International Arctic Science Committee (IASC)

An International Review and Recommendations for the Future

2016

Summary

At its meeting in 2014, IASC Council appointed an international group of experts to carry out a review of progress for the 2006-2016 period, including progress implementing the recommendations of the 2006 Review Committee, and to recommend strategies for the future. This Review Committee met in Potsdam, Germany, on September 22-23, 2015, to discuss the responses received from questionnaires circulated to the wider Arctic scientific community, as well as to representatives of IASC stakeholders.

The Review Committee found that IASC had responded positively to the vast majority of the 2006 Review Group recommendations, and is to be commended for its excellent progress. Responses to the questionnaire praised IASC for meeting the requirements of its mission, and highlighted its success in research planning and coordination, its leadership of the Arctic Science Summit Week, and the successes of its Working Groups (WGs). IASC was praised for its exemplary support for early career scientists.

Respondents to the IASC stakeholder questionnaire felt that they benefitted from IASC, were reasonably well informed about activities, and were broadly satisfied by the current working group structure. They indicated that IASC's network affiliation was beneficial, and praised both the efforts of the IASC Secretariat and IASC's overall commitment to the advancement of early career scientists. IASC has clearly made outstanding progress and grown in capacity over the past decade, positioning the organization well for making sustained progress in the future.

Clearly IASC has matured as an organization, and it now plays a prominent role in facilitating and coordinating Arctic science activities. Nevertheless, some key challenges lie ahead. In particular, now that it has matured, IASC has the potential to play a much more central role in Arctic science than it now does, especially in conjunction with partner organizations. Opportunities for expanding IASC's role are already arising, due to the rapidity of environmental, social, economic, and political change in the region. As a sign of what is possible, the Arctic Science Summit Week (ASSW) has already become the preeminent inter-disciplinary Arctic sciences conference, attracting scholars from across the natural, social, and physical sciences.

Bearing this feedback in mind, the Review Committee's recommendations should be taken as advice for a touch on the tiller, and not for any major change in direction. The Review Committee recommends the Council consider making advances under seven key themes:

1. **Planning**
2. **Finance**
3. **Science**
4. **Services**
5. **Linkages**
6. **People**
7. **Raising Awareness**

Rather than repeating them here, recommendations appear later in the text that follows, along with background statements to establish their context.

Background

The IASC Founding Articles call for a regular review of the organization. The first of these reviews was undertaken in 1996, and the second in 2006. At its meeting in 2014, IASC Council detecided that ten years after the second review, and after completion of the third International Conference on Arctic Research Planning (ICARP III), it would be timely to conduct another review of IASC.

The IASC Council duly appointed an international group of experts to serve on the IASC Review Committee. These committee members were selected as experts of international renown, with a broad understanding of Arctic research and policy. To the extent possible, expertise of the members covered the whole spectrum of IASC´s activities, considering geographical, age, and gender balance. The list of members is provided in Appendix (1). Secretarial support was provided by the International Arctic Research Center in Fairbanks, Alaska, USA, courtesy of IASC Vice-President Larry Hinzman.

The overall tasks for the Review Committee were to

(1) Evaluate IASC´s activities over the 2006-2015 10-year period; and to

(2) Recommend strategies for the future.

The Review Committee was appointed after the 2015 Arctic Science Summit Week (ASSW), with a one-year mandate until the ASSW 2016. The group held one telephone conference, on June 11, 2015, and a face-to-face meeting, at the IASC Secretariat in Potsdam, on September 22-23, 2015. Subsequent communications between members of the review group took place by e-mail. Modifications to the report took place as inputs from ICARP-III became available (February 2016). An interim report was drafted for presentation to the Executive Committee in November 2015, with the final report drafted for submission to the Council at the ASSW in Fairbanks in March 2016.

The review was designed for application to the organization as a whole and to include an evaluation of IASC´s various groups and initiatives. It was to be based on both assessments from the committee members and consultations with the Arctic science community. Consultations took place by means of questionnaires sent to (a) the Arctic science community, and (b) “the IASC family” (IASC operatives). The make up of the questionnaires differed, with those for Group (a) regarding IASC in general, and those for Group (b) focused more directly on IASC operations (See Appendix (2) for complete lists of questions for the two groups). Roughly one thousand survey questionnaires were distributed to Group (a) using the IASC mailing list, and roughly two hundred were distributed to Group (b) through contact with members of various IASC stakeholder bodies. Groups (a) and (b) overlapped, as many members of “the IASC family” were also members of the wider Arctic science community. About 10 % of those in Group (a) responded, and about 25 % of Group (b). These are considered to be reasonable levels of response for questionnaires of this kind. The 2006 survey had a 22 % response.

Appendix (3) offers a breakdown of respondents in Group (a). As expected, most respondents came from countries with substantial Arctic research programmes. There were some

surprises—notably the small number of respondents from Russia and the UK, and the lack of any response from India and Austria.

Most respondents identified as Professors (44.6 %), Scientists/Researchers (19.35 %), or Directors/Administrators (14.5 %). The median age of respondents was 51.5 (range: 26-81), and there was a disappointingly small response from early career scientists, including IASC Fellows. There were significantly more respondents (38) from the physical sciences sector (glaciology, climate, cryosphere, permafrost, atmosphere, remote sensing) than from the biological sciences (9) or social sciences (11).

Introduction

IASC's mission is "*to encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research and in all areas of the Arctic region.*" To achieve this, IASC promotes and supports leading-edge multi-disciplinary research, so as to foster a greater scientific understanding of the Arctic region and its role in the Earth system. IASC carries out its mission through a number of tasks, including:

Initiating, coordinating, and promoting scientific activities at a circum-Arctic or international level; Providing mechanisms and instruments to support science development; Providing objective and independent scientific advice on issues of science in the Arctic and communicating scientific information to the public; Seeking to ensure scientific data and information from the Arctic are safeguarded, freely exchangeable, and accessible; Promoting international access to all geographic areas and sharing of knowledge, logistics, and other resources; Providing for the freedom and ethical conduct of science; Promoting and involving the next generation of scientists working in the Arctic; and Promoting bipolar cooperation through interaction with relevant science organizations.

The importance of IASC's scientific studies is underscored by the rapid changes taking place in the Arctic in response to global warming. Change is happening faster in the Arctic than elsewhere as the planet warms, and change is expected to increase rapidly. Changes in the Arctic climate system are not confined to the region; their effects are transmitted to surrounding areas, and ultimately around the globe. Environmental change is leading to changes in the exploitability of the Arctic, with the opening of northeastern and northwestern sea routes, and increasing pressure for oil and gas exploration, especially offshore. These developments are further increasing the world's attention on the Arctic. Recognition of this importance of the polar regions in the global climate system led to the development of the 4th International Polar Year (IPY) in 2007-2008, in which IASC played a central role. Research outcomes from that exercise continue to emerge and influence the current review of Arctic science in ICARP-III, which concluded its decadal deliberations in late 2015. IASC is well placed to respond to these various pressures and opportunities.

Over the past decade, since the international review of 2006 (published in 2007), IASC has responded well to these growing challenges. For a start, it accepted practically all the advice of the 2006 review committee, establishing an entirely new structure. The present review group is convinced that IASC has done very well, and is ably supported by a highly competent Secretariat. The organization has become even more international, accepting new member countries. It is very well regarded within the scientific community and by its sister organizations.

Among IASC's very real achievements over the past decade (highlighted in the rather useful book "IASC After 25 Years") are:

- **Major contributions to the success of the IPY (including co-hosting the 2008 IPY Conference in St Petersburg and co-organizing both the 2010 IPY conference in Oslo and the 2012 conference in Montreal);**

- **Support for the establishment and continuance of APECS;**

- **Expansion of the IASC Fellowship programme;**

- **Creating a new formula for the ASSW, allowing a major Arctic science conference every two years;**

- **Supporting the development and completion of ICARP-III;**

- **Merging AOSB into IASC, as the IASC Marine Working Group;**

- **Developing a Data Committee, for facilitating data collection and sharing;**

- **Establishing the IASC Working Groups, through which the IASC family was substantially enlarged;**

- **Pairing with SCAR to sign various partnership agreements, improving coordination between the different polar research entities of ICSU (the International Council for Science);**

- **Increasing the IASC Secretariat, with sub-secretariats in South Korea, Japan, Canada, and Poland.**

The 2007 Review Committee noted that the development of a paradigm shift toward a more holistic and multidimensional perspective in the Arctic required that IASC should embrace a new vision, in which it would uphold the necessary holistic and multidimensional perspective, address the Arctic as part of the global process, and play a central role as THE international and interdisciplinary organization for harnessing the scientific expertise of the Arctic. That committee noted that: "*IASC must find a way to bring the full body of scientific knowledge of the Arctic together so that it can provide collective international advice on science issues in the North to the Arctic Council and other international organizations*."

It was further suggested that IASC should: adopt a new structure to reflect the more integrative nature of today's polar science; expand its functions to include such issues as new technology, data management, education, and outreach; strengthen its relations with the Arctic Council, social science organizations, and other global organizations interested in Arctic science; and reorganize and revitalize ASSW, which recent questionnaire respondents noted is now *"the pre-eminent inter-disciplinary arctic sciences conference, attracting scholars from across the natural, social and physical sciences,*" and "*is becoming a much more important meeting to attend.*"

IASC responded to the previous recommendations by, for example: developing a new Working Group structure; abolishing its Regional Board; incorporating AOSB; improving its relations with other Arctic or polar organizations (IPA, SCAR, IACS, CLIC) and the Arctic Council; increasing the extent of ASSW to include a major three-day science conference every second year, and an Arctic Observing Summit in between years; increasing social science involvement through the creation of a social science Working Group; increasing the involvement of indigenous people in IASC activities; and making procedures (e.g., for forming Working Groups) more transparent.

Report and Recommendations

As in 2006, the present report is organized into what the current Review Group considered to be Key Themes. These do not coincide with, but draw upon, the organization of and responses to the questionnaires in Annexes 2 and 3. *Quotes in italics are from responses to the questionnaires*.

As a preamble, the present Review Group wishes to congratulate IASC for having responded positively to the vast majority of the recommendations of the 2006 Review Group. Comments such as "*Keep doing a great job, IASC,*" and "*no other organization is providing these services,*" and "*thanks to the help and support of IASC many new international and interdisciplinary Arctic research projects were initiated*" reinforce the point that IASC is doing well overall. Nevertheless, "*The challenge remains to promote truly interdisciplinary and trans-disciplinary research, including the full range of social sciences and humanities*."

Special note was made of the fact that "*IASC is exemplary in its support of early career scientists.*" The Secretariat also received special praise, with comments like "*the work of the Secretariat is perfect,*" and "*the IASC Secretariat is providing a lot of support in [an] adequate and timely manner.*"

Clearly, good progress has been and continues to be made. Nevertheless, all organizations can improve from where they are at any given point in time, and IASC is no exception. In this context, comments from the Review Group should not be taken as criticism of the hard work to this point. IASC is in a good place, and the following observations and recommendations should be taken as advice for a touch on the tiller, not for any major change in direction. In that context, these recommendations in no way replace those of the previous Review Committee, and should be regarded as complementary. The Council should continue to monitor progress against both sets of recommendations.

Key Theme 1: Planning

IASC lacks a coherent approach to strategic planning, which hampers its transparency and weakens its credibility. The development of a Strategic Plan would enable IASC to indicate how it will: commit to achieving the recommendations of ICARP-III; communicate subsequent results and achievements; work with partners; allocate its resources; and attract inward investment. This Plan should include descriptions of main science activities, along with succession planning for the location of the Secretariat and appointment of Secretariat staff.

Relocating the Secretariat at relatively 'short' intervals poses potential problems: (a) it is likely to lead to the loss of experienced staff, potentially damaging the continuity of effort; and (b) it may possibly lead to the deterioration of the accustomed level of support. It is for these reasons that SCAR finds it convenient to maintain the SCAR Secretariat in Cambridge and that the Antarctic Treaty Parties elected to establish their Secretariat within one country (Argentina), with both Secretariats being supported by collective funding. The Council should give serous consideration to these matters as part of the development of a Strategic Plan for the organization.

Attention also must be paid to implementing recommendations from the newly formed Data Committee. Data exchange and sharing between nations is an extremely worthy goal (on the principle of '*obtain once; use many times*'), but experience within the Antarctic Treaty System (where data exchange is a Treaty obligation) shows that it is much more difficult in

practice than in theory—not least in part because of the lack of standardized forms of data input. This lack (a generic problem within the international system) leads to data being grossly underused. One of the best ways to avoid this is to get all potential participants to agree to use common standards, as was done, for example, in the World Ocean Circulation Experiment (WOCE). There is an evident cost implication, but benefits should vastly outweigh these costs.

The Review Committee recommends:

- **Development of a five-year Strategic Plan, complete with clear objectives, expected outcomes, and milestones, and including opportunities to collaborate with other organizations and leverage additional resources, along with a succession plan for the Secretariat.**

- **Development of Working Group plans, in the context of the overall IASC Strategic Plan, making sure to address**

    - **priorities identified in the ICARP-III process;**

    - **encouragement for WGs to work through e-mail ahead of budget meetings, to become more effective at focusing their limited budgets on fewer, more important activities; and**

    - **a process for Council approval (or modification) of WG budget proposals, bearing in mind the need to focus expenditures on strategically important cross-cutting activities.**

- **Continued review of progress by the Council at decadal intervals.**

- **Continued review and revision of IASC website, to better reflect organizational structure and capabilities, including**

    - **clarification of existing links between IASC and comparable organizations (e.g., EU Polar Board, AFOPS, etc);**

    - **improved descriptions of and access to activities of each IASC entity (Working Groups, Action Groups, Networks, etc.); and**

    - **Secretariat monitoring of the web site use, for annual reporting to Council.**

Key Theme 2: Funding

IASC's funding is mainly self-limited to what Member Nations contribute. ICSU has been an additional source of funding; e.g., for joint grant proposals made with SCAR. Stringent efforts should be made to expand the funding pool, and to put in place mechanisms through which IASC can accept external funds. [*Sources of information on funding include, e.g., Vartorella, W.F. and Keel, D.S., 2004, Funding Exploration-the Challenge and Opportunity for Funding Science and Discovery in the 21st Century. MPM9, Marco Polo Monographs. Shangri-La Publications*]. Clearly, the search for funding must be handled judiciously, so that IASC does not find itself competing with its own members for funds.

IASC also allows its Working Groups (WGs) to spread their money too thinly, minimizing opportunities to make significant advances on strategically important topics. The Review Committee recommends:

- **Expansion of IASC activities, and for Council to seriously consider creating a Development Committee (à la SCAR) to locate and attract additional sources of funding (e.g., from Foundations), to meet the requirements of the Strategic Plan.**

- **Reconfiguration of IASC operations, in such a way as to accept external (preferably tax-free) funding, without incurring significant overhead costs.**

Key Theme 3: Science: (A) Identification of and Links to Major Scientific Concerns (Grand Challenges)

IASC is linked to the International Council for Science (ICSU), and its programmes should be aligned with ICSU's Grand Challenges, and with 'Future Earth' (www.futureearth.org), and should demonstrate awareness of the need not to exceed planetary boundaries [*Steffen, W., et al, 2015, Planetary boundaries: Guiding human development on a changing planet. Science 347 (6223), 1259855-1 to 10, and page 736*]. Some, but not all, of the required future directions have emerged from ICARP-III, whose scientific messages will lead to further thoughts on how IASC's science might develop in the future, focusing in particular on:

(1) The role of the Arctic in the global system;

(2) Observing and predicting future climate dynamics and ecosystem responses;

(3) Understanding the vulnerability and resilience of Arctic environments and societies and supporting sustainable development.

These directions would be expected to include such topics as "*Arctic amplification and what that means for the rest of the globe.*" The Review Committee recommends:

- **Solicitation of advice from the wider community (IASC and other stakeholders) on the development of 'Grand Challenge'-type cross-cutting programmes for connecting the activities of different Working Groups.**

- **Working with ICSU's senior management and like-minded organizations such as SCAR to ensure that IASC's and SCAR's activities contribute to and are recognized by other appropriate regional and global initiatives (e.g., the 'Future Earth' programme (www.futureearth.org)).**

Key Theme 3: Science: (B) Range of IASC Knowledge and Expertise

As pointed out by many respondents to the questionnaires, IASC is clearly not THE primary source of scientific information about the Arctic. To get close to that position, the organization first needs to demonstrate where it sits in the panoply of Arctic science. Change is necessary to avoid being trapped by tradition and by the necessarily limited horizons of Working Group scientists. "*IASC can (become) a dominant or 'omnipresent' body within (the) larger matrix (of Arctic research) to enhance linkages and synergies across many different organizations and countries.*" "*IASC should (aim) to reach … (other) groups and facilitate cross-disciplinary links*."

IASC should also make more of the fact that it and SCAR were charged by ICSU with ensuring the IPY legacy, which IASC has done through: its involvement in SAON (currently incomplete, because of delays within the Arctic Council); creation of the Data Committee; Joint sponsorship of APECS and providing IASC Fellowships; joint work on bipolar initiatives with SCAR; and help in the development of WMO's proposal for an International Polar Partnership Initiative (IPPI) mechanism, to implement and coordinate activities emerging from ICARP-III and the SCAR Horizon Scan. The Review Committee recommends:

- **Carrying out of a Social Network Analysis to demonstrate linkages between IASC activities and other Arctic science activities, so as to identify gaps in coverage that must be filled, as well as opportunities for the development of new partnerships.**

- **Giving serious consideration to expanding the range of topics covered by WGs, to include, for example, WGs on topics such as the Upper Atmosphere, Birds, Mammals, and Geosciences, to fill important gaps in science coverage.**

- **Ensuring that IASC's Arctic science connects with that of the wider world.**

- **Following-up on the IPY requirement to develop an integrated Arctic Ocean Observing System (iAOOS), along the lines of SCAR's Southern Ocean Observing System (SOOS), in partnership with WMO, CliC, WCRP, and IOC, to address both societal needs and scientific priorities.**

Key Theme 3: Science: (C) Structural Improvements and Increasing Cross-Disciplinarity

There is general agreement that the Working Groups are working well, but also that they are 'discipline silos'. Responses to the questionnaires showed that much more needs to be done to provide cross-disciplinary links between them (e.g., "*interdisciplinary efforts…sometimes have trouble getting funding through traditional channels,*" "*stronger advocacy for interdisciplinary research and rewards for truly interdisciplinary research are needed,*" "*facilitate interdisciplinary research,*" "*[study] biogeochemical cycles between ice, ocean, and atmosphere*", "*reorganiz[e] WGs to be more inclusive across disciplines*", and "*Foster thematic-specific cooperation across disciplines*"). The push for more cross-discipline activities echoes that of the 2006 Review Committee. Furthermore, one of the overarching messages from ICARP-III is the requirement to address the needs for communication across disciplines and with the potential user community. This is one area where IASC's response has been weaker than hoped.

There is also insufficient understanding and clarity regarding the respective roles of Working Groups, Action Groups, and Networks. Despite the fact that "*IASC has actively included social sciences in an area historically overwhelmingly dominated by physical/natural sciences,*" more could be done to encourage the development/involvement of the social sciences within IASC. The Review Committee recommends:

- **Stronger budgetary and Council encouragement for the development of joint cross-discipline thematic activities to link established WGs (e.g., a review of the functioning of the Arctic carbon cycle).**

- **Assurance that Action Groups and Networks, if retained, contribute to cross cutting activities and to IASC's selected main themes and challenges.**

- **Encouragement for natural science Working Groups and IASC's social science community to form links with one another, to improve capacities for addressing such topics as Arctic sustainability and resilience.**

- **Consideration for increasing the amount and diversity of social scientific involvement with IASC, especially in cross-cutting themes interacting with natural science WGs.**

- **Production of outcomes from all IASC activities (WGs, AGs, Networks) in the form of reports and, preferably, papers in high impact scientific journals. Such successes should feature in IASC news and outreach, and be easy to locate in electronic media.**

- **Consideration for expanding IASC communications to reach additional stakeholders, including local communities, decision-makers, managers, and the private sector.**

Key Theme 4: Branding IASC as a Service Provider

Several questionnaire responses, as well as the Review Group, indicated that Council should give serious consideration to providing services to the wider community—for instance, acting as a 'broker' for the provision of expertise (via Working Groups and Networks) and knowledge (of priorities and opportunities). The provision of services constitutes a significant benefit arising from the science. IASC is already providing some key services and should showcase these benefits, as well as giving serious consideration to expanding its array of services.

The previous Review Group also noted that IASC paid insufficient attention to commercial developments and relations with major stakeholders, and that "*IASC could make an instant and highly visible impact in this area by applying its available resources and human talent.*" Evidently more effort is needed. For example, respondents suggested that IASC should contribute to the WMO/WCRP Polar Prediction Project, and instigate ventures like "*Ice-Free Arctic – ecosystem changes, sea route opportunities, socio-economic changes,*" or "*Challenges – preservation vs exploration/exploitation,*" or assessments as the basis for decision making. Who else but IASC will address social questions in relation to economic resources ("*mineral, petroleum, fishing etc"*)? Furthermore, IASC should "*Provide EVIDENCE for the impact of climate change to ecosystems.*" IASC has a primary role to play in "*Monitoring Arctic change, understanding (the) processes of Arctic change, and assessing (the) economic effect(s) of Arctic change.*" This would include "*Enhancing our capability to predict the changes in the Arctic regions.*" Among other suggestions, there was a call to "*take the lead in activities like the ACIA process…. Revisit the ACIA volume and review it and provide a synthesis and follow up.*"

Better use of major facilities is also called for—e.g., "*Look at the research icebreaker situation. Some new ships have come on line, but where is an internationally coordinated scientific program to optimize their use?*"

Finally, IASC clearly has a role in the setting of standards, which is in itself a service.

The Review Committee recommends:

- **Act to position IASC as a service provider (in addition to its role as a scientific research facilitator), based on IASC's authority as a prominent Arctic science**

organization backed by an extensive knowledge and expertise base. The following recommendations flow from this change in emphasis.

- **Offer to review self-organizing international projects (as done by the IPY Joint Committee) so as to assist them in obtaining national and international funding from multiple sources, by providing endorsement where appropriate.**

- **Provide public comments or advice regarding major ongoing or forthcoming Arctic environmental, and/or socio-economic activities and initiatives, such as the development by IMO of the 'Polar Code' for shipping.**

- **Provide a follow-up report to the Arctic Climate Impact Assessment (ACIA), focusing on where we are now, and what we need to do next to better monitor and forecast Arctic climate change. This could be followed by a companion piece on actual and potential impacts. Both should feature prominently in leading scientific publications. [*Much as did SCAR with its 'Antarctic Climate Change and the Environment' (ACCE) report (provided as advice to the Antarctic Treaty Parties, as well as to other stakeholders), these reports would constitute advice to the wider community, as well as to the Arctic Council*].**

- **Contribute to public outreach through 'hot-buttons' on the home page, linking to other web pages dealing with major issues, like the NSIDC for updates on Arctic sea ice.**

- **Appeal for greater media attention at ASSW meetings, e.g. through the provision of press access to keynote speakers, and of expert position statements on current Arctic science issues.**

- **Improve outreach to Arctic residents, and to other Arctic science organizations.**

- **Establish a series of contributions, drawing from other efforts where possible, to establish a 'Polar Code,' which could include, but not be limited to, codes of conduct, scientific impact, data documentation and archiving, communication with Arctic residents, recommendations to tour operators, etc.**

Key Theme 5: Linkages

IASC now has good links to the AC, especially at the level of the Secretariat, but there is considerable room for further improvement—e.g., "*improve cooperation between IASC scientific groups and Arctic Council Working Groups,*" and "*IASC has not established itself to be the prime voice for Arctic science in AC in the way that SCAR has done at the Antarctic Treaty Consultative meetings.*" The Review Committee realizes that the AC itself is in the process of examining its subsidiary bodies. In addition, there is considerable scope for further improvement to links to other relevant organizations, as alluded to in the first recommendation (Theme 3, Science (B), above). The Committee therefore recommends:

- **Representatives of Arctic Council (AC) Working Groups (WGs) and other relevant organizations should be invited to attend meetings of IASC WGs, and to reciprocate such exchanges.**

- **Better notification to the IASC community regarding IASC's links to the AC and other relevant organizations by advertising them on the IASC web site.**

- **Encouragement to Member Nations to form links at the national level between IASC and AC.**

- **Closer work with FARO to forecast scientific needs, so as to facilitate multinational access to research infrastructure such as icebreakers, field stations, aircraft, data centers, and other resources.**

- **Creation of a cross-WG task force, in association with CLIVAR-CliC, to formulate Arctic-centred recommendations for the Committee on Earth Observing Satellites (CEOS), especially regarding the re-establishment of publicly available coverage by Synthetic Aperture Radar (a key tool for mapping Arctic processes).**

- **Stronger bipolar cooperation, to improve understanding of the operation of planet Earth.**

Key Theme 6: People: (A) Engaging IASC Fellows and Early Career Scientists:

There is general agreement that the IASC Fellowship system is working well, but some improvements are required to give IASC an even higher profile among Early Career Scientists. In part, this can be achieved through the development of a communications strategy to improve IASC's visibility. Improved communication is entirely consistent with the recommendations of ICARP-III. The Review Committee recommends:

- **Establishment of direct communication channels with IASC Fellows to clarify and extend IASC expectations for Fellows' participation, including:**

    - **presentations (e. g., AGU) regarding fellowship work, outcomes, benefits, and future objectives/contributions, as well as a final report on individual fellowship outcomes for publication on IASC web site;**

    - **extended contributions to non-traditional social media outlets (e.g., YouTube), to describe and promote Fellowship experience and the IASC mission, as encouragement for others to participate in IASC activities; and**

    - **advice from IASC's Early Career Scientists and Fellows to the Secretariat on how to improve the public face of IASC and attract more Early Career Scientists.**

- **Engagement with WG members and IASC Fellows directly, individually, and continually to ensure Fellows understand their roles in Working Groups, WG officers are employing Fellows appropriately, and WG members understand their potential roles and responsibilities as mentors for Early Career Scientists and IASC Fellows.**

Key Theme 6: People: (B) Increasing the Involvement of Indigenous People and Local Communities

IASC "*has taken an assertive role in including indigenous voices at its conferences and in planning committees.*" That development is entirely consistent with the recommendations of ICARP-III, which called for (i) encouraging better use of traditional and local knowledge; and (ii) building up human capacity among researchers, decision makers and residents, so as to

ensure that research translates into results that will have local, regional and global impact especially in the three priority areas listed above.

Despite the recommendations of the previous Review Group, the present Review Committee found that there are still insufficient links between university- and government-based Arctic science communities and indigenous scientists, as reflected in the call for "*improving utilization of indigenous traditional knowledge and community-based monitoring.*" In part, this issue can be resolved through the development of a communications strategy (see Key Theme 5). The Review Committee recommends:

- **Stronger IASC public outreach efforts and mechanisms for strengthening relationships with Arctic, indigenous, and local communities, including:**
    - **formalized collaborations with indigenous scientists, to bring 'academic or government' and 'indigenous' science communities closer, and to build capacity among indigenous scientists;**
    - **formal communication, transmission, and mutual exchange of knowledge with communities (including construction of socially-oriented observational networks involving local stakeholders) to achieve more effective use of indigenous knowledge in setting priorities and designing research activities;**
    - **development of a Memorandum of Understanding with indigenous peoples organizations with status as Permanent Participants at the Arctic Council, to better engage indigenous peoples with IASC activities; and**
    - **inclusion of at least one to two indigenous science representatives within each Working Group.**

Key Theme 7: Raising Awareness of IASC's Contributions

Much of the lack of awareness of what IASC is doing and contributing comes down to weaknesses at the national level. This reflects the tendency among all international organizations for national representatives to operate like 'black holes' when they return home from international meetings. This dynamic is a key factor in making IASC appear less transparent than it would like to be. The Review Committee recommends:

- **Encouragement to ALL national representatives to see themselves as the main avenues of communication back to their respective nations about what IASC is doing and contributing. They each have a responsibility to report widely as IASC disciples.**
- **Ensuring that all IASC scientists know that their publications or presentations regarding IASC science or made possible with IASC funding MUST acknowledge IASC's contribution.**

Annexes

(1) Group Members
(2) Questionnaire questions (A and B)
(3) Breakdown of Respondents to Questionnaire A.

Annex 1: Membership of the IASC Review Committee

Colin Summerhayes, Scott Polar Research Institute, UK (Chair), cps32@cam.ac.uk

Dr. COLIN SUMMERHAYES is a marine geochemist and oceanographer. Currently an Emeritus Associate of the Scott Polar Research Institute of Cambridge University, he was the first Executive Director of the Scientific Committee on Antarctic Research (SCAR) (2004-2010), and from 2005-2010 he was a member of the steering committee for the International Polar Year (2007-2008). He organised or helped to organise major polar science conferences in Bremen (2004), Hobart (2006), St Petersburg (2008), Oslo (2010), Buenos Aires (2010) and Montreal (2012). He has published several books including "Oceanography: an Illustrated Guide"(1996), "Oceans 2020: Science, Trends and the Challenge of Sustainability" (2002), "Antarctic Climate Change and the Environment" (2009), "The Third Reich in Antarctica" (2012), and "Earth's Climate Evolution" (2015), along with 290 research reports, papers and abstracts. From 2004-2009 he provided advice to the Antarctic Treaty Parties at their Consultative Meetings. He chaired the International Advisory Board for the Korean Polar Research Institute (2011-2012), and has advised WWF on polar science. His main interest is climate change in the Polar Regions and in the Earth System, and its relation to energy and policy, and he writes and lectures widely on these topics, including on an Antarctic cruise ship each December. Dr Summerhayes was Director of the UK's Institute of Oceanographic Sciences Deacon Laboratory (Wormley, Surrey) from 1988 to 1995, before moving it to become part of the National Oceanography Centre, Southampton, where he was Deputy Director from 1995-1997. Before joining SCAR he spent 7 years as Director of the Global Ocean Observing System Project for UNESCO's Intergovernmental Oceanographic Commission in Paris (1997-2004). From 1985-88 he was a Visiting Professor in Geology at University College London. Those activities followed scientific research appointments at Oxford, Imperial College London, the University of Cape Town, the Woods Hole Oceanographic Institution (Massachusetts), the New Zealand Oceanographic Institute, plus 12 years as a researcher in the oil and gas sector. Aside from Antarctic advice he has provided oceanographic and climatic advice to the UK Government, and to intergovernmental bodies including WMO, UNESCO, UNEP and the UNFCCC. He was President of the Society for Underwater Technology (2009-11), and a Vice President of the Geological Society of London (2010-2013). He is a Fellow of the Geological Society of London and of the Institute for Marine Engineering, Science and Technology, an Honorary Fellow of the Society for Underwater Technology, and a past Fellow of the Royal Geographical Society. He has a PhD from Imperial College and MSc and DSc degrees from Victoria University, Wellington, NZ. Dr Summerhayes has an inlet named after him on the Antarctic Peninsula. Aside from the IPY, his Arctic involvement comprised creation with Volker Rachold of the SCAR-IASC Bipolar Action Group, co-organizing with IASC the 2008 polar science conference in St Petersburg, attendance at ASSW meetings in Potsdam (2006), Hanover USA (2007), Bergen (2009), and Seoul (2011), and development with Volker Rachold of various Memoranda of Understanding involving IASC and SCAR.

Gunn-Britt Retter, Saami Council (Finland, Norway, Sweden and the Russian Federation) gunn-britt@retter.no

Ms Retter is born and raised in the coastal Saami community Unjárga-Nesseby by Varangerfjord in the north-eastern Norway. Retter is a teacher of training from Sámi University College (Guovdageaidnu - Kautokeino, Norway) and holds MA in Bilingual studies from University of Wales. Since 2001, Retter has worked with Arctic Environmental issues, first at Arctic Council Indigenous Peoples' Secretariat (IPS) (Copenhagen, Denmark) and since 2005 in the present position as Head of Arctic and Environmental Unit of the Saami Council. Retter has participated in various Arctic Council Working Group meetings, Senior Arctic Officials meetings and Ministerial meetings with the Arctic Council, as well as in several meetings with the UN Convention on Biological Diversity (CBD). She was also member of the AMAP external review team in 2009/2010. Gunn-Britt co-convened a session at ASSW2013 in Poland, but did not attend an ASSW until Toyama in 2015. She has attended a number of other science conferences, such as IPY and IASSA.

In her position as head of the Arctic and Environmental Unit in the Saami Council, Retter has been involved in issues related to indigenous peoples and climate change, biodiversity, language, pollution and management of natural resources.

Penny Wagner, Norwegian Meteorological Institute, Norway, penelopew@met.no

Penelope Wagner is a sea ice researcher at the Norwegian Meteorological Institute in the Norwegian Ice Service where she works on the development of sea ice products for safety in navigation through ice-infested waters. She received her Bachelors and Masters degree at the University of Texas at San Antonio in Applied Geology with a focus on helping to develop ways to standardize sea ice data collection techniques. She is also currently a PhD Candidate at the University of Delaware, Geography Department working on evaluating Antarctic sea ice charts from the U.S. National Ice Center as a proxy for sea ice edge to validate scatterometer data for use in navigational planning. She has worked with sea ice observations and remotely sensed data in both the Arctic and Antarctic. During IPY 2007-2008 she participated in the Sea Ice Mass Balance in the Antarctic (SIMBA) cruise to the Amundsen-Bellingshausen Sea where she led the ASPeCt observation activities and assisted with several different types of sea ice profile measurements. As an early career scientist during IPY, Penelope had been an active member in the Association for Polar Early Career Scientists (APECS) since November 2008. She joined the APECS Council from 2009-2012 and became the APECS President during the 2012-2013 term. The formal agreement between APECS and IASC had allowed her to: participate in IASC initiatives focusing on education and outreach for other early career scientists by heading activities and workshops, help to facilitate collaborations with research and non-research institutions in the Arctic by promoting alternative careers in polar science, and engage in professional projects with other international organizations as a student. She is currently part of the International Ice Charting Working Group (IICWG) and helping to organize sea ice charting training workshops and on-line resources for ice charting institutions in the Southern Hemisphere. Additionally, she is actively involved in assisting other international organizations, such as the Southern Ocean Observing System (SOOS) and the Climate and Cryosphere (CliC) Project to resolve satellite products and needs to improve how sea ice is monitored in both polar regions.

Craig Tweedie, The University of Texas at El Paso, USA, ctweedie@utep.edu

Craig Tweedie was born and raised in Brisbane, Australia, and received university level training at The University of Queensland, graduating BSc, BSc (hons), and with a PhD in Botany in 1992, 1995, and 2000, respectively. His honors degree examined the ecology of vascular epiphytes in sub tropical rainforests, and his PhD examined the autecology of six plant species along altitudinal gradients on Subantarctic Macquarie Island, one of Australia's four permanently occupied Antarctic bases. Between 1993 and 1994, Tweedie was employed by the Queensland National Parks and Wildlife Service to conduct flora surveys and devise fire management plans for several national parks in northeastern Australia. Between 2000 and 2005, he was employed by Michigan State University as a visiting research associate, where his passion for Arctic and functional ecological research and international scientific networking was established.

HongKum Lee, Korea Polar Research Institute, Korea, hklee@kopri.re.kr

HongKum Lee is a Principal Researcher at the Korea Polar Research Institute (KOPRI), where she has worked on the polar microbial diversity and ecophysiology. She graduated from Seoul National University in microbiology and received her PhD degree at TU Braunschweig, Germany. During IPY 2007-2008 she participated in the Microbial and Ecological Responses to Global Environment (MERGE). As Director-General of KOPRI during 2007-2013, she was active in enhancing polar research infrastructure and strengthening international cooperation. She supported construction of Korea's first research icebreaker, ARAON delivered in 2009. ARAON equipped with state-of-the-art research facilities is now conducting multidisciplinary scientific research in geophysics and geology, oceanography, biology. As Chair of Local Organizing Committee, she devoted herself to successful ASSW 2011 held in Seoul. She also supported the construction of the Jang-Bogo Antarctic Research Station in Terra Nova Bay of Northern Victoria Land in Antarctica, which was completed in 2014. As a year-round station, Jang-Bogo Station serves as a platform for the research on climate change and developing the West Antarctic observatory network. She joined ICSU Regional Committee for Asia and the Pacific (RCAP) from 2009-2014. As Chair of ICSU RCAP during 2011-2014, she participated in implementation of the ICSU Strategic Plan 2012-2017, and in developing Future Earth in Asia and the Pacific. HongKum Lee established and operates the Polar and Alpine Microbial Collection (PAMC), which is opened to share biodiversity information and research bio-recourses collected from polar and alpine areas. Approximately 2,800 microbial strains maintained in PAMC are ready to be provided in science and public communities with information on taxonomy, geographical origin, habitat and physiological characterization. PAMC was registered to international networks, the World Federation of Culture Collection (WFCC) and now functioning as an official depository institution.

Tatiana Vlasova, Russian Academy of Science, Russia, tatiana.vlsv@gmail.com

Tatiana Vlasova is a leading researcher in Institute of Geography, Russian Academy of Sciences where she received her Ph.D. in socio-economic and political geography. She graduated from Moscow State University, Geographical Department as a biophysical geographer. Her experience in the Arctic is based on the field work and participation in several international multidisciplinary projects such as Arctic Climate Impact Assessment, Arctic Resilience Report, Adaptation Actions for a Changing Arctic, Arctic Social Indicators, Local Health and Environmental Reporting from the Indigenous Peoples of the Russian North (UNEP Grid-Arendal), IASC Taiga-Tundra Interface project, etc.During the IPY 2007-2008 she served as a member of the IPY Committee of Russia and the Sub Committee on Observations under the WMO-ICSU IPY Joint Committee. She is the leader of the IPY National Russian project devoted to the construction of the "Integrated Arctic Socially-oriented Observation System" (IASOS) to be a network of observation sites in the Russian North.She is currently the International Arctic Social Science Association (IASSA) councilor and co-chair of the International Geographical Union Cold Regions Environment (IGU CRE) Commission. Tatiana Vlasova is a co-leader of international Arctic Sustainability: a synthesis of Knowledge(ASUS) project under the Arctic Call of the Belmont Forum co-funded by the Russian Foundation for Basic Research. She is a member of the international Steering Committee of the project entitled "Arctic-FROST: Arctic FRontiers Of SusTainability: Resources, Societies, Environments and Development in the Changing North". Both projects have special initiatives involving Early Career Scholars. Tatiana Vlasova is a mentor of APECS. Several times she took part in IASC ASSW and participated in two ICARP initiatives (in 2005 and 2015). She usually participates in IASC HSWG and IASC ISIRA meetings.

Nate Bauer, International Arctic Research Center, Fairbanks, USA (Secretary), nbauer@iarc.uaf.edu

Nate Bauer is the Editor and Publications Manager for the International Arctic Research Center (IARC) at the University of Alaska Fairbanks (UAF). His prior roles have included Technical Production Editor for Pearson Evaluation Systems and Legislative Correspondent in the U.S. House of Representatives. He holds Master's degrees in English (Boston College) and Business Administration (UAF).

Annex 2: Questionnaire questions (A and B)

International Arctic Science Committee (IASC) Performance Survey

Part A: General Questionnaire

Please provide the following information about you and your involvement in IASC:

Country:	
Age:	
Gender:	
Current position:	
Area of expertise:	
Involvement in IASC:	

(1) In your opinion, what are three most critical contributions by IASC to the development of international and interdisciplinary polar research over the past 10 years (2006–2015)? Please rank them, according to their value.

1	
2	
3	

(2) Do you believe that IASC has mostly fulfilled its original mission, which was defined as "to encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research and in all areas of the Arctic region, and to promote and support leading-edge multi-disciplinary research in order to foster a greater scientific understanding of the Arctic region and its role in the Earth system"?

Yes	
No	

Why did you select yes/no?

(3) In promoting multi-disciplinary research, what can IASC do to increase awareness about its activities?

(4) What themes should attract more attention of IASC nowadays in a rapidly changing Arctic? Please rank them according to their importance.

(5) If you were asked to trim and/or modify one particular current activity of IASC, in order to redirect the organization's limited resources, what would be your first choice?

a) Asking IASC Working Groups to seek seed funds for IASC research projects and project meetings	
b) Supporting major discussion forums and big science conferences, like ICARP	
c) Forging more integration among existing Arctic science organizations through	

ASSW or other venues

d) Providing other IASC instruments, e. g. Networks or Expert Groups

e) I don't know

f) Other, please specify

(6) What science policy priority would you consider the most critical for IASC to address over the next five years (next decade) (Select all that apply)?

a) New technology
b) Data Management
c) Public Outreach
d) Social media
e) Education
f) Early Career Scientist support
g) I don't know

h) Other, please specify

(7) From your perspective, should IASC improve its relationships with any particular organization(s) representing

a) Polar scientists

b) Educators

c) Funding agencies

d) Arctic residents

e) I don't know

f) Other, please specify

(8) Which ways can the existing relationships between IASC and the Arctic Council and its Working Groups and Permanent Participants be improved?

(9) How useful do you find the format of the Arctic Science Summit Week, with a Science Symposium every second year and an Arctic Observing Summit every other year, as a major cross-disciplinary venue and what, if any, actions would you recommend to improve it?

(10) Would you consider IASC the focal point for facilitating collaboration in Arctic research? If not, what in your opinion should be done to position the organization as "THE" focal point?

Part B: IASC-internal questionnaire

In which of the IASC bodies are you involved?

IASC Council		
IASC Working Group *(if yes, which one)*		
IASC Action Group *(if yes, which one)*		
IASC Network *(if yes, which one)*		
IASC Data Standing Committee		
International Science Initiative in the Russian Arctic		

(1) How do you benefit from being involved in IASC bodies?

(2) How well do you feel informed about IASC activities and how well does IASC represent your (or your country´s) interests?

a) Very well	
b) Above satisfactory	
c) Satisfactory	
d) Somewhat satisfactory	
e) Do not receive enough information	
f) I do not know	
g) Other (please explain)	

(3) Do you think that the current Working Group structure is appropriate given the interdisciplinary nature of Arctic research? Do you have any suggestions as to how to improve the performance and visibility of the Working Groups and how to encourage more cross-cutting themes and activities?

(4) Do you see the need for any additional IASC Standing Committees, Action or Advisory Groups?

(5) Do you think that the IASC Network affiliation is beneficial? If not, what should be changed?

(6) Do you have any suggestions as to how to improve the annual meetings of the IASC bodies at the Arctic Science Summit Week?

(7) Do you think that IASC puts enough emphasis on supporting early career scientists and mentors? If not, what should/could be done?

(8) Do you feel that the IASC Secretariat provides sufficient support for the various IASC bodies? If not, what can be done to provide an adequate amount of assistance?

(9) Do you feel that the level of national coordination of IASC related activities is sufficient in your country?

(10) Do you have any other comments that you would like the Review Committee to consider?

Annex 3: Breakdown of Respondents to Questionnaire A.

Part A: General Questionnaire

Please provide the following information about you and your involvement in IASC:

Country:

USA	19.5%
Germany	13.8%
Norway	9.2%
Canada	9.2%
Japan	5.7%
Sweden	4.6%
UK	3.4%
Spain	3.4%
Russia	3.4%
Poland	3.4%
China	3.4%
Denmark	3.4%
Korea	2.3%
Italy	2.3%
France	2.3%
Czech Rep.	2.3%
Netherlands	1.1%
Switzerland	1.1%
Portugal	1.1%
Iceland	1.1%
Finland	1.1%
Austria	---
India	---

Age:

Median: 51.5 (Range 26-81)

Gender:

Male	76.2%
Female	23.8%

Current position:

Professor	44.6%
Scientist/researcher	19.3%
Director/admin	14.5%
Postdoc	7.2%
Retired/Professor Emeritus	7.2%
PhD student	3.6%
Other	3.6%

Area of expertise:

Glaciology	11
Arctic climate	8
Policy	6

Socioeconomics/public interest	5
Cryosphere	7
Permafrost	4
Ocean ecosystem	4
Atmospheric science	4
Polar ecology	4
Remote sensing	4
[…]	
“Saving the planet”	1

Involvement in IASC:

Working Group member	32.9%
IASC meetings/confs	14.6%
IASC Council	12.2%
Working Group Chair/VC	11.0%
IASC sponsored/beneficiary	8.5%
Little/None	7.3%
Arctic Council	7.3%
Partner org (APECS, FARO, etc)	3.7%
Advisory Group (ISIRA)	2.4%