of time and space scales.

Major questions that might be addressed under this theme include:

1. How are the atmosphere, cryosphere, hydrosphere, high-latitude oceans, ecosystems and social systems changing in polar regions?
2. How has polar biodiversity responded to long-term changes in climate?
3. What are the socio-economic consequences of environmental changes in polar regions, and how do polar communities respond to and interact with change?
4. How will mass balance changes on the polar ice sheets impact global sea level over the next 100 years?
5. How has the planet responded to past multiple glacial cycles, and what critical factors triggered the cooling of the polar regions?

Quantifying, monitoring, understanding, and predicting environmental change can be done with a variety of methodologies. These include the recovery of historical, archaeological and paleoclimatic records; documenting the physical factors which controlled past climate change; enhancing modelling capability through re-analysis and improved parameterization; and development of a long-term observation system. Socio-economic studies need to consider the consequences of these natural environmental changes on polar communities.

Strategically located circumpolar paleoclimatic records are required to quantify the magnitude and natural variability of past environmental changes, to better understand the mechanisms controlling these, and to identify inter-hemispheric connections. Potential activities within IPY 2007-2008 cover time scales ranging from tens of million of years (ocean sediment cores) through hundreds of thousands of years (deep ice cores) and thousands of years (lake cores and shallow ice cores) to hundreds of years (borehole temperatures and permafrost studies). Geophysical mapping of the key ocean gateways in both hemispheres is needed to understand the important roles they played in controlling the past cooling of the polar regions, and the fundamental role they continue to play as boundary conditions for the modern polar environment. Present and future sea level changes are directly related to ice mass balance changes which must be addressed through satellite and surface measurements in combination with modelling forced by high resolution atmospheric data from meteorological re-analyses.

Activities necessary to understand more recent change include meteorological, ocean and sea-ice reanalyses; collation of a comprehensive database of polar weather, climate, cryosphere, ocean, ecosystem and socio-economic data;

enhanced studies of cryospheric processes and feedbacks in polar climate; and parameterization of the hydrological cycle of cold regions. The IPY 2007-2008 synoptic snapshot (Theme #1) will also contribute to the understanding of processes needed to improve integrated models and our ability to predict future change.

An enhanced system to observe the polar natural and social environments during the IPY should leave a long-term legacy for documenting change. These enhancements should include the activities proposed by WMO for IPY 2007-2008 (see Box 1) to improve synoptic weather observations in polar regions, increase monitoring of the ozone layer and of greenhouse gases and aerosols; and the establishment of polar ocean and hydrological observing systems.

1.7.3 Theme #3: To advance our understanding on all scales of the links and interactions between polar regions and the rest of the globe, and of the processes controlling these links

Although the polar regions are frequently omitted from world political maps, their global influence, especially in the climate system, is profound and far reaching. The polar regions contain some of the world's major resources such as fisheries and minerals; hold massive stores of ice capable of causing significant global sea level rise under global warming; represent large carbon sinks that may ameliorate anthropogenic carbon dioxide production; and are also home to peoples that contribute to global cultural diversity. Just as the polar regions influence global processes, global processes also impact the poles. Examples include the formation of the ozone hole, the accumulation of pollutants in the Arctic, the influence of global satellite communication connectivity on polar residents and the impacts of world price variations on resource exploitation.

Research into polar-global linkages during IPY 2007-2008 might address questions such as:

1. What role do the polar regions play in the global cycles of water and carbon?
2. What are the interactions among the physical, chemical and biological systems in the polar regions and how can

Box 1

WMO CO-SPONSORSHIP OF IPY 2007-2008

At the 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 meeting of the ICSU Planning Group, 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 Committee (for IPY) was established by ICSU and WMO following the submission of this Science and Implementation 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 greatly facilitates the involvement in IPY of the National Meteorological and Hydrological Services and scientists from those nations. 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 sponsorship of organizations, such as WCRP, that have expressed a broad set of programmes suitable for IPY.

In their planning, WMO have identified a number of activities of high priority for IPY. These activities, which are particularly relevant to Themes #1, #2 and #3, are summarized as:

1. Improvement and further development of the World Weather Watch Global Observing System in the polar regions, including the space-based component;

2. Enhancement of ozone layer monitoring, with increased spatial and temporal coverage;

3. Intensification of long-term integrated measurement and modelling of the transport of greenhouse gases and aerosols, particularly in the Arctic;

4. Assessment of global-to-regional influences on the initiation, evolution and predictability of high impact weather events in polar circulation;

5. Intensification of studies addressing the role of polar cryospheric processes, and of feedbacks through which the polar cryosphere interacts with the other components of the climate system;

6. Establishment of a comprehensive database of polar climate data to support the assessment of current climate change in the polar regions, and to project future change;

7. Investigation of physical processes in polar oceans and establishment of the Arctic Ocean and the Southern Ocean Observing Systems;

8. Further development of capabilities to observe and model or parameterize the hydrological cycle of regions with cold climate, including the establishment of the Arctic Hydrological Cycle Observing System.

It is expected that the major WMO contributions in these activities will develop to take advantage of the potential for expanded observations and for establishing new observational networks throughout the polar regions during IPY 2007-2008. Such enhancements recognize IPY as a means to improve what already exists, to recover what has been lost, and to expand what has been planned; but without degrading or diminishing existing programmes in the polar regions.

these be better simulated?

3. What are the implications to human socio-environment and quality of life, both at poles and globally, of natural polar processes?
4. What are the impacts of polar climate change on resource exploitation, world economy and global politics?
5. How are solar variability and the response of the magnetosphere, ionosphere and upper atmosphere coupled to lower atmospheric climate, ecosystems and environment through the polar regions? What are the effects of space weather on technological systems and modern societies?

The programmes proposed to enhance our understanding of the polar-global linkages include physical, biological and social ones. Activities to address these issues include measurements of carbon fluxes in both marine and terrestrial polar ecosystems, improvement of polar meteorological and hydrological networks, analysis of climate indices and data sets, socio-economic surveys, comparative case studies and investigations of living conditions of the polar residents, and modelling studies that seek to integrate each of these elements. Many solar-terrestrial physical phenomena are best observed near the poles, and expanded observational networks for these are needed in both polar regions.

Key phenomena to be targeted should include the patterns of multi-year climatic fluctuation that affect the polar regions (e.g. North Atlantic Oscillation, Southern Hemisphere Annular Mode), and the potential for feedback from the polar regions to lower latitude climate. Conversely, forcing of the polar environment by low latitude patterns of variability (e.g. El Nino - Southern Oscillation), and the response of polar marine ecosystems and carbon fluxes to such forcing, require investigation.

Although IPY 2007-2008 activities will be focused on the polar regions, coordination with global programmes will be necessary to achieve an advanced understanding of the polar-global linkages. Projects outside the poles may be part of IPY if they have essential links with polar processes. There are logical connections between the International Heliophysical Year (IHY; see Box 2), which is global but has strong polar elements, and IPY. Collaboration with existing Arctic organizations to further develop the overall IPY human dimension themes and the observational initiatives that serve these, will also be appropriate.

1.7.4 Theme #4: To investigate the frontiers of science in the polar regions

Humans have probed the polar regions, investigating the frontiers of the planet, since people began living in the Arctic as the ice sheets retreated thousands of years ago. Nevertheless, gaps in our knowledge remain and there are important scientific challenges to be investigated in the polar regions. Beneath the polar ice sheets and under the ice-covered oceans, the bedrock and sea floor are largely unknown. Similarly, the pattern and structure of polar ecosystems is yet to be mapped in detail, and neither can the impacts of large-scale resources exploitation on polar biodiversity and societies be reliably projected. Today the new scientific frontiers in the polar regions are at the intersection of disciplines. Progress can be made not only using new observational techniques, but also by interdisciplinary cross-analysis of existing databases, utilizing the overwhelming recent advances in computing capability.

IPY research endeavours at the frontiers of science might address questions such as:

1. What are the nature, composition and morphology of the deep sea floor and Earth's crust beneath the polar ice, and what effect does the solid earth have on ice sheet dynamics and vice-versa?
2. What are the characteristics of the most extreme environments on the surface of the Earth, such as on the summits of the Antarctic plateau?
3. What are the pattern and structure of the overall polar ecosystems, and what unknown ecosystem characteristics may be hidden beneath continental ice and in the deep polar oceans?
4. How does genetic and functional diversity vary across extreme environments and what are the evolutionary responses underpinning this variation?
5. What have been the connections between the northern and southern hemispheres during past periods of large or abrupt climate change, and what processes have driven these changes?

Box 2

INTERNATIONAL HELIOPHYSICAL YEAR (IHY)

The launch of Sputnik on October 4, 1957, three months after the International Geophysical Year (IGY) began, marked the beginning of the space age. Space science has made enormous progress in the last 50 years, routinely monitoring the Sun, the interplanetary medium, and the atmosphere of Earth from space. The IHY in 2007 will provide a unique opportunity to coordinate observations from the current impressive fleet of international space missions, with data from solar ground-based observatories, ground based auroral observatories, neutron monitor observations, magnetic field observatories, ionospheric, meteorological, and other atmospheric observatories. Unprecedented simultaneous observations with broad coverage of all associated solar, heliospheric, geospace, and atmospheric phenomena will be obtained. The resulting data will allow global studies of the complete Sun-Earth system. The polar regions are key areas of the globe for space observation and may also be sensitive locations for studying the influence of solar processes on climate change. IHY therefore has considerable relevance for IPY 2007-2008 and both programmes have agreed to work together for mutual benefit.

6. What will be the nature and extent of social transformations induced by large-scale resource exploitation, industrialization and infrastructures development in polar regions? How will these influence relations between demographic, economic and social trends, and ultimately impact the environment?

A diverse range of activities is required to address these questions. Geophysical exploration of sub-glacial lakes and other unknown terrain beneath the Antarctic and Greenland ice sheets should use modern remote sensing technologies, airborne and ground geophysical surveys using remotely operated vehicles, and new rapid access ice-drilling techniques. Marine and terrestrial biological surveys should employ modern genomic methods. Tools to support social science activities should include circumpolar demographic, social and economic data banks; and comparative studies can be made to investigate the social impact of industrial exploitation within different political and socio-economic context, for example between the North-American Arctic and the Russian North.

1.7.5 Theme #5: To use the unique vantage point of the polar regions to develop and enhance observatories from the interior of the Earth to the Sun and the cosmos 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 and phenomena, such as solar-terrestrial interactions, the rotation of the Earth's inner core and the strength of its magnetic dipole, cosmic ray detection, and astronomy and astrophysics, are uniquely benefited by observations from both northern and southern polar regions. Several disciplinary based groups have existing programmes or well advanced plans to use the polar regions as observing platforms. These are complemented by interest in developing broader science agendas for new polar research stations proposed by several nations.

Questions that can be addressed by polar observations include:

1. How does the neutral atmosphere interact with geospace in the polar regions and what are the consequences?
2. How does solar variability impact the structure and dynamics of the middle atmosphere?
3. How do upper atmospheric phenomena and space weather interact with Earth's climate and biosphere?
4. What is the state of the Earth's magnetic dipole?
5. Is the inner core rotating differentially?
6. Are the characteristics of the premier sites for observing the cosmos on the surface of the Earth, the summits of the Antarctic plateau, good enough to permit the exceedingly sensitive observations required to detect other Earth-like planets in the Galaxy?

Resolution of some of these issues will require extended (up to 6-month) uninterrupted time-series observations in solar, planetary and stellar astronomy. Proposed activities for polar observatories are generally mono-disciplinary but reflect well-developed concepts. Some of these activities have strong connections to the IHY (see Box 2).

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

Some 10-12 million people, both indigenous and more recent emigrants, now live in polar regions. The well-being of polar peoples has always been closely linked to their understanding of, and adaptation to, their environment, and polar societies have been agents in shaping changes in their environment for millennia. Understanding of the historical, social, and cultural dimensions of the polar regions and of the complexity and diversity of polar living conditions, both human and physical, has grown considerably. But key deficiencies remain with issues of partnership and public involvement, socio-economic development, governance, cultural viability, and the human rights of all polar people, but especially indigenous people. Internationally coordinated research projects involving constituencies ranging from disciplinary experts to policymakers to local communities are needed to explore how humans and the environment interact in polar regions at scales from the local to the global.

Societal questions central to the IPY 2007-2008 objective of enhancing the understanding of human-environmental interactions in the polar systems might include:

1. How can the "wellness" of polar environments be studied in terms of changing socio-political conditions and the health of ecosystems?
2. What has been the effectiveness of governance regimes in polar regions, and how can these respond to the divergent and rapidly evolving cultural and socio-economic systems?
3. What research methodologies are best suited to an interdisciplinary understanding of the fundamental links between ecosystems, economies and cultural diversity? How can polar residents become more instrumental in shaping these activities; and how can social sciences, humanities, and fine arts communicate this understanding to diverse audiences?
4. What are the key human health and medical issues in polar regions? How, for example, are diseases carried into polar communities and how is community health affected by environmental change?
5. How can historical studies and records of the polar regions enhance understanding of contemporary social and cultural problems?
6. What do the polar societies contribute to global cultural diversity and the political status of indigenous people worldwide?

IPY 2007-2008 offers an unprecedented opportunity to examine data from the human environment, past and present, and to identify emerging paradigms of development in the Arctic and Antarctic. Studies of the vulnerability, resilience,

adaptability and sustainable development of polar human societies should be undertaken by networks of researchers and experts, both local and international. Research in the social sciences and humanities has changed significantly during the last few decades, and there is now an inclusion of polar peoples as scientific partners in research. Methodologies will include structured and semi-structured interview techniques, questionnaire surveys, participant observation, participatory research approaches, archival and archaeological studies, discourse analysis, and reception theory.

The IGY of 1957-1958 resulted in the creation of an innovative model of Antarctic governance based on international scientific and political agreements: IPY 2007-2008 could provide a comparable opportunity to further advance and facilitate international scientific cooperation in the Arctic.

1.8 NEW OBSERVATIONAL SYSTEMS

The limited timeframe of IPY 2007-2008 encourages activities that focus on data collection and that utilize the potential of increased coordination of logistic assets. Many of the ideas submitted by the community recognized this emphasis. Different discipline based groups often proposed similar activities, sampling strategies and field programmes. At the same time, several national or even different multinational groups advocated similar activities. Observational systems or observational programmes 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 2007-2008 contribution. Similarly, we hope the overlapping national and multinational groups will be able to build effective interdisciplinary, international programmes achievable within the IPY timeframe. Some of the key scientific questions facing humankind 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 2007-2008 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.

The emerging observational systems that serve the scientific themes are presented below. It is hoped that this synthesis stimulates the next level of discussion, debate and planning.

1.8.1 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 IPY 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 programmes are designed for IPY 2007-2008, high impact, interdisciplinary activities, incremental to the main focus of a programme must continuously be considered. For example, it will be useful to encourage bird observations from oceanographic and other vessels to provide the data needed for a comparison with existing data sets and serve as a basis for a study of the variability of diversity with time. Similarly opportunistic deployments from vessels employed in IPY projects could be made of continuous plankton recorders (to obtain comprehensive coverage of upper ocean plankton around the polar regions) and single beam and multi-beam echo-sounders (for marine geological studies and for defining the shape of the seabed for ocean modelling). Multidisciplinary measurements should be made during proposed ice sheet traverses in order to better integrate geological, glaciological, geophysical, atmospheric and biological data collection.

The cryosphere is an important element of the Earth system, but probably its most under-sampled part. 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.

Internationally coordinated field transects supported by ships, aircraft and traverse vehicles are a prime measurement strategy for the IPY. These were proposed by a broad range of discipline-based scientists from biologists interested in the Census of Marine Life and genetic diversity of polar organisms through oceanographers interested in the state of polar sea ice and water masses to geodetic scientists interested in post-glacial rebound at the poles. Bipolar comparative biological studies are also likely to significantly improve understanding of how severe climatic constraints have shaped life both on the organism and the ecosystem level, particularly in partially isolated polar environments. A number of groups advocated establishing baseline observation of polar ecosystems, which are complementary to the concept of mapping polar biodiversity along transects. Focused, internationally coordinated atmospheric and oceanic transects were proposed by several groups to document temporal and spatial variability of climate, ecosystems, and their interactions. In the polar oceans, programmes are needed that will provide a circumpolar snapshot of the oceanic environment, including physical, ecological and biogeochemical properties, measure the circumpolar volume (extent and thickness) of 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.

A second measurement strategy, complementing the programmes of underway observations along set transects, is a series of proposals to deploy permanent or semi-permanent instruments in inaccessible regions. For example, automatic meteorological and geophysical instrumentation can be deployed on the polar ice sheet during over-snow traverses. In general, these proposed deployments were very discipline based. Some efforts clearly would benefit by bringing together the different discipline-based proposals. For example, there were separate 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 IPY 2007-2008 is 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 the European Space Agency's 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.

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

A number of concepts have been advanced for internationally coordinated mapping of key marine and continental sites that have played important roles in controlling the nature of polar environments. These include marine studies of the Antarctic and Arctic ocean gateways and, on the continents, a wide range of aero-geophysical surveys both to support the acquisition of a long palaeoclimate record and to determine the controlling topography for the onset of past Glaciations. These surveying efforts are complemented by proposals for the international collection of targeted paleoclimatic data sets such as sediment drilling in the Arctic and Southern Ocean and ice core drilling on the Greenland and Antarctic ice sheets. The key proxies for changes in climate also 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 the study of permafrost boreholes. On short time-scales lake cores, shallow ice cores, borehole temperatures and permafrost studies can provide measurements of change, and of its regional variability, while studies of socio-economic change require archaeological and historical records.

1.8.3 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 IPY 2007-2008. 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.

Previous 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 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. It is envisaged that the jointly sponsored ICSU-WMO IPY 2007-2008 will leave a legacy observation network that will leverage the critical communication and power infrastructure. This will then 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 co-located observations measuring such diverse features as the earth's atmosphere, oceans, magnetosphere, seismic structure of the lithosphere and mantle, and isostatic rebound. These permanent stations will enable scientists in the future to isolate short-term variability from long-term change for topics ranging 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 a potential vehicle to provide enhanced science access to both polar regions.

International coordination in the Arctic has already started by the creation of an Arctic Ocean Observing System (AOOS) to be developed around four main components: (i) a space component based on remote sensing, satellite data transmission and precise geo-location, (ii) a surface component based on ice-tethered platforms equipped with sensors for meteorological, sea ice and oceanographic observations, (iii) an underwater component based on autonomous underwater ballast controlled floats equipped with ice profiling upward looking sonars, gliders equipped with CTD and acoustic transceivers for navigation and ocean thermometry, and (iv) 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. A similar, complementary observing system is required for the Southern Ocean.

1.8.4 The launch of internationally coordinated, multidisciplinary investigations into new scientific frontiers

Many proposals for the IPY 2007-2008 addressed new scientific frontiers. In earlier IPY and IGY research programmes, 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 Polar Years and the IGY.

The international community has proposed several major investigations of new frontiers, and IPY 2007-2008 offers the opportunity to focus attention on these. The proposed investigations include mapping the biodiversity of the Gakkel Ridge (Arctic Ocean), an interdisciplinary geophysical / geological study of the sub-glacial Gamburtsev Mountains (East Antarctica), and exploring the extremophiles of ice sheet sub-glacial environments, for example in subglacial lakes. These challenges, which require tools such as remote sensing, airborne and overland traverse geophysical survey and ice drilling, will not be met without the pooling of resources, international collaboration and impetus provided by IPY 2007-2008. They will challenge and capture the imagination of a new generation of global 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.

1.8.5 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 the cosmos beyond which can be best studied from the polar regions. Simultaneously several groups indicated the potential establishment of new polar stations. Such new stations, together with enhanced activity at existing stations, would present a unique opportunity for IPY 2007-2008 to establish a new suite of observatories. The implementation of these observatories should be coordinated to optimize the use of logistics and to encourage the sharing of data. The proposed observatories range in focus from the inner core to atmospheric physics to the heliosphere and studies of neutrinos. Some of the proposed observations would complement the developing initiative for an IHY during 2007. New observational programmes should exploit the large arrays of observatories that are already in place for upper atmosphere and geospace measurements, and enhance effective comparisons between phenomena in the two hemispheres. Synergies facilitated through the IPY 2007-2008 planning have the potential to assess the viability of the summit of the Antarctic ice sheet as a site for a large diameter telescope capable of exploration into deep space.

1.8.6 The creation of datasets on the changing conditions of circumpolar human societies

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, standardization, geographic transects and inter-comparisons, time series, etc. Social observations are conducted at different scales, from community to the entire circumpolar region. Cooperation and data transparency are essential parts of research design. The IPY 2007-2008 presents an opportunity for researchers in the social sciences and humanities to transcend national boundaries through international cooperation and coordination, thereby creating new datasets that document and characterize the most important transitions in polar societies. Social observation offers the most opportune means to engage polar residents in the IPY 2007-2008 research and data collecting process.

Efforts will be made to ensure that data collected during the IPY 2007-2008 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 2007-2008 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 2007-2008 projects will use technologies and engage in practices that enable the data to be widely used in outreach programmes, education, and efforts towards 'knowledge repatriation'. These activities will expand scientific literacy among students, the general public, and polar residents.

In both polar regions multinational, multidisciplinary, collaborative datasets can be collected to validate and analyse current physiological, public and occupational health and psycho-social 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 can be used and enhanced in the collection and support of a snapshot of human health in polar regions during IPY 2007-2008.

2. Data Management Plan for IPY 2007-2008

2.1 INTRODUCTION

The significant advances of computer and Internet-based technologies in recent decades now enable unprecedented management of large amounts of data, including storage, access and sharing. Data management is regarded as a key component for transforming the IPY 2007-2008 into a legacy that will endure into the future, providing future generations with a relevant database.

The data management plan strives to ensure that data usability is a primary objective for all IPY 2007-2008 scientific projects. The basic principle is that IPY-generated data should be collected, used and preserved. These data should be freely available, although restricted access can exist initially. This plan draws directly from the paper "Data and information management for IPY 2007/2008" submitted to the ICSU IPY 2007-2008 PG by the International Project Office of the World Climate Research Programme's Climate and Cryosphere Programme (WCRP-CliC) and its Data and Information Panel. It also draws on the paper "Recommendations on data management for the International Polar Year 2007-2008" prepared by the Joint Committee on Antarctic Data Management (JCADM) of SCAR-COMNAP (Scientific Committee on Antarctic Research, Committee of Managers of National Antarctic Programmes). Both these organizations have considerable experience with management of polar data, and their proposals and recommendations for IPY data management were remarkably consistent. Their recommendations are also in line with the draft report of the ICSU Panel for "Priority Area Assessment on Scientific Data and Information", which was also used in compiling this document.

The ICSU IPY 2007-2008 PG recognizes that an intense, interdisciplinary, and internationally coordinated campaign of research and observations can deepen our understanding of polar processes and their global linkages. If the knowledge and observations realized from this programme are to become a legacy for future generations, then this knowledge and the observations upon which it is built must be effectively managed to ensure the greatest benefit in the future.

Data management is an important component of any science project, and in particular a programme of the scope and complexity of IPY 2007-2008. Funds must be set aside from the outset, to ensure that the diversity of data from the programme collected in a consistent fashion is preserved, properly archived and made accessible to the science community.

In fifty years time the data resulting from IPY 2007-2008 may be seen as the most important single outcome of the programme. These data, which will be the result of a period of intensive measurements, will act as benchmark data which can serve as a baseline against which global change is measured. Excellent data management, carefully staged and professionally executed, is essential.

The IGY led to many advances in data and information management (e.g. establishment of World Data Centres, and improvements in the exchange of research data between nations). IPY 2007-2008 provides a similar opportunity to bring about a step improvement in the management of data and information, for the polar regions. It offers a chance to develop a data and information management policy that uses scientific best practice and demonstrates the value of such practice in providing an effective and integrated system for data and information management for the polar regions. It is a unique opportunity to utilize the new tools and capabilities brought about by the pervasive use of the World Wide Web, increased computer power and storage capabilities and emerging technologies for utilizing metadata for efficient data exchange and access.

2.2 THE SPECIFIC AIMS OF IPY 2007-2008 DATA MANAGEMENT

The overarching objective of IPY 2007-2008 data management is to ensure the security, accessibility and free exchange of relevant data that both support current research and leave a lasting legacy. Thus IPY data management should aim to:

1. ensure that all data collected as part of the IPY 2007-2008 are securely stored for use at any time in the foreseeable future. Data must be stored in a usable format, and be accompanied by sufficient metadata to allow interpretation by any reasonably informed scientist;
2. ensure that current or future users, using freely available, user-friendly, web-based search techniques, can find all data;
3. encourage the free and open exchange of all IPY 2007-2008 data collected in the polar regions for the purposes of scientific research;
4. take advantage of existing data centres, improved communications infrastructure and international collaboration for achieving IPY objectives;
5. use IPY 2007-2008 as a catalyst to leave in place a system of data and information management that makes it easy for the polar research community to continue to store, find and distribute scientific data collected in the polar regions in the foreseeable future.

To achieve these aims IPY 2007-2008 needs a strong data and information management strategy and policy to guide the collection, handling, storage, description and distribution of data. The success of this policy and of IPY 2007-2008 in general, will necessitate a considerable commitment of resources including people, money and facilities.

2.3 A DATA MANAGEMENT STRATEGY FOR IPY 2007-2008 – THE DATA POLICY AND MANAGEMENT SUB-COMMITTEE

A data and information strategy and policy for IPY 2007-2008 needs to be developed at an early stage, so that researchers proposing projects have a clear idea of how they will be required to handle the data they produce. Future usability of the data must be an essential component. The concept of data includes electronic data but also samples, photographs, maps, magnetic media, social science data sets, etc.

A focus group should be set up as soon as possible and be tasked with the rapid development of the IPY 2007-2008 data and information management strategy and policy. This Data Policy and Management Sub-Committee, should be a Sub-Committee of the planned overarching IPY 2007-2008 coordinating committee, the Joint Committee (JC), which is introduced in detail later.

Initially the Data Policy and Management Sub-Committee will focus on determining specific goals for IPY 2007-2008 data management, based on the scientific questions formulated in the IPY 2007-2008 Science Plan, and to determine a workable and useful data policy, to be followed by all nations and projects involved in the programme. It should outline the IPY 2007-2008 organizational data structure, which must be established before the start of the field phase. The Data Policy and Management Sub-Committee will develop plans for the structure, procedures, transmission and archival of data to support the IPY 2007-2008 science objectives as agreed by the Joint Committee (JC).

The Data Policy and Management Sub-Committee should make sure that IPY 2007-2008 project proposals have an adequate data management plan with identification of appropriate funding sources. The Sub-Committee will also provide advice to the JC on proposed data management programmes that may be independent of specific IPY 2007-2008 science projects.

The membership of the IPY 2007-2008 Data Policy and Management Sub-Committee should represent:

1. data managers and information technology professionals;
2. active scientists from the Antarctic and the Arctic science communities representing both the natural and social sciences;
3. representatives from ICSU's World Data Centre system and from relevant discipline based data centres;
4. representatives from funding agencies (which will have a role in implementing some aspects of the policy);
5. representatives from the proposed IPY Data and Information Service (see below) and from the IPY International Programme Office;
6. representatives from relevant existing data management bodies such as the Joint Committee for Antarctic Data Management (JCADM).

While a full and detailed IPY data and information management strategy should be developed by the IPY Data Policy and Management Sub-Committee, there are several clearly emerging key elements to this strategy. These include a technologically advanced professional support service, a philosophy of building on existing facilities and embracing new structures and technologies.

The production, management, and dissemination of scientific data and information have become increasingly critical functions within the scientific research enterprise. Professional standards and practices must be employed in order to properly perform these functions. Data must be preserved over long periods of time so that the scientific records and observations obtained today will be available for use in research in the future. The use of advanced information

Box 3

THE ELECTRONIC GEOPHYSICAL YEAR (eGY)

The concept of holding an Electronic Geophysical Year (eGY) in 2007-2008 as a celebration of the 50th anniversary of the International Geophysical Year (IGY) is under development within the International Union of Geodesy and Geophysics (IUGG). A key achievement of the IGY was to provide efficient access to data by means of a worldwide network of physical observatories and the creation of data centres. The eGY concept is based upon the enormous present potential, generalized acceptance, and rapid growth of "e-science" using Internet-based technologies.

The main issues to be addressed by the eGY include:

1. Data discovery: improving records of what data holdings exist and where;

2. Permission: encouraging data owners to make them available to the international scientific community and to provide descriptive (meta-data) information;

3. Access and sharing: enabling users to obtain and share data, often from distributed sources, in an appropriate electronic format.

Access is the most challenging and exciting issue, considering the capabilities of the modern information techniques. Activities would include the digitization of analogue records and the establishment of Virtual Observatories encompassing, for example, all available and future data (e.g., atmospheric, geomagnetic, gravity, ionospheric, magnetospheric) into a series of virtual observatories to be "deployed" in cyberspace. This would effectively provide free access to all available data through the Internet and the World Wide Web. The existing World Data Centre system is proposed to become a part of this distributed global data source.

Given its global and interdisciplinary approach, the eGY concept will likely be incorporated into the International Polar Year initiative as an effective means for accessing and sharing data within the IPY timeframe and beyond.

technology in scientific data management and dissemination makes it essential that data management be the responsibility of experienced data management professionals.

Considering the relatively short period until the start of the IPY field phase, the IPY data management strategy must make use of existing data infrastructures, services and proven concepts where it is advantageous

IPY 2007-2008 should make use of existing facilities such as World Data Centres, other regional or national data centres, and recognized metadata centres (e.g. the Global Change Master Directory (GCMD), which hosts the Antarctic Master Directory and also contains a large number of Arctic data set descriptions) for the handling and storage of metadata and data. Facilities or centres used must have a history of successful data and information management and should use appropriate standards in accordance with IPY 2007-2008 data and information management policy. IPY 2007-2008 should adopt lessons learned from other global scientific programmes with successful data management, such as the World Ocean Circulation Experiment (WOCE).

Whilst building as much as possible on existing infrastructure, IPY should also be prepared to rethink, re-orient, and substitute for existing structures and bodies where it is necessary to achieve its objectives. It should be ensured that the full benefits of new data and information technologies and capabilities are maximised. A possible approach to develop these issues is to encourage the establishment of data management and IT projects for IPY 2007-2008, ideally in close collaboration with ongoing initiatives and/or experts, such as the Electronic Geophysical Year (eGY) for example (see Box 3). This could result in IPY 2007-2008 leaving a new legacy of data and information management, which is built upon existing infrastructure, but also provides the springboard for the realisation of new and emerging technologies and ideas.

2.4 AN IPY 2007-2008 DATA AND INFORMATION SERVICE

The Data Policy and Management Sub-Committee will define the data and information strategy for IPY 2007-2008 but will not implement this policy. To succeed in data and information management, IPY 2007-2008 will need to create a full-time, professional data and information unit as soon as possible to implement the programmes data and information management policy. This service, the Data and Information Service (DIS), should be closely associated with, but should probably not be located within the International Programme Office.

The DIS will be the main metadata and information portal for the programme. Existing models of DIS services can be useful, such as the World Ocean Circulation Experiment (WOCE) data management effort, and the ongoing Climate and Cryosphere Programme (CliC). The DIS will be the central gateway to the online, distributing IPY 2007-2008 data and metadata, actively tracking the data flow within the field programmes, and acting as the single access point for IPY 2007-2008 related information.

An early implementation of the DIS and the policies and procedures related to metadata submission will allow proposals for IPY 2007-2008 projects to be managed in such a way that information is easily retrievable in the future. An important task of this service will be to make compliance with IPY 2007-2008 data and information standards simple for all project leaders and scientists. In order to address the technical challenges involved in implementing IPY 2007-2008 data policy, the DIS must have adequate resources.

2.5 DATA MANAGEMENT REQUIREMENTS FOR IPY 2007-2008 PROJECTS

Requiring compliance with the IPY 2007-2008 data strategy from the very start of a project, at the expression of intent stage, is likely to be much more successful than trying to obtain compliance at a later date. Each IPY 2007-2008 proposal must include a data management plan which should include the appointment of a dedicated project data manager, appropriate funding for data management, and describe how the project data management plan is linked into the IPY 2007-2008 Data Management Plan.

In order to be considered as an officially identified IPY 2007-2008 project, proponents must agree to follow the IPY 2007-2008 data and information management policy, including submission of metadata and data according to an agreed timetable. In a similar fashion, in order to take part in an IPY 2007-2008 project, participants must agree to submit information and data from their component of the project, and comply with other relevant IPY 2007-2008 data and information management policy. Funding from national and international agencies should be sought.

IPY 2007-2008 projects will be required to submit metadata at the proposal stage (see next section). These metadata should be updated as the project is implemented, with the most important update of the full metadata occurring when the data collection is completed. An advantage of early submission of metadata is that it will allow the DIS to actively seek all data that have been collected. Scientists should be recognized and given credit for the scientific contribution of the data sets that they produce as well as for the analysis of those data.

2.6 METADATA

Metadata describe a data set so that someone looking for that type of data can find its location, and know whether it is appropriate for a particular use. Metadata must be in a searchable database. These 'catalogue metadata' usually describe who measured what parameters, where and when, how, and who to contact to obtain the data. Much of this information is known when a project is proposed, so these metadata can be submitted when a project is proposed.

Before being identified as an IPY 2007-2008 project or participant, project leaders or participating scientists must submit such 'catalogue metadata' to a central database, describing what data they intend to collect as part of IPY 2007-2008.

IPY 2007-2008 should also require submission of more detailed metadata to an IPY-identified data centre immediately after data collection. These will describe the collection or creation of the data in enough detail so that a user can understand fully the data itself, including potential errors. Metadata should be the principal vehicle for documenting known data quality issues and be part of the same database, ultimately containing both the catalogue metadata and the metadata for scientific use.

All IPY 2007-2008 metadata should conform to uniform flexible, open, and easy to use community standards for metadata so that it is simple to transfer information from one database to another. These standards should be interoperable and independent of specific hardware and software platforms. Guidelines for their use should be widely circulated. Appropriate standards will be adopted for the type of data such as the international metadata standard (ISO 19115) recently agreed for the structure and content of geographical metadata. Similarly, to allow flexibility a common fully interoperable language system (e.g. XML4 (eXtensible Markup Language)) and format should be used for metadata exchange and storage.

If possible, a specific IPY Metadata Centre should be created as the official metadata portal for IPY 2007-2008, having the responsibility for collection of all project information and creating one central database of all IPY 2007-2008 projects. This initiative should build upon the experience and act in coordination with other data management systems, such as the Global Change Master Directory.

2.7 DATA ARCHIVING AND DISSEMINATION

The IPY 2007-2008 science projects are likely to produce vast quantities of data, which will require effective and secure storage, and (in most cases) post-project archiving.

The long-term IPY data management system should build upon the experience from ICSU, WMO and other organizations, which already have existing data systems (e.g. World Data Centres, CODATA, and other established data centres). In many cases the data system will need to be enhanced to cope with the flow of data from IPY 2007-2008.

IPY 2007-2008 should require submission of raw data and calibration data, along with the detailed metadata and processed data, to an appropriate data centre within a reasonable time (typically less than one year) after data collection. These data should be stored securely by the data centre and have restricted access for an agreed period.

There are many arguments why raw data and subsequently processed data as well should be submitted to a recognized data centre soon after collection. Data centres have routines to ensure data security and back-up so that data will not be lost through local or personal computer failures. The data can be released at an appropriate time after collection, should the original collector of the data fail to do so. In addition, the data collector can avoid having to deal with multiple requests to access the data. Finally, it ensures that the original data are available for re-analysis and re-interpretation using the improved tools and knowledge that will undoubtedly be available in the future.

Common data formats and standards are a prerequisite to data sharing both nationally and internationally, an inherent component of IPY 2007-2008. Whenever possible, data should be supplied in formats that can be handled using commonly available (preferably open-source) software. Where special software has been developed to handle data, this should be supplied to a user with the data.

Delivery of relevant scientific data to geographically distributed repositories (e.g. World Data Centres, National Antarctic Data Centres, etc.) should be envisioned. This will enable storage of all types of data in relevant formats for each repository, delivered in an integrated and effective format for subsequent users.

2.8 ACKNOWLEDGEMENT, INTELLECTUAL PROPERTY RIGHTS AND SECURITY

Since IPY 2007-2008 is not a funding body it cannot control the ownership of the data, which ultimately depends on the policies of the body that funded the data collection or creation. Once data are submitted to a data centre, there should be an agreed period during which the data will not be released by the centre to a third party, except by special arrangement. At the expiry of the agreed period, data (including raw data) will become freely available for research purposes. Whilst it is strongly discouraged, data owners could retain the right to restrict release of data after negotiation with the IPY 2007-2008 Data Policy and Management Sub-committee. Exceptions to the open data release policy may be necessary where there is a commercial component to the collection of data, where an agency funding the data collection requires special conditions to be adhered to, or where security or privacy issues are involved. Under such conditions, separate arrangements will be agreed between IPY 2007-2008 (through the Data Policy and Management Sub-Committee) and the data providers. An ethical policy for data use should be established, complying with the existing data policies of ICSU and WMO, and building upon other already existing models, with special emphasis in incorporating social science data.

As a basic principle, scientists should receive due credit when other parties use their original data. Similarly, funding agencies or scientific institutions need to know that their contribution will be properly recognized by users of the data. Hence appropriate acknowledgement of data providers should be part of the IPY 2007-2008 data management strategy. Along with their metadata or data, scientists submitting data to a data centre should provide clear information about their preference for acknowledgment and/or contact prior to publication (by third parties) of studies using those data. Data centres should ensure that this information is distributed with any data when they are released.

2.9 FUNDING IPY DATA MANAGEMENT

Data production and management is an invaluable and essential investment for future generations. But collection of data, preparation of metadata, provision of professional data management expertise and institutional support for data dissemination and permanent archiving will add to the overall expense of research projects.

Scientific data centres and archives require stability in their financial resources so that they can make institutional commitments to data management and preservation over many decades. Ensuring this long-term accessibility of increasing quantities of scientific data and information will necessitate increased public (and private) investment in data management and long-term institutional support.

Sources of funding for IPY 2007-2008 data management should be investigated as a matter of urgency. While the funding bodies that will support IPY research have a vested interest in ensuring efficient, secure and ongoing data management, IPY should also explore other solutions to meet the financial challenge of providing full and open access to IPY 2007-2008 scientific data. An Announcement of Opportunity to host the Data and Information Service, similar to that for the International Programme Office, should be extended to nations and funding agencies as soon as possible.

2.10 OTHER ISSUES

Other issues, which will require discussion by the IPY 2007-2008 Data Policy and Management Sub-Committee, include:

1. handling of information that currently goes on the WMO Global Telecommunications System;
2. archiving and dissemination of Numerical Weather Prediction model data including model initialization data, 0-hr analyses, model assimilation datasets and "re-analysis" results;
3. access to data from space agencies, especially data sets which are costly to purchase;
4. supply and subsequent storage of data and information on weather conditions during intensive observation periods;
5. evaluation and prioritization of historical data recovery efforts including classified data;
6. the role of commercial data or information products including prioritization on collection and preservation as well as access to research data;
7. development of flexible data protocols that will address the unique datasets originating from intensive observing periods and focused field projects;
8. education and outreach as a component of IPY 2007-2008 data management support;
9. fostering the preparation of mapped data sets for a representation of appropriate data benchmarks.

3. Education, Outreach and Communication Plan

3.1 OVERVIEW

The polar regions provide a powerful context for teaching and learning, attracting a wide and diverse audience. The education, outreach and communication strategy for the IPY must address the question: "Why are the polar regions and polar research important to all people on Earth?" through a series of nationally and internationally coordinated programmes producing an improved understanding of the importance of the poles globally.

The ICSU IPY 2007-2008 PG was charged with developing a plan that captures the interest, and increases the knowledge of polar regions and the Polar Year, of educators, the public, government officials, researchers, media reporters and writers. This plan is also expected to contribute to the IPY 2007-2008 objective of attracting and developing the next generation of polar scientists, engineers and leaders; establish a way to interact with other parties promoting IPY 2007-2008, such as IPY National Committees, polar organizations, foundations etc.; and provide a channel for people living in the polar regions to interact with the polar science community on research, especially in the Arctic.

The following sections of this plan define the scope, identify the target audiences, and develop a structure for national and international education, outreach and communication efforts.

3.2 THE SCOPE OF EDUCATION, OUTREACH AND COMMUNICATION EFFORTS

For the purpose of this document the following definitions are used:

Education: Here, education refers to efforts designed to promote the development of programmes, infrastructure and resources needed to improve knowledge of polar-focused science, technology and humanities. These formal educational efforts mainly occur within classrooms. Formal education is not necessarily limited to curricula, but ranges from teacher training to classroom science experiments.

Outreach: Outreach, sometimes called informal education, is used here to refer to experiences for learning outside of formal classroom environments through stimulating media, exhibits, and community-based programmes. Examples of outreach activities include field trips, museums exhibits, zoo exhibits, lecture series, computer software, school competitions, quizzes and essay writing.

Communication: Communication is used here to identify interactions with the print, television, radio, internet and film media.

3.3 IDENTIFYING THE TARGET AUDIENCES FOR IPY 2007-2008

Five major, sometimes overlapping, audiences for the IPY education, outreach and communication efforts have been identified:

1. primary and secondary education community – school children;
2. young and potential new polar researchers;
3. Arctic communities;
4. the general public;
5. decision-makers.

This IPY 2007-2008 Education Outreach and Communication strategy document addresses each of these audiences by developing an overarching goal and highlighting some of the possible programmes.

For each constituency, the efforts should take into consideration what the message is, how that message can be conveyed most effectively and where this message should be targeted. Educational efforts should be focused on the primary and secondary education community and the young and potential new polar researchers while the outreach efforts are presented more for the general public, Arctic residents and decision makers. The communication effort is targeted at the general public.

3.3.1 School Children

The IPY strategy targeting the primary and secondary education community aims to increase the awareness and understanding of polar issues and to help infuse learning with the excitement of discovery of the polar regions while creating interest for science.

National engagement in education activities at primary and secondary level is important because of differences in language and methodologies in different nations. Many of the potential partners and stakeholders in IPY 2007-2008 have ongoing education and outreach experiences and programmes. These should be considered in the development of an overall IPY 2007-2008 education strategy.

Nationally based school magazines were widely used during the IGY to convey information on science programmes to elementary schools. During IPY 2007-2008, a special effort could be made to increase the opportunities for primary and secondary teachers to participate in research fieldwork and thereby inspire their audience at home.

Some educational initiatives for primary and secondary students could be developed to an international level in order to link communities together through synoptic environmental observations, and to link communities with polar researchers. The GLOBE programme, a worldwide hands-on, primary and secondary school-based education and science programme active in 106 countries and 15,000 schools provides a vehicle

for linking global education communities through synoptic observations during the IPY. Linkages with the Year of the Planet Earth (now "The Year") and the UNESCO network have the potential to provide a conduit for linking polar residents and polar scientists with a diverse and geographic widespread audience. Involving people living in the Arctic in IPY 2007-2008 education efforts has tremendous potential and should be developed into formal programmes. Use of modern web based technology for remote participation and interactive programmes will translate into genuine learning experiences for people of all ages.

3.3.2 Young and Potential New Polar Researchers

The IPY 2007-2008 strategy for post-secondary students is to promote the recruitment of new and future research scientists and collaborators, and to increase awareness of polar issues at educational and research institutions. Attracting young people to science is necessary in an ever-increasingly technical world. The IPY 2007-2008 planning process revealed how many of today's leaders were introduced to science through the IGY.

We aim to leverage inherent human interest in the polar regions to stimulate a new generation of researchers. The undergraduate level is an excellent place to instil students with an interest for the polar regions that can be followed through to the graduate, doctoral, to post-doctoral and Principal Investigator (PI) level. Research and field experiences for university students are a powerful mechanism for engaging this audience. A number of established universities have polar focused programmes such as the University of the Arctic, the University of Svalbard, and some Australian and New Zealand universities. These programmes should be networked into the IPY 2007-2008 education, outreach and research activities. An effort and strategy to use already established programmes like the Humboldt (http://www.avh.de/en/stiftung/index.htm) and Fulbright (http://www.iie.org) Fellowship programmes should be promoted through IPY 2007-2008 to develop new researchers, including participation from Arctic residents, in international and national efforts within IPY. PhD and postdoctoral stipends should be established to stimulate involvement.

3.3.3 Arctic Communities

IPY 2007-2008 must strengthen the dialogue and links between Arctic residents and the research community, and must engage Arctic residents in the design and implementation of IPY science, education and outreach programmes.

Different approaches and material are required for northern residents and for people living outside the polar area. Materials developed should aim for a holistic approach, being sensitive to natural science, social science and traditional knowledge. It is particularly important to see the IPY 2007-2008 as a special opportunity to raise awareness and build connections between researchers and residents of the Arctic communities.

As an example, the early engagement of residents has been launched in the Canadian North. This includes a series of consultations with Canadian northern residents on the planning and implementation of the IPY 2007-2008, and is reflected in the initial guiding principle of "In the North, for the North, by Northerners." Such proactive engagement of northern residents should be expanded. The Arctic Council as a forum with participation from many observers and the eight Arctic countries has the potential to play a leading role strengthening the dialogue and links between the Arctic and the research communities.

3.3.4 The General Public

IPY 2007-2008 aims to promote polar research to the general public, helping make the public more aware, excited and supportive of polar issues including understanding "Why are the polar regions and polar research important to all people on Earth?" The target group is global, reaching people living outside the polar areas, Arctic residents, and tourists visiting the Antarctic and the Arctic. The Polar Year should be used as a special opportunity to raise awareness among people living far away from the poles with nearly no relationship to the regions. This task requires specially planned activities. Many different methods and tools can be used to attain this goal ranging from museum exhibits, large and small, television documentaries, zoos and live webcasts. Involvement of established scientific information centres, many of which have relevant experience and are already committed to polar issues, should be used. A network of polar reporters, artists, authors, film producers, etc. could be created.

3.3.5 Decision-makers

IPY 2007-2008 aims to inform both governmental and scientific decision-makers, including funding and resource managers, on the roles and importance of polar regions. The decision makers are mainly politicians and high-ranking officials, who can influence the level of funding for IPY 2007-2008, and who have to be contacted early in the planning process to secure adequate financial support for IPY 2007-2008. Decision-makers require summary programme information and an explanation of the programme relevance to policy and economic decision-making. This communication responsibility is mainly a national or regional one although appropriate supporting international perspectives would be helpful.

The audience of parliamentarians, legislators and policy makers is also part of the larger audience that include the media and general public. Thus, efforts and strategies devised for media and the general public will also contribute to the more specialized audience of decision makers. Ministers of Education and Science and other representatives from the Arctic Council Member States recently (June 2004) declared that full use should be made of the opportunities offered by the IPY 2007–2008 to foster joint education and research that pertains to sustainable Arctic development (see www.ipy.org). The IPY 2007-2008 Education, Outreach and Communication plan must build on this expression of cooperation and further develop this initial Opportunity.

Promotion of polar research and understanding of the poles to the general public and decision-makers should utilize different media and information channels such as reporters, artists, authors, film producers, exhibitions and events. The media by which the communication efforts will be implemented will be specific to the particular audience. Outreach will also create and maintain direct links to education communities. Outreach should extend beyond the official IPY 2007-2008 period, beginning before field expeditions, communicating from the field and disseminating research results after the conclusion of the polar year. Communicating why and how research in polar regions is undertaken is often as important as the outcomes. Current technology makes real-time outreach of research activities possible through the internet with, for example, real-time GPS locations of researchers and vessels, live webcasts from the field, and email.

3.4 COORDINATION OF THE IPY 2007-2008 EFFORTS FOR EDUCATION, OUTREACH AND COMMUNICATION

At the international level there will be a need for an Education, Outreach and Communication (EOC) Sub-Committee. This will coordinate international communication activities; formulate a broadly accepted framework for IPY 2007-2008 education, outreach and communication; and serve as a forum for exchange of ideas to assist National Committees in their communication efforts. The IPY 2007-2008 education, outreach and communication framework should be adaptable to the business, language and cultural needs of each participant, while retaining a clear direction, identity and 'voice' for IPY 2007-2008. Leading educators and professional communicators should be attracted to serve on this critical Sub-Committee.

The EOC Sub-Committee should be an advisory Sub-Committee of the ICSU-WMO IPY 2007-2008 Joint Committee (see Section 4). The EOC Sub-Committee should also consult with IPY 2007-2008 projects to improve their Education, Outreach and Communication plans and to support their efforts to secure national or international funding to carry out their designated activities. This Sub-Committee will also provide feedback on proposed IPY 2007-2008 Education, Outreach and Communication programmes that are independent of any specific IPY science projects. The EOC Sub-Committee shall link specialized education, outreach and communication institutions/centres dedicated to polar science information.

The EOC Sub-Committee would serve as a focal point for developing international Education, Outreach and Communication programmes by , for example:

1. providing feedback to the Joint Committee on the education, outreach and communication plans submitted by the IPY project proposals;
2. facilitating international communication among the education, outreach and communication communities;
3. developing consensus standards and protocols, and providing simple guidelines and resources for education and outreach activities made in the name of IPY;
4. maintaining an Education and Outreach web site that would list and describe all IPY education and outreach activities;
5. producing a quarterly electronic newsletter emailed to appropriate audiences and posted on the web. This could include feature articles on IPY-activities and issues, details of upcoming conferences and meetings, highlights from fieldwork, etc;
6. developing materials such as illustrated brochures and pamphlets that can be translated by national committees for distribution in different languages;
7. identifying funding possibilities for international education and outreach activities;
8. promoting education and outreach activities among national and international agencies through newsletters, meetings and networks;
9. developing for the IPY a Junior Arctic Council and Junior Antarctic Treaty Consultative Meeting following the model of the Junior United Nations Assembly;
10. working to develop events such as an international polar day at schools coinciding with an IPY special observing day.

The National IPY Committees and IPY Project Steering Committees (see Section 4.5) will also organize various Education and Outreach projects, and their use of existing outreach and education networks and organizations will be essential. Individual countries contributing to IPY 2007-2008 may need a national facility to assist in the development and coordination of outreach activities, for example a Sub-Committee of the National IPY Committee. Such National EOC Committees will develop Education, Outreach and Communication programmes through activities such as:

1. targeting outreach activities in the name of IPY to national needs and education programmes;
2. maintaining a national Education and Outreach web site listing and describing all IPY education and outreach activities;
3. identifying existing national communication programmes and initiatives, and building national IPY E&O plans on these;
4. developing and publishing material in local languages;
5. promoting education and outreach activities among national agencies, organizations and networks;
6. ensuring development of high bandwidth communications between IPY researchers in the field and education and outreach programmes;
7. introducing a polar emphasis into existing science and history contests;
8. encouraging the development of polar-relevant national and regional museum and art exhibits;
9. providing material for national science television and radio programmes as well as print media.

10. promoting the design of a national IPY stamp;
11. promoting the involvement of students and young scientists in national IPY field activities.

3.5 ESTABLISHING THE VISUAL IDENTITY OF IPY 2007-2008 – THE IPY LOGO

In communicating IPY 2007-2008 to a wide range of audiences it is important to have a visual cue that people can come to associate with the programme and which places the programme in an appropriate context. Initially, NASA graphics artists assembled a colour montage of polar images and this has provided a striking representation of what IPY 2007-2008 encompasses. The individual images identify geography, geospace, ecosystems and society, technological capabilities and the researching of scientific frontiers. The montage has featured in many PowerPoint presentations, on the covers of reports and is used extensively in the existing IPY 2007-2008 website so is serving a very useful purpose in promoting the programme.

There is also a requirement for simpler artwork (a logo) that can be used in colour or in a black and white form and be reduced to a very small image without losing its ability to identify IPY 2007-2008. The brief for the logo was that it should identify the polar regions, refer back to IGY but also look to establishing a legacy of significantly increased awareness of, and activity in, polar regions. It should also clearly indicate the importance of the human dimension in IPY 2007-2008. The logo shown in Fig. 1 consciously takes the original Globe logo of IGY, but highlights both polar regions, superimposes a large human figure symbolising the human dimension and replaces the original representation of an orbiting satellite with an arrow symbolising the establishment of a legacy.

Fig 1: Proposed logo for IPY 2007-2008

4. Organizational structure and implementation

4.1 PRINCIPLES FOR IMPLEMENTATION OF THE IPY 2007-2008

To be successful, IPY 2007-2008 needs a sound organizational structure with minimal bureaucracy that promotes efficient communication and attracts excellent people. This means a simple framework that makes effective use of existing polar organizations and avoids duplication of the roles of these organizations, yet provides needed additional coordinating and oversight bodies. It should provide a means to influence major stakeholders while seeking to adapt and link to existing plans in imaginative and innovative ways, recognising that some logistic schedules and other activities for the IPY 2007-2008 period are already largely defined.

This implementation plan aims to be a transparent, inclusive process that gives an equal opportunity to all potential participants in IPY 2007-2008 and encourages projects that satisfy the IPY objectives. The core participants of IPY 2007-2008 will be self-organising groups of researchers, their parent organizations, existing bodies with a role in polar regions research and monitoring, and consortia of such bodies.

4.2 ROLE OF ICSU AND WMO AS IPY SPONSORS

The IPY sponsors, ICSU and WMO, have established the International Polar Year 2007-2008 Joint Committee (JC) described below and will fund its activities. Neither ICSU, WMO nor the Joint Committee have, or will seek authority over national or international polar research programmes. The JC's approach will be to influence the actions of the national and international bodies for the overall benefit of IPY 2007-2008 through encouragement, persuasion and consensus building. The one exception is that WMO will exert direct control over IPY contributions from internal WMO approved and funded programmes.

4.3 IPY 2007-2008 PARTICIPANTS

IPY 2007-2008 research activities will be carried out by scientists and support staff from university research groups, other research organizations, operational bodies such as national meteorological services, and international organizations.

Data management is expected to be supported within individual research activities by the contributing organizations using trained data specialists. To ensure that IPY 2007-2008 data sets are managed to fulfil the long-term Polar Year objective of increased polar research capacity, the data management must conform to the principles defined by the JC-appointed specialist Data Policy and Management Sub-Committee.

IPY 2007-2008 education and outreach activities will be carried out both by scientists and their support teams, IPY 2007-2008 National Committees, the JC and by other organizations as appropriate. This critical aspect of IPY 2007-2008 will be led, advised and facilitated by a JC-appointed Sub-Committee on Education, Outreach and Communication.

4.4 IPY 2007-2008 FUNDING

The financial support for IPY 2007-2008 activities will be obtained by researchers making proposals to existing funding organizations, many of which will be encouraging IPY-related work with specific solicitations. Thus, the research activities will mainly be approved and funded through national mechanisms, as well as through regional and international funding bodies, such as the European Commission.

The Joint Committee is not a funding organization and has no funds to dispense. It will, however, host a submission process that conveys official IPY 2007-2008 status as described below.

4.5 ORGANIZATIONAL STRUCTURE FOR THE IPY

The structure presented overleaf (Fig. 2) will be established for IPY 2007-2008 to provide the enabling mechanism for the IPY activities to occur.

4.5.1 Role of the IPY Joint Committee

The IPY 2007-2008 Joint Committee (JC) will exist until the end of 2009. It consists of two Co-Chairs and no more than 12 additional members appointed by ICSU and WMO. SCAR (Scientific Committee for Antarctic Research), IASC (International Arctic Science Committee) and IOC (Inter-governmental Oceanographic Commission of UNESCO) have each been invited to nominate ex officio representatives. In addition, the Executive Heads of ICSU and WMO will each appoint an ex officio member of the Committee. The Co-Chairs can invite additional persons to attend sessions for specific agenda items, as necessary.

The Joint Committee will be responsible for overall scientific planning, coordination, guidance and oversight of IPY 2007-2008. In performing its functions, it will be supported by an International Programme Office (discussed below). It should work closely with all relevant organizations and National IPY Committees/contact persons. The Joint Committee will meet at least twice a year.

Drawing from the agreed terms of reference, the specific tasks of the Joint Committee are:

1. to assign official IPY 2007-2008 status to projects based on submitted expressions of intent and/or proposals;
2. to develop and keep under review an implementation plan for IPY2007-2008 in close consultation with appropriate bodies and to ensure that the plan makes optimal use of available resources;
3. to establish mechanisms for the design, guidance, development and oversight of IPY 2007-2008 projects;
4. to provide leadership in developing IPY 2007-2008 data

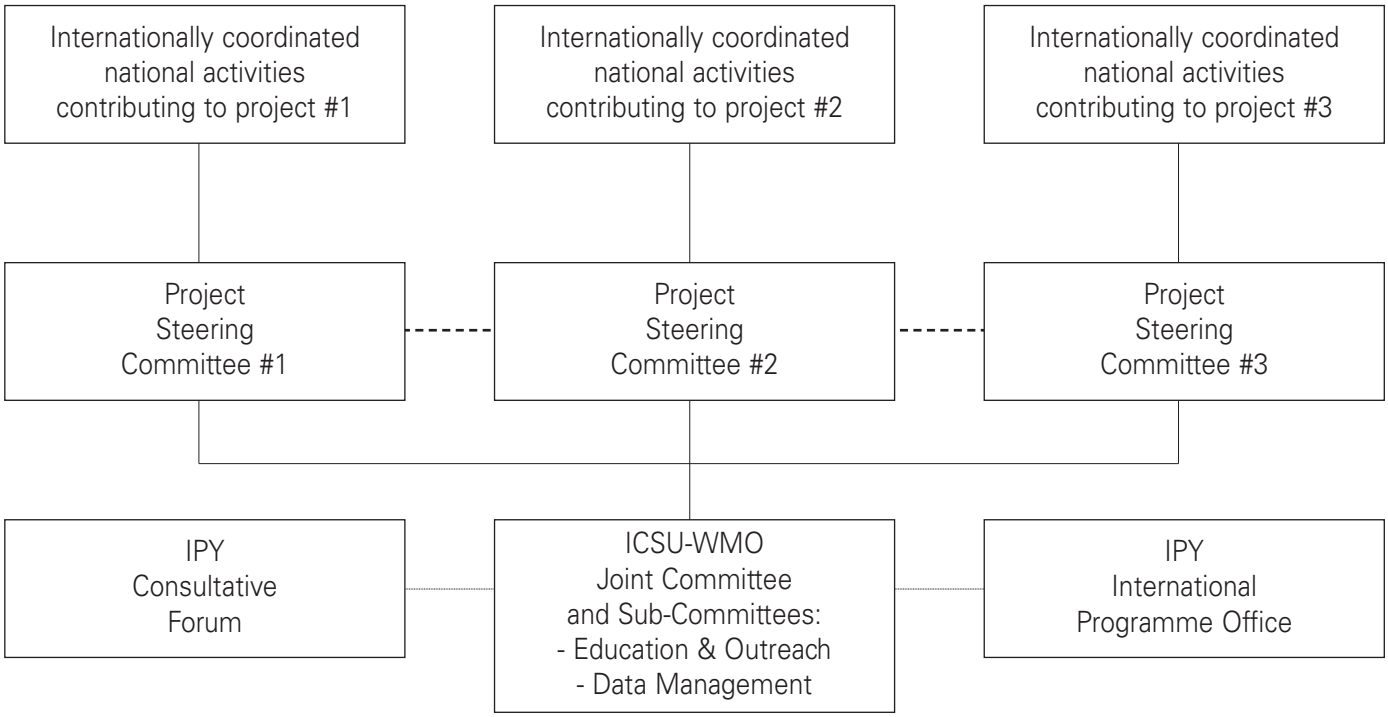

Figure 2: The organizational structure for the IPY. The overall programme is addressed by a combination of a Consultative Forum and the ICSU-WMO IPY-JC, supported by the International Programme Office. Individual projects operate with a degree of autonomy under the direction of a Project Steering Committee. The connecting lines symbolise two-way communication pathways and (upwards) lines of decision-making (to be exercised as far as possible through consensus).

policy and data management protocols through the establishment and guidance of a Data Policy and Management Sub-Committee;

5. to promote the IPY 2007-2008 objectives and its achievements including through the appointment of a Sub-Committee on Education, Outreach and Communication;
6. to encourage the active participation of other relevant organizations in IPY 2007-2008;
7. to convene sessions of an IPY 2007-2008 Consultative Forum to which all stakeholders will be invited;
8. to raise additional funds for planning and coordination activities, including activities of Sub-Committees set up by the Joint Committee, and to assist in convincing national and international funding bodies to support IPY 2007-2008 projects;
9. to provide oversight and guidance to the activities of the IPY 2007-2008 International Programme Office; and
10. to report to the ICSU and WMO Executive Bodies on IPY 2007-2008 progress after each meeting of the Joint Committee.

4.5.2 Role of the Project Steering Committees

All IPY 2007-2008 projects will have a Project Steering Committee (PSC). The Joint Committee will identify and recognize the Project Steering Committee and its leader, who will serve as the point of contact between the project and the other elements of the Polar Year organizational structure. The size of the committee should be appropriate to the complexity of the project. Small or simple projects might decide that the Project Steering Committee functions can be handled by a single individual, while it is expected that more complex projects will have a larger, international Project Steering Committee. Funding for activities of the Project Steering Committee will be provided by national participants in the relevant IPY 2007-2008 projects.

The Project Steering Committee will be responsible for the detailed planning, execution and reporting of science activities of that project. Each Project Steering Committee must have an identified leader who is the communication link to the Joint Committee and to leaders of other Project Steering Committees.

The Project Steering Committee will have considerable autonomy. Members are expected to be active participants of the activities or responsible for critical elements, such as logistics, data management, or education, outreach and communications.

4.5.3 Role of the International Programme Office

An activity as large and complex as IPY 2007-2008 will require daily, full-time staff support. Most of the IPY participants who will serve on the various IPY committees and Sub-Committees will be volunteers drawn from the academic community and from the stakeholder bodies. The International Programme Office (IPO) will provide the day-to-day administrative support to the Joint Committee, its Sub-

Committees and, to a more limited degree, to the larger Project Steering Committee. The International Programme Office is a crucial element of IPY implementation. The International Programme Office may have distributed sub-offices with specific tasks, as well as using ICSU and WMO facilities as appropriate.

ICSU and WMO have solicited proposals from nations or organizations prepared to support and fund the International Programme Office. Selection between multiple submitted proposals will be based on the extent to which the proposal is able to provide the expected functions of the International Programme Office, which include:

1. to provide active support to the ICSU-WMO Joint Committee, for the central planning, coordination, oversight and guidance of IPY 2007-2008;
2. to support the meetings and activities of the Joint Committee;
3. to act as the central point of contact for IPY 2007-2008 National Committees, related international programmes, and all participating or interested organizations and individual researchers;
4. to support the development of outreach and education programmes through development of IPY 2007-2008 "branding" and through coordinating the creation of promotional material;
5. to organize and/or coordinate international meetings and workshops on the Polar Year;
6. to promote IPY 2007-2008 internationally by all appropriate means;
7. to coordinate the dissemination of research outputs across IPY 2007-2008 organizations;
8. to facilitate the acquisition of funding to sustain IPY 2007-2008 coordination and oversight structure;
9. to support and maintain the IPY 2007-2008 website.

Specific functions that the International Programme Office will provide to support the Joint Committee are:

1. central handling of correspondence;
2. tracking of action items;
3. archiving of key documentation;
4. maintaining an IPY 2007-2008 activities database;
5. managing the central budget;
6. assisting in the production of reports and synthesis documents.

An additional task of the International Programme Office will be to serve as an interface with other International Year programmes being planned to coincide with the 50th anniversary of the IGY (see Box 4). Links will be forged with the Programme Offices of these international initiatives.

4.5.4 Role of the Consultative Forum

Given the large numbers of IPY 2007-2008 stakeholders, an advisory Consultative Forum (CF) will be established to provide a consultative platform for Polar Year development including dialogue among the various stakeholders, expressions of views on IPY 2007-2008, and a venue for exchange of information with the Joint Committee on IPY 2007-2008 development. The opinions and views expressed by stakeholders at this forum will be considered by the Joint Committee in all aspects of planning, implementation and management of the IPY 2007-2008. The Consultative Forum will assemble once per year and will be coordinated by the JC and the IPO. The funding for these meetings will be provided by the participants.

4.5.5 Role of IPY 2007-2008 National Committees

The functional responsibilities of IPY 2007-2008 National Committees will vary between countries. In some countries, National Committees may be involved in funding processes. In all countries, these Committees are expected to work under the following general terms of reference:

1. to act as an information conduit from the Joint Committee to the national scientific community and National Meteorological Services to promote awareness of and interest in IPY 2007-2008;
2. to provide national input to the Joint Committee for the formulation of the IPY programme of activities;
3. to facilitate the planning and implementation of national activities contributing to IPY 2007-2008, including, where appropriate, the endorsement of IPY expressions of intent and/or proposals;
4. to ensure that nationally-collected IPY data are available to the international research community in accordance with protocols developed for data exchange within IPY 2007-2008;

Box 4

OTHER INTERNATIONAL YEAR INITIATIVES

There are other communities conducting special activities during the 50th anniversary of the IGY in 2007, and which share many objectives and parentage with IPY 2007-2008. Various ICSU unions are coordinating these efforts. The IPO will serve as official contact point for these other programmes, and it is expected that the open development process adopted by IPY 2007-2008 will ensure that such programmes can keep themselves abreast of the emerging Polar Year programme. IPY 2007-2008 will pursue and establish an appropriate level of shared involvement and cooperation with these programmes.

Related efforts:

The International Year of Planet Earth, now called "The Year" (http://www.esfs.org/);

The Electronic Geophysical Year (eGY) (http://www.egy.org/);

The International Heliophysical Year (IHY) (http://ihy.gsfc.nasa.gov/).

5. to take a lead role on issues of outreach education and communication at the national level;
6. to encourage and facilitate the provision of necessary national funds, logistical support, and other support for the implementation of national activities contributing to the IPY 2007-2008 objectives;
7. to encourage and facilitate national contributions to the cost of the international scientific coordination and integration of IPY 2007-2008;
8. to assist the Joint Committee in the planning, implementation, data management, and delivery of IPY 2007-2008;
9. to host regional and national IPY 2007-2008 meetings.

4.5.6 Role of other bodies

A significant difference between the current IPY and its predecessors is the existence of a large number of bodies, both non-governmental and governmental, each with established roles and legitimate interests in the international coordination of scientific activities carried out in the polar regions. The Antarctic Treaty Consultative Meeting and the Arctic Council are especially significant in this respect.

The potential exists for organizational arrangements to be established which imaginatively and cost-effectively draw upon the effort, funding and influence of existing bodies to implement the IPY, while at the same time satisfying their specific interests in an IPY involvement. A large number of these bodies have already given their endorsements to IPY (see Annex 3).

4.6 PROCESS FOR IDENTIFYING IPY CONTENT

4.6.1 Solicitation of Expressions of Intent

In order to facilitate an IPY 2007-2008 that is composed of projects and activities that support the themes and observational goals outlined in this report, and to develop IPY 2007-2008 in a rapid timeframe, especially for those projects that involve complex logistics, the Joint Committee must move quickly to collect community input. This collection will benefit IPY 2007-2008 in a number of ways: first, it will be helpful in planning the overall programme to have available as comprehensive a set of thoughts and ideas as possible at an early stage; second, emerging projects will benefit from an early approval from the Joint Committee in seeking funding in their home countries; and third, funding and logistic support organizations will benefit by having an early measure of IPY interest in their countries (and others) to be used in influencing national budgets.

These mutually supporting advantages lead to a call for brief expressions of intent to be submitted to the Joint Committee by 14 January 2005. Specific information will be requested by electronic form that will total no more than four or five pages, and an example of a completed submission will be made available on the website well in advance of the deadline. The submission will provide the information needed by the Joint Committee to evaluate how well each proposed activity will meet the IPY 2007-2008 criteria given below. These criteria address science content, feasibility, data management, outreach and education, and overall project management, and are drawn from the IPY objectives and characteristics (Sections 1.5 and 1.6).

The Joint Committee will examine these submissions in a timely manner for the purpose of assigning preliminary official IPY 2007-2008 status. The Joint Committee will respond to each submission, including advising where relevant on ways to improve the proposed project's contribution to the overall IPY objectives. This might be done, for example, by suggesting increased cooperation with other submitted projects. Submitted expressions of intent (but not the Joint Committee responses) will be posted on the IPY 2007-2008 website (www.ipy.org) to offer opportunities for all prospective participants to link to other related projects and enhance the overall IPY 2007-2008 programme.

It is hoped that the broad awareness of IPY 2007-2008 over the past year makes this short deadline manageable by most interested groups. It is imperative that projects requiring complex logistics or extended preparations be identified by this call for expressions of intent. There will be subsequent opportunities to submit proposals for consideration as IPY activities, to accommodate for example projects that start late during the IPY 2007-2008 programme period or have less complexity. However, the relatively short preparation time prior to 2007, especially as regards the availability of polar logistics, provides a strong incentive for projects to submit as early as possible, if they are to be successfully integrated into the overall IPY 2007-2008 programme.

4.6.2 Criteria for Identifying IPY 2007-2008 Activities (covering science, feasibility, data, outreach and education)

The expression of intent is expected to demonstrate that the project will meet the following criteria (taken from the IPY 2007-2008 objectives and characteristics). It is recognised, however, that in some cases not all criteria can be met, especially at this preliminary stage. In these cases the proposer(s) must explain why specific criteria are not met.

The criteria for identification of an IPY project are that it:

1. makes significant advances within one or more IPY 2007-2008 themes;
2. involves at least one polar region and takes place within the IPY 2007-2008 timeframe;
3. contributes to international collaboration;
4. presents a viable management plan and organizational structure, including a time line when commitments (funding, logistic etc) can be expected;
5. presents a viable approach for securing funding;
6. proposes a viable plan for securing appropriate logistical support;
7. signs up to the principles and aims of IPY 2007-2008 data management and proposes a viable data management plan;

8. proposes a viable plan or approach for education, outreach and communication activities;
9. shows how it will foster the next generation of polar researchers.

Some additional criteria that add further value are:

1. includes nations not traditionally involved in polar research;
2. provides the opportunity for a legacy of infrastructure (observation sites, facilities, systems);
3. builds on existing plans, programmes or initiatives or at least does not conflict with them;
4. has interdisciplinary elements;
5. is "endorsed" by one or more IPY 2007-2008 National Committees.

4.6.3 Expressions of Intent Examination and Feedback

The Joint Committee will evaluate how well submitted expressions of intent satisfy the criteria listed above, and shall assign submissions to one of three categories. This objective assessment will begin before the end of January 2005 with responses provided to the proposers no later than the end of February 2005. The three assessment categories are:

1. Submissions which satisfy all criteria. These will be encouraged to be developed into a full proposal. They will also receive formal recognition including provisional permission to adopt and use the IPY 2007-2008 imprimatur pending the receipt of an acceptable full proposal. Submissions which satisfy most criteria (and where not, give adequate justification) will be treated similarly.
2. Submissions which satisfy many, but not all IPY 2007-2008 criteria. It is expected that there will be a number of submissions that the Joint Committee feels can be substantially improved in meeting IPY 2007-2008 objectives. The Joint Committee will provide guidance on how these can better address IPY 2007-2008 criteria and invite resubmission of an amended expression of intent. This guidance is regarded as one of the most important functions of the Joint Committee. It indicates the intent of the Sponsors to make IPY 2007-2008 as inclusive as possible while maintaining the highest standards of science, international collaboration and coordination, effectiveness and societal relevance.
3. Expressions of intent or proposals that are assessed as not relevant to IPY 2007-2008 objectives will be omitted from further consideration.

Soon after the expression of intent assessment is complete, the JC will report to the Consultative Forum (CF) on the results of this phase, highlighting issues where the CF could be of particular value by facilitating research, addressing imbalances or gaps, etc. The Joint Committee will take into account comments from the CF, as appropriate.

4.6.4 Full Proposal Preparation and Submission

The period following the Joint Committee's response will be used by proposers to fully develop their plans for research implementation and management (including any appropriate additional collaborations), data and information management, and education/outreach plans. Proposers should also seek National Committee endorsement (if not already obtained). Full proposals will be due in June 2005 and should include a complete science proposal and detailed descriptions related to all criteria described above in Section 4.6.2, including identification of the Project Steering Committee composition and its leader.

4.6.5 Identification of IPY Activities

Based on the submitted full proposals, the JC will decide which proposals satisfy all the criteria, approve those activities as part of the official IPY 2007-2008 programme, and give permission for the project to use the IPY imprimatur. The JC will identify and recognize the Project Steering Committee and its leader, as part of this final assessment.

4.6.6 Project Steering Committee Phase

Following Joint Committee identification of the official IPY 2007-2008 programme elements, the emphasis for realizing the total programme shifts to the Project Steering Committees. These will be responsible for securing funding for their activities, for ensuring that adequate logistic support will be provided, for proper management (including archiving and availability) of their data, and for effective communication of their activities to the public, decision makers and education stakeholders.

The Project Steering Committees will continue to steer project implementation through the formal IPY period (1 March 2007 - 1 March 2009) with ongoing support and oversight provided by the JC, and with continuing communication support functions provided by the International Programme Office.

4.6.7 Time Schedule

Early November 2004: ICSU and WMO, on behalf of the JC, will call for expressions of intent submissions for IPY 2007-2008 Projects. These submissions must address the criteria for IPY 2007-2008 identification given in 4.6.2 above.

14 January 2005: deadline for submission of expressions of intent. It is hoped that these will primarily be those proposed activities requiring substantial logistic support and therefore the longest logistic lead times.

February 2005: the JC will review the expressions of intent and make a preliminary identification of those which satisfy the criteria or which, with some amendment could satisfy the criteria. Letters with guidance will be sent to all proposers.

March 2005: the JC will meet with the Consultative Forum to review the overall scope of IPY 2007-2008, including possibly comments on funding and implementation from national committees and logistic operators.

June 2005: submission of complete proposals with updated plans and more detailed information on funding and support. If funding and support schedules do not allow statements of commitments at this stage, the proposal should give an indication of when firm commitments are expected.

Second half of 2005: the JC decides and announces which projects and activities contribute to the official IPY 2007-2008 programme.

Subsequently, further opportunities will be available during 2005 and 2006 to submit proposals for consideration as IPY 2007-2008 activities. It is anticipated that these will primarily be logistically less complex projects, as the more complex logistic resources will have been allocated.

Annexes

ANNEX 1

Terms of Reference of the ICSU IPY 2007-2008 Planning Group

August 2003

The role of the IPY-PG should be to formulate a concept for an IPY 2007-8 and to design the means of ICSU leading such a programme.

Specifically the Group's tasks are:

1. To gather, summarise and make widely available information on existing ideas for an IPY, serving as a clearinghouse for ideas,
2. To stimulate, encourage and organise debate amongst a wide range of interested parties on the objectives and possible content of an IPY,
3. To formulate a set of objectives for an IPY,
4. To develop an initial high level Science Plan for an IPY which engages younger scientists throughout the planning process,
5. To develop a specific set of objectives targeted at formal and informal education as well as the general public in the next IPY,
6. To develop a proposed mechanism for the design, development, guidance, and oversight of an IPY,
7. To present a draft plan to the ICSU EB at their February 2004 meeting, and
8. To report to the ICSU 28th General Assembly in 2005 a plan for an IPY in 2007-8 for final endorsement.

ANNEX 2

Membership of the IPY International Planning Group

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ANNEX 3

National and International Organizations Endorsing or Contributing to IPY 2007-2008

- Antarctic Treaty Consultative Meeting (ATCM)
- Arctic Climate Impact Assessment (ACIA)
- Arctic Council
- Arctic Ocean Science Board (AOSB)
- Census of Marine Life (CoML)
- Commission for the Geological Map of the World (CGMW)
- Climate and Weather of the Sun-Earth System (CAWSES)
- Climate of the Arctic and its Role for Europe (CARE)
- Committee of Managers of National Antarctic Programmes (COMNAP)
- European Science Foundation Polar Board (ESF-EPB)
- European Space Agency (ESA)
- Forum of Arctic Research Operators (FARO)
- Global Ocean Observing System (GOOS)
- International Arctic Science Committee (IASC)
- International Council for Science (ICSU)
- International Geosphere-Biosphere Programme (IGBP)
- International Heliophysical Year (IHY)
- Inter-Governmental Oceanographic Commission (IOC)
- International Arctic Social Sciences Association (IASSA)
- International Hydrographic Bureau (IHO)
- International Permafrost Association (IPA)
- International Science Initiative in the Russian Arctic (ISIRA)
- International Society for Photogrammetry and Remote Sensing (ISPRS)
- International Union for Radio Science (URSI)
- International Union of Geodesy and Geophysics (IUGG)
- International Union of Geological Sciences (IUGS)
- National Aeronautics and Space Administration (NASA)
- National Oceanographic and Atmospheric Administration (NOAA)
- The Norwegian Academy of Science and Letters
- The Royal Academies for Science and the Arts of Belgium
- The Royal Society of London
- Scientific Committee on Antarctic Research (SCAR)
- Scientific Committee on Oceanographic Research (SCOR)
- Scientific Committee on Solar Terrestrial Physics - Solar Terrestrial Physics Programme (SCOSTEP-STPP)
- Surface Ocean-Lower Atmosphere Programme (SOLAS)
- United States Polar Research Board (PRB)
- United Nations Environment Programme (UNEP)
- World Climate Research Programme (WCRP)
- WCRP Climate and Cryosphere Programme (CliC)
- WCRP International Programme for Antarctic Buoys (IPAB)
- WCRP Southern Ocean Climate Variability Programme (SO CLIVAR)
- World Meteorological Organization (WMO)

ANNEX 4

List of Acronyms

AAFICOST	Arctic and Antarctic Firn Core Studies
AALM	Antarctic Active Layer Monitoring
ABRIS	Antarctic Bed Relief and Ice Sheet
ACIA	Arctic Climate Impact Assessment
AICI	Air Ice Chemical Interactions
AMAP	Arctic Monitoring and Assessment Programme
AOOS	Arctic Ocean Observing System
AOSB	Arctic Ocean Science Board
ASOF	Arctic-Subarctic Ocean Fluxes
ASSW	Arctic Science Summit Week
ATCM	Antarctic Treaty Consultative Meeting
AUV	Autonomous Underwater Vehicle
CARE	Climate of the Arctic and its Role for Europe
CAWSES	Climate and Weather of the Sun Earth System
CF	Consultative Forum
CGMW	Commission for the Geological Map of the World
CLIC	Climate and Cryosphere Programme
CLIVAR	WCRP Climate Variability Programme
CODATA	Committee on Data for Science and Technology
CoML	Census of Marine Life
COMNAP	Committee of Managers of National Antarctic Programmes
CRC	Cooperative Research Centre
DIS	Data and Information Service
DPM	Data Policy and Management
E&O	Education and Outreach
EBA	Evolutionary Biology in Antarctica
EOC	Education, Outreach and Communication
EPB	European Polar Board
ESA	European Space Agency
ESF	European Science Foundation
FARO	Forum of Arctic Research Operators
GCMD	Global Change Master Directory
GDSIDB	Global Digital Sea Ice Data Bank
GLOBE	The GLOBE educational programme
GOOS	Global Ocean Observing System
GPS	Global Positioning Satellite
IASC	International Arctic Science Committee
IASSA	International Arctic Social Sciences Association
ICARP	International Conference on Arctic Research Planning
ICSU	International Council for Science
IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere Biosphere Programme
IGCP	International GeoScience Programme
IGY	International Geophysical Year
IHO	International Hydrographical Organisation
IHY	International Heliophysical Year
IMO	International Meteorological Organization
IOC	Inter-Governmental Oceanographic Commission
IPA	International Permafrost Association
IPAB	International Programme for Antarctic Buoys
IPO	International Programme Office
IPY	International Polar Year
ISIRA	International Science Initiative in the Russian Arctic
ISIS	Information Society Initiatives in Standardization
ISO	International Organization for Standardization
ISPRS	International Society for Photogrammetry and Remote Sensing
IT	Information Technologies

IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
JC	Joint Committee
JCADM	Joint Committee on Antarctic Data Management
NASA	National Aeronautics and Space Administration
NC	National Committee
NERC	Natural Environment Research Council
NOAA	National Oceanographic and Atmospheric Administration
NSF	National Science Foundation
PG	Planning Group
PI	Principal Investigator
PRB	Polar Research Board
PSC	Project Steering Committee
ROV	Remote Operated Vehicle
SCAR	Scientific Committee on Antarctic Research
SCOPE	Simple Communications Programming Environment
SCOR	Scientific Committee on Oceanographic Research
SCOSTEP	Scientific Committee on Solar Terrestrial Physics
SOLAS	Surface Ocean Lower Atmosphere Study
SPACE	Synoptic Pan Arctic Climate and Environment
STPP	Solar Terrestrial Physics Programme
UK	United Kingdom
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Science and Culture Programme
URSI	Union for Radio Science
US	United States
USA	United States of America
UV	Ultraviolet
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment

ICSU mission statement

In order to strengthen international science for the benefit of society, ICSU mobilizes the knowledge and resources of the international science community to:

Identify and address major issues of importance to science and society

Facilitate interaction amongst scientists across all disciplines and from all countries

Promote the participation of all scientists – regardless of race, citizenship, language, political stance, or gender – in the international scientific endeavour

Provide independent, authoritative advice to stimulate constructive dialogue between the scientific community and governments, civil society, and the private sector.

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