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Smithsonian at the Poles

Contributions to International Polar Year Science

Igor Krupnik, Michael A. Lang,
and Scott E. Miller
Editors

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The Policy Process and the International Geophysical Year, 1957–1958

Fae L. Korsmo

ABSTRACT. By the post–World War II era, the U.S. federal government's role in science had expanded considerably. New institutions, such as the Office of Naval Research and the National Science Foundation, were established to fund basic science. Technological breakthroughs that had provided the instruments of war were recognized as having important economic, civilian applications. Understanding the earth's environment, including the extreme polar regions, the upper atmosphere, and the ocean depths, was recognized as key to enhancing a nation's communications, transportation, and commerce. The IGY developed in part from such national interests, but became a huge international undertaking. The process of international negotiations leading up to and during the IGY set a precedent for organizing cooperative scientific undertakings and enshrined norms and practices for sharing data and resources. Further, the IGY demonstrated the importance of communicating results across political, disciplinary, and societal boundaries. Fifty years later, the organizers of the International Polar Year embraced these values.

INTRODUCTION

Legacies of the Third International Polar Year, more commonly known as the International Geophysical Year (IGY) of 1957–1958, include the launch of the first artificial Earth-orbiting satellites, the negotiation of the Antarctic Treaty, the establishment of the World Data Center system, the discovery of the Van Allen belts, and the long-term measurements of atmospheric carbon dioxide and glacial dynamics (Sullivan 1961; Korsmo 2007b). While the outcomes of the IGY are well known, the social and political processes that led to the IGY are less studied. One of the best sources from a policy perspective is a small pamphlet produced by the Congressional Research Service (Bullis 1973). Another source is the U.S. National Academy of Sciences voluminous IGY Archive in Washington, D.C., in addition to other archives containing the papers of IGY scientists and government sponsors. Some IGY participants have contributed their recollections in oral histories (e.g., Van Allen, 1998; see Acknowledgements), an excellent source of information on what it was like to be a researcher or an administrator before, during, and after the IGY.

This chapter draws on archival collections, biographies, oral histories, and secondary sources to ask the question, What lessons can IGY teach us about

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organizing and carrying out a large-scale, international, and multidisciplinary science program? The IGY helped to establish a precedent for the post–World War II conduct of international science, particularly as organized campaigns of international years or decades. In addition, the U.S. organizers of the IGY within the National Academy of Sciences left a well-organized archive of documentation, including a set of full transcripts from executive committee meetings. It is as if they wanted to be studied, since they purposely recorded their daily conversations, arguments, and decisions. As a political scientist, I find this record irresistible. When it comes to setting science agendas, building coalitions to advocate for programs, and making sure that commitments for funding and other support are made and kept, it is seldom one has access to so complete a record of events. Even as we find ourselves in the midst of the [Fourth] International Polar Year 2007–2008, it is not too late to learn from the IGY.

Policy can be thought of as a set of processes, including the setting of the agenda (the list of problems or subjects to which the decision-makers are paying serious attention at any given time); the specification of alternatives from which a choice is to be made; an authoritative choice among the alternatives, and the decision itself (Kingdon, 1995). In the process of setting the agenda or advocating for alternatives, those motivated by the outcomes form coalitions and engage in coordinated behavior based on common beliefs or motivations (Sabatier and Jenkins-Smith, 1999). Policy entrepreneurs—advocates willing to invest their resources to promote an alternative in return for anticipated future gain—look for opportunities to link solutions to problems, using what they know about the relevant coalitions and decision-makers. They are the classic integrators, creating connections among people, problems, alternatives, and decisions. Once a decision is made, then the question becomes, Who will implement the decision? There must be a credible commitment among institutions (and by "institutions," I mean the rules and norms that groups of people live by, which may or may not be embodied in organizations) to match subsequent actions with authoritative choices (North and Weingast, 1989). In the follow-through, the rules of the game and lines of accountability become crucial.

The IGY, on the one hand a daring and audacious plan to make the entire earth—surface, oceans, and atmosphere—the topic of concerted studies, and on the other hand a series of small, incremental decisions taken independently by numerous small groups, can be understood as a set of policy processes. A retrospective analysis of what worked enabled us to compare these IGY lessons with the science planning we are doing now. Was the IGY simply a product of its time or are there enduring legacies in terms of how we construct and conduct coordinated research programs? In terms of process, this chapter provides some of the highlights. First, however, it is helpful to examine the political context of the IGY in comparison to the other Polar Years.

THE POLITICAL CONTEXT

All of the Polar Years occurred in periods of relative peace and political stability, when international organizations had emerged in a new or reconstituted fashion (e.g., from periods of inactivity during wartime or economic depression) and when powerful nations were not distracted by the drain of soldiers and armaments. The idea for a First Polar Year or coordinated polar studies, for example, emerged within the Austro-Hungarian Empire in the early 1870s but only gained traction with other major powers after the 1878 Congress of Berlin had settled the Balkan War (Baker, 1982). The idea for a Second Polar Year was raised in 1927 and the studies took place in 1932–1933, fifty years after the First Polar Year (Baker, 1982; Nicolet, 1984). The Great Depression, followed by the outbreak of World War II and the untimely death of the International Polar Year Commission's President D. LaCour in 1942 resulted in a lengthy delay in publishing the results from the Second Polar Year. By the end of World War II, science and technology, as well as politics, had changed. The main factor that separates the IGY from the first two Polar Years was the existence of nuclear weapons and the beginnings of the Cold War between East and West. Understanding, detection, and development of nuclear weapons became a driving force for investment in the physical sciences following World War II. The Arctic, as geographer Paul Siple pointed out in 1948, afforded a straight line of attack to the Soviet Union (Siple, 1948). The United States began to conduct top-secret overflight missions to determine whether the Soviet forces were staging long-range bombers in the frozen north (Hall, 1997). The artificial Earth-orbiting satellites that emerged from the IGY were useful in studying the upper atmosphere but also provided a means of checking on enemy activities (Day, 2000). Basic science and military objectives both were motivations. The debate among historians has centered on how inextricably linked the motivations were for participating scientists and institutions. As in the first two Polar Years, international scientific organizations, such as the International Meteorological Congress in the 1870s and the International Council of Scientific Unions in the 1930s, played a key role in providing stable, reliable fora in which to build coalitions and collaborations. However, individuals—our policy entrepreneurs—also were required to initiate and carry out ambitious programs.

AGENDA SETTING: FIRST, SET A DATE

It sounds easy to set a date but even this requires some thought. How many declared international years of *this* and decades of *that* pass unnoticed? There has to be a reason for the date, preferably a reason tied to the proposed activity, an agenda that establishes the urgency of action within a specific time frame. What is the scientific justification for an "international year"? Unless the urgency appeals to a community of scientists beyond the initially small group of advocates, it will be difficult to affix a convincing time period for intense activity.

Setting a date, then, requires the ability to persuade others and build coalitions of advocates and future performers—those who will carry out the activity. Building the coalitions requires access to other potential supporters who can help to make the case. Access comes through networks of contacts, including committees, boards, and other fora.

It helps to start with venues that allow for the exchange of ideas. Most sources place the beginning of the IGY at the home of Dr. James Van Allen, in Silver Spring, Maryland in the spring of 1950 (Sullivan, 1961; Van Allen, 1997 and 1998). Trained as a nuclear physicist, Van Allen (1914–2006) was well known for the development of the proximity fuze during World War II. He became involved in the use of rockets to study the upper atmosphere immediately following the war, instrumenting captured and refurbished German V-2 rockets to study cosmic radiation, the ionosphere, and geomagnetism. At the time of Chapman's visit, Van Allen headed up a high-altitude research group at Johns Hopkins University, Applied Physics Lab. Shortly thereafter, Van Allen would go to the University of Iowa, where he would spend most of his professional career as a professor of physics (American Institute of Physics, 2000). While in Maryland, he and his wife Abigail hosted a dinner on 5 April 1950 for British geophysicist Sydney Chapman (1888–1970). Chapman, a theoretical physicist interested in the earth's magnetic phenomena, had participated in the Second Polar Year of 1932–1933. He was well known for his work on magnetic storms, and would come to spend a great deal of time in the United States, at the University of Alaska Fairbanks, the High Altitude Observatory in Boulder, Colorado, and University of Michigan (Good, 2000). He was to start his lengthy U.S. sojourn at Caltech. In April 1950, Chapman was in the United States on his way to join a Caltech study on the upper atmosphere. Van Allen described the gathering as "one of the most felicitous and inspiring" that he had ever experienced. Also present at the dinner was Lloyd Berkner, a former radio engineer who had been on Admiral Byrd's 1928–1930 Antarctic expedition. Berkner had both science and policy in his background. According to Van Allen,

> The dinner conversation ranged widely over geophysics and especially geomagnetism and ionospheric physics. Following dinner, as we were all sipping brandy in the living room, Berkner turned to Chapman and said, "Sydney, don't you think that it is about time for another international polar year?" Chapman immediately embraced the suggestion, remarking that he had been thinking along the same lines himself. (Van Allen, 1998:5)

Chapman also observed that the years 1957–1958 would be a time of maximum solar activity, so the time frame for the Third Polar Year was settled. The properties of the upper atmosphere, including the relationships among magnetic storms, cosmic rays, and solar activity intrigued scientists. The military, in particular, was interested in very-high-frequency scatter technology for reliable low-capacity communication that could avoid the disruptions caused by solar emissions, magnetic storms, and auroras. The perturbations emanated from high latitudes. Choosing a year of maximum solar activity for a new international polar venture made scientific sense for atmospheric physicists interested in understanding more about these high-latitude phenomena. Furthermore, as Chapman explained later (1960, 313) and may well have noted at the Van Allen residence, technological improvements in instrumentation and rocketry had now enabled scientists to probe much deeper into the atmosphere. The time was ripe. Was the Berkner-Chapman exchange rehearsed? Perhaps. But the main point is that there were many opportunities for leading scientists to get together and persuade one another of the need for an intense research campaign (Kevles, 1990). One of the main venues in the United States after World War II was the Joint Research and Development Board, renamed the U.S. Research and Development Board in 1947. Led by Vannevar Bush, the Research and Development Board combined civilian researchers and military personnel in determining and coordinating research priorities for the Department of Defense. Bush was President of the Carnegie Institution of Washington and had led the Joint Committee on New Weapons and Equipment during the war. Widely respected today as the author of *Science—The Endless Frontier* (Bush, 1945), a book that stressed the importance of basic research in the United States, Bush represented the transition from wartime science—applications focused on immediate problems of winning the war—to peacetime science—research into fundamental questions for the sake of discovery.

The Research and Development Board's committees and their subcommittees and panels took up scientific problems that the military identified—or civilian scientists identified for them. They covered the physical, medical, biological, and geophysical sciences (U.S. National Archives and Records Administration, n.d.). Vannevar Bush tapped Lloyd Berkner (1905–1967) to run the Research and Development Board as its executive secretary. Berkner, profiled in Allan Needell's excellent biography (2000), had a rich experience in ionospheric research, government consulting, and national security. He had been to Antarctica in 1928–1930. He was not afraid to speak out publicly on science policy. He was perfect example of a policy entrepreneur: breaking down boundaries between government agencies and between government and other sectors of society, exploiting every opportunity for bringing solutions—in this case technological breakthroughs and scientific programs—to problems. In the world of agenda setting, solutions, carried in the pockets of entrepreneurs, go searching for problems. While we are left with the impression that Berkner first introduced the idea of a Third International Polar Year at the Van Allen home in April 1950, undoubtedly he had broached the topic before, perhaps on the Research and Development Board, using his previous Antarctic experience and his knowledge of postwar developments in international science policy.

Berkner was not the only science entrepreneur in the postwar science world. One can also think of Swedish meteorologist Carl Gustav Rossby (1898–1957), who called the attention of the U.S. military to the climate warming occurring in the 1920s through the 1940s (e.g. Rossby 1947). His fellow Swede, glaciologist Hans W. Ahlmann (1889–1974), studied the properties of glaciers as indicators of climate variation. Rossby urged the U.S. military to take advantage of Ahlmann's knowledge as the military searched for expertise on high-latitude operations. Because the Arctic represented the shortest distance between the United States and Soviet territory, Rossby and Ahlmann knew they had the attention of the U.S. military planners. Using solid ice for planes and other military transport was fine as long as the ice was not melting; a warming trend would require a change in strategy. In a way, it was Ahlmann who helped to set the science agenda for the IGY's approach to glaciology. Using mountain glaciers, Ahlmann measured accumulation, ablation, and regime (the grand total of a glacier's entire accumulation and net ablation) and recommended simultaneous measurements in different climates (Kirwan et al., 1949). In 1946, he called for exact measurements to be made on the ice sheets: temperatures at different depths, seismic methods to compute thickness, and detailed observations of stratification of annual layers. The only way to do this systematic comparison in different parts of the world was through international cooperation (Ahlmann, 1946). Ahlmann's frequent calls for this style of comparative work eventually led to the Norwegian-British-Swedish Antarctic Expedition of 1949–1952, the first scientific traverse in the Antarctic interior. This traverse served as a model for the IGY expeditions to Antarctica (Bentley, 1964). Of course, the U.S. had political reasons for a scientific presence in Antarctica; the existence of competing territorial claims and concerns about possible Soviet claims ensured the Antarctic would have a place on the IGY agenda (U.S. National Security Council, 1957).

How did the Third Polar Year, originally envisioned as a high-latitude, upper-atmosphere research campaign, become the International Geophysical Year? In the process of enlisting support among the international scientific societies, Chapman and Berkner found a strong preference for a global program encompassing additional geographical regions and physical science disciplines. To attain widespread support, Chapman and Berkner skillfully embraced a much broader geophysical agenda.

The international science scene after World War II included a reconstituted International Council of Scientific Unions (ICSU), a body where membership was both by nation-state and by international scientific union, e.g., the International Union of Geodesy and Geophysics (IUGG). The national member might be a national academy or a government agency with research responsibilities. Berkner and Chapman first presented the idea for the Third International Polar Year to the constituent scientific unions that made up a "Mixed Commission on the Ionosphere" under ICSU (Beynon, 1975:53). These unions included the IUGG, International Astronomy Union (IAU), International Union of Pure and Applied Physics (IUPAP), and International Union of Radio Science (URSI) (Beynon, 1975:53). The unions, in turn, presented the proposal to the ICSU General Assembly, and ICSU, in turn, invited the World Meteorological Organization (WMO) to participate as well as the national organizations adhering to ICSU. (Note that this pattern of approaching international scientific organizations first ICSU, then the WMO, was also used to prepare for the International Polar Year 2007–2008). By 1953, there were 26 countries signed up to participate in what came to be known as the International Geophysical Year 1957–1958. The disciplines included practically all the earth, atmosphere, and oceanic sciences, covering many parts of the globe beyond the polar regions (Nicolet, 1984). The price of coalition building beyond the minimum one needs to win an objective is that the agenda—the set of interesting science questions and topics—becomes expansive and unwieldy.

Political scientists have theorized that a minimum winning coalition—the number of political parties, representatives, or individuals needed to win a particular competition such as an election—will prevail in democratic politics given a zero-sum situation of clear winners and losers (Riker, 1962). Surplus coalition members may bring instability and demands that cannot be met. While coalition theory has been a lively topic of debate and study in the political science literature (e.g., Cusack et al., 2007), I believe it is a useful concept outside the realm of electoral politics to analyze the building of science coalitions, which are not necessarily zero-sum endeavors.

Did Berkner, Chapman, and their allies know that they needed to build a large umbrella? Their intentions are not explicit, but they may have felt that they needed as much support as possible from the international scientific organizations in order to press their case at home for an IGY. To prevent the science agenda from becoming too diffuse, barriers to entry have to be established. By 1954, the international IGY organizing committee (set up by ICSU in 1952 and known as CSAGI after its French name, Comité Spécial de l'Année Géophysique Internationale) established criteria for IGY proposals. Priority would be given to projects with at least one of the following characteristics:

1. Problems requiring concurrent synoptic observations at many points involving cooperative observations by many nations.
2. Problems in geophysical sciences whose solutions would be aided by the availability of synoptic or other concentrated work during the IGY.
3. Observations of all major geophysical phenomena in relatively inaccessible regions of the Earth that can be occupied during the IGY because of the extraordinary effort during that interval (the Arctic and Antarctic).
4. Epochal observations of slowly varying terrestrial phenomena (International Council of Scientific Unions, 1959).[1]

These were not arbitrary or unreasonable criteria, since they still permitted a variety of disciplines and conformed in the main with the justification for a coordinated program confined to an 18-month time period, from July 1957 until December1958. Each discipline fitting the criteria had a reporter, whose responsibilities included working with the appropriate scientific union to organize the program for that discipline. The program for each discipline was first outlined by an IGY Committee created by the appropriate scientific union or by some other ICSU body. Detailed coordination of the program, such as the issuance of instruction manuals for the taking of measurements, was the responsibility of the reporter. The overall direction was the responsibility of the CSAGI Bureau (Bullis, 1973; Nicolet, 1984; see Appendix 1).

The CSAGI Bureau members, reporters, and members of the CSAGI General Assembly all served based on their scientific field and their professional standing in the ICSU unions rather than based on nationality. Representation on the basis of science rather than nationality enabled CSAGI and the committees to focus on the nature of the work to be done. This model set a precedent in subsequent ICSU and joint ICSU/WMO scientific campaigns, most recently in IPY 2007–2008. A separate Advisory Council, composed of one delegate from each national IGY committee, assisted with practical arrangements such as finances, regional meetings, access to foreign territory and facilities, bilateral exchanges, and the collection and storage of data. The national committees, through the Advisory Council, were responsible for implementation (Bullis, 1973).

The use of national committees for the IGY ensured that government agencies—both as sources of funding and as authorities—would be involved in science planning from the beginning. Decisions about what was to be funded were made at the national level, so that the IGY amounted to a loosely coordinated set of parallel (or simultaneously run) national programs. The structure of parallel science committees and the advisory council at the international level enabled realistic commitments to be made on the spot.

The U.S. National Academy of Sciences assembled the IGY national committee of 19 members (see Appendix 2; Atwood 1952) in early 1953 and it included government scientists, operational agencies such as the National Weather Bureau, funding agencies, and the military agencies that would provide personnel and logistics. The U.S. national committee formed special technical panels to plan the science and evaluate proposals sent to the National Science Foundation. Including the operational agencies ensured that whatever academic scientists had in mind could be compared to what was possible on the ground.

The National Science Foundation (NSF), established with a very small budget in 1950, was charged to be the official IGY funding agency in the United States, the one that would carry forward and coordinate the IGY budget for the U.S. government. The director of the NSF, Alan Waterman, enthusiastically supported and lobbied for the IGY, no doubt seeing an opportunity for the small agency to gain visibility and resources (Korsmo and Sfraga, 2003). Internationally, UNESCO helped out financially (Bullis, 1973). As an independent, nonmilitary agency, the NSF offered a credible funding source both here in the United States and internationally, in an era where military funding—accompanied by classification and secrecy—was the prime source of most geophysical research. The IGY was to be civilian in character, with the scientific results shared in the open literature. Nevertheless, the logistics for fieldwork and of course the satellite program would be shouldered by the military agencies.

What about political and monetary support for the IGY? Where was the money coming from? That is where solutions go searching for problems. In order to persuade nonspecialists to fund the large-scale nonmilitary science program, the U.S. National Committee for the IGY had to move beyond agenda-setting and coalition building with scientists and executive branch agencies to approach the U.S. Congress and respond to congressional concerns about the public value of science.

LINK SOLUTIONS TO PROBLEMS: THE STATE OF SCIENCE EDUCATION IN THE UNITED STATES

The National Academy of Sciences' IGY Archive provides evidence that the U.S. National Committee for the IGY reached out to many audiences and answered the hundreds of inquiries received from teachers, students, media, and members of the public. The archive contains, for example, a copy of a letter to an elementary school student who had written of his ambition to become a "space man." Hugh Odishaw (1916–1984), another entrepreneurial character and, as the Executive Director to the U.S. National Committee, the architect of the Committee's information strategy, replied with a two-page letter:

> I was happy to receive your well-written letter, and to learn of your interest in becoming a "Space Man." While you are in elementary school, you won't have to choose your own subjects of course. Later on, when you to go high school and college, you will want to take as many Mathematics and Science courses as possible, together with courses in English, History, and other subjects which will help to make you a well-rounded person, as well as a possible "Space Man."

The letter goes on to recommend reading all the materials assigned by the student's teacher in addition to other books such as Ronald Fraser's *Once Round the Sun* (H. Odishaw, letter to J. Bunch, 15 April 1958, in Chron. file, IGY Office of Information, National Academy of Sciences IGY Collection, Washington, D.C.).

Odishaw's response to the young student is typical of the care with which the U.S. National Committee's Office of Information answered the mail. During the IGY, about a dozen people worked in this Office, maintaining close contact with media, schools, government agencies, Congress, private industry, and professional societies.

Well before the IGY began in 1957, the U.S. National Committee for the IGY thought about providing education materials and general information about the exciting "experiments in concert" that were about to begin. Broadly accessible information about the IGY was necessary background for the National Science Foundation's IGY budget request, but also there was a sense of urgency regarding the state of science education in the country. In its 30 November 1956 issue, the magazine *U.S. News and World Report* focused on education and science, noting the disparity between the Soviet Union and the United States in the size of the workforce engaged in technical and engineering jobs. One of the articles in this issue, by chemist and businessman Arnold Beckman (who developed the first commercially successful pH meter), leveled the all-too-familiar complaints about the American school system: it has failed to anticipate and prepare for the increasing need for more scientists and engineers; its science teachers are not competent to teach science; and its teacher certification requirements pay more attention to how to teach rather than mastery of the subject matter (Beckman, 1956).

Beckman was not the only one calling for improvements in science and mathematics education across the United States. The U.S. Congress raised the same concerns to the National Science Foundation and the IGY Committee. As recounted to Hugh Odishaw by S. Paul Kramer, a consultant to Odishaw who attended the congressional hearings, Senator Everett Dirksen (R–Illinois) urged the IGY scientists to involve the high schools and colleges in real time: "I would not like to see available information embalmed until the year and a half is over," said Dirksen. "I would like to see it move out where it will do good." Senator Warren Magnuson (D–Washington) reminded the National Science Foundation that education and public outreach were well within the scope of the Foundation's mandate: "I know from having authored the bill. The real reason for approving it was this sort of thing" (S. P. Kramer, correspondence to H. Odishaw, 6 March 1957, in Chron. file, IGY Office of Information, National Academy of Sciences IGY Collection, Washington, D.C.). In response, the IGY organizers worked with publishers, universities specializing in teacher training, and organizations such as the Science Service to develop educational pamphlets, teacher guides, posters, and classroom activities. An example of one of IGY posters on the Oceans that also appeared in a pamphlet is reproduced in Figure 1. The IGY organizers also produced a film series, *Planet Earth*, released in 1960, for use in schools and for educational television (U.S. National Committee for the IGY, 1960; Korsmo, 2004).

There was little if any dissent on the need for an education and information campaign; the organizers believed it was the right thing to do. The arguments that emerged from the archival records were about the best ways of doing it (Korsmo, 2004).

FULFILLING THE COMMITMENTS: DATA, PUBLICATION, AND RESULTS

The justification for having a Third International Polar Year, which became the International Geophysical Year, only twenty-five years after the Second Polar Year of 1932–1933 rested in part on the many advances made in techniques of geophysical observation, including radio communications and aviation (Chapman, 1960). If new techniques of analysis, including advances in instrumentation and processing, seem adequate to push for large-scale data collection, then how does one go about it on a worldwide scale? Who takes responsibility to collect, process, and share the data in useable formats?

This was the question faced by the designers of the International Geophysical Year. The U.S. National Committee for the IGY met for the first time on 27 March 1953 in Washington, D.C. In Berkner's absence on the first day, the participants expressed their doubts. There were at least two problems: first, the question of whether the Soviet Union would participate at all, and second, the problem of secrecy and classification of geophysical data that existed in the United States (Gerson, 1953; Needell, 2000).

How could you have a worldwide program when the Soviet Union and its allies were not involved? With Stalin's death earlier that month, on 6 March 1953, the question hung in the air: Would the Soviet Union open up? At the time, the Soviet Union belonged to the World Meteorological Organization and the International Astronomical Union, but not to ICSU or other ICSU member unions. There was hardly any data exchange between the United States and its allies and the Soviet Union except for routine weather observations. On the other hand, the United States also classified much of its data; the entire polar program funded by the military, for example. How could the United States expect the Soviet Union to supply data when we withheld ours? All high-latitude ionospheric data—the original focus of the Third Polar Year as proposed by Berkner and Chapman back in 1950—were considered classified in the United States.

The U.S. National Committee for the IGY was not the only committee to raise the problem of classification and secrecy. In May 1953, the U.S. Research and Development Board's Geophysics Committee also raised the issue to the army, navy, and air force (U.S. Research and Development Board, 1953). The Geophysics Committee made a distinction between basic data—"the elementary building blocks of scientific progress in the earth sciences"—and the end products, such as reports that might be used for military or national security purposes. Free access to the data, insisted the Committee, was necessary for scientific progress.

The designers of the IGY deliberately decided in favor of a science program with free and open data exchange. Indeed, they saw IGY as a means to loosen up the secrecy classifications in their own country in addition to encouraging better data flow from other nations.

By the fall of 1954, it became clear that the Soviet Union would indeed participate in the IGY, so Berkner instructed the U.S. National Committee to prepare a description of all the data that the United States was prepared to gather and exchange. The idea was to get standardized instruments to record multiple observations taken at frequent intervals in many parts of the world. These observations would be recorded, analyzed, synthesized, and preserved in usable formats for further study. As Berkner told the U.S. National Committee in 1953, "Let our measurements be designed so that repeats during the 4th [Geophysical Year] will be valuable" (Gerson, 1953).

The idea of the world data centers also came up early in the IGY planning process (Chapman, 1955). The United States volunteered to host one, which became a distributed system involving several universities and research institutions all over the country, and then the Soviet Union followed suit. A third world data center was established for Europe and Japan. Multiple data sets in different parts of

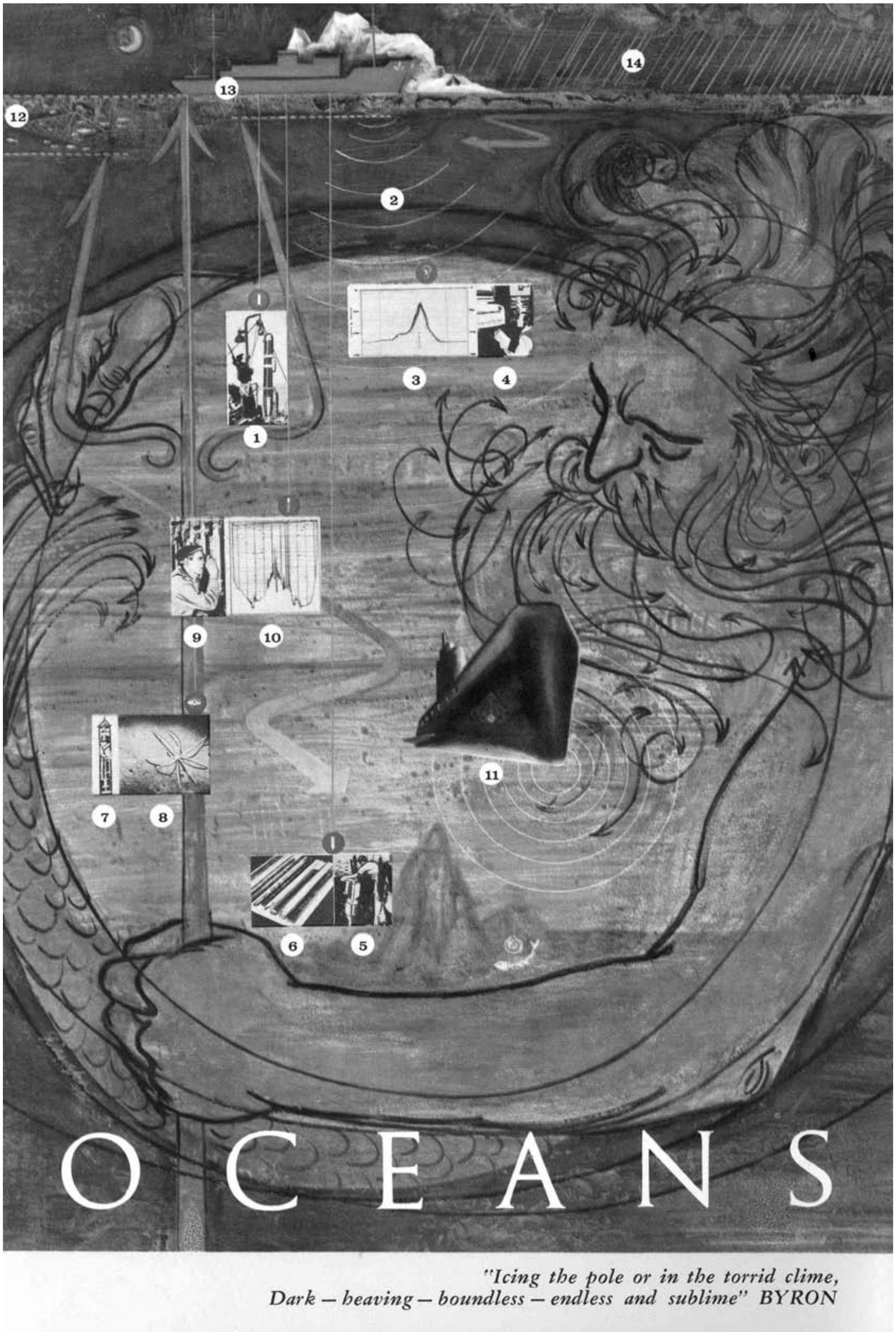

FIGURE 1. The Oceans, IGY Poster. National Academy of Sciences, 1958.

the world were encouraged to ensure against catastrophic destruction of a single center and to make the data accessible to researchers in different parts of the world.

While the national IGY committees were responsible for delivering timely and quality data, the world data centers were responsible for the safekeeping, reproduction, cataloging, and accessibility of the data. Anyone engaged in research was to be given access. If you could get yourself into the host country and up to the door of the data center, you could not be turned away (P. Hart, personal communication). We know there were gaps, and the limits of East–West cooperation became immediately apparent in the satellite program. However, the rules of the game were in place, establishing norms of behavior that lasted well beyond the IGY.

Finally, the IGY publications included but went much further than peer reviewed scientific journals. The *Annals of the IGY*, 48 volumes published by Pergamon Press between 1959 and 1970 (International Council of Scientific Unions, 1959; Fleagle, 1994:170), record not only the results of the research, but also the process of developing the IGY—the international meetings, the world data center guidelines, and the resolutions. This was a self-conscious documentation effort, and we are still benefiting from that today. We have journalists' accounts such as Walter Sullivan's *Assault on the Unknown* (1961). Upon completion of the IGY research, Sullivan was given virtually unfettered access to the IGY field projects and documentation.

The establishment of the world data centers and the constant encouragement by the U.S. National Committee for researchers to publish and share their results in many forms demonstrated to many audiences the ability of science organizations to live up to their commitments. The world data centers, which continue to function today, were instrumental in continuing the legacy of the IGY: coordinated, international science to understand the interactions of atmospheric, oceanic, and terrestrial processes. While entrepreneurs initiated schemes and linked solutions to problems, the thousands of people who carried out the work and contributed results gave credibility to the geophysical sciences, both in the United States and in other countries. Sufficient trust had been established to begin the demilitarization of geophysics.

CONCLUSION

The IGY can teach us something about both process and results. The ways in which Berkner, Chapman, Odishaw, and many others pursued the activities of agenda-setting, linking solutions to problems, and establishing a pattern of credible commitments, turned a casual conversation among a few experts into a whirlwind series of international expeditions and experiments. There are many other ways of looking at the IGY. Elsewhere, I have compared my approach to the story of the blind men and the elephant. After they felt different parts of the animal, they each proclaimed the elephant looked like a tree trunk, a snake, and a fan (Korsmo, 2007a). The policy sciences are useful in deciding what rules of decision-making and allocation of resources work the best for different types of projects in different contexts. The context I chose here was primarily based in the United States, but it would be quite valuable to compare both current and historical science policy evolution in other countries during the time of the IGY.

This symposium is an important step in the documentation of our present efforts in the International Polar Year 2007–2008. Due to the precedents set by the IGY and its successors, such as the International Years of the Quiet Sun (1964–1965) and the Upper Mantle Project (1962–1970), we have international frameworks for scientific cooperation as well as a history of data sharing and long-term environmental observations.

While the IGY did not include social sciences, it supported a surprising amount of geography and natural history associated with the study of ice sheets and mountain glaciers. The umbrella was large enough to include these projects and contribute to our knowledge of alpine and Arctic ecosystems. The glaciology program of the IGY was a bridge between the physical and biological sciences, paving the way for programs such as UNESCO's International Hydrological Decade, 1965–1974 (Kasser 1967; Muller 1970). In a similar fashion, the social and human studies included in the present International Polar Year 2007–2008 are a bridge between science and policy. Their inclusion (e.g., Krupnik et al., 2005) provides even more opportunity for self-reflection and evaluation of what lessons and legacies we will leave for the future.

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APPENDIX 1

The CSAGI Bureau Members and Reporters, IPY 1957–1958

The following list demonstrates the breadth of disciplines and expertise represented among the international IGY leadership (Nicolet, 1984:314).

CSAGI Bureau

S. Chapman, President (UK)
L. Berkner, Vice President (USA)
M. Nicolet, Secretary General (Belgium)
J. Coulomb, Member (France)
V. Beloussov, Member (USSR)

CSAGI Discipline Reporters

World Days (when intensive measurements would be taken)—A. H. Shapley (USA)
Meteorology—J. Van Mieghem (Belgium)
Geomagnetism—V. Laursen (Denmark)
Aurora and Airglow—S. Chapman (UK), with F. Roach and C. Elvey (USA)
Ionosphere—W. J. G. Beynon (UK)
Solar Activity—Y. Ohman (Sweden)
Cosmic Rays—J. A. Simpson (USA)
Longitudes and Latitudes—J. Danjon (France)
Glaciology—J. M. Wordie (UK)
Oceanography—G. Laclavére (France)
Rockets and Satellites—L. V. Berkner (USA)
Seismology—V. V. Beloussov (USSR)
Gravimetry—P. Lejay (France)
Nuclear Radiation—M. Nicolet (Belgium)

APPENDIX 2

Members of the first U.S. National Committee for IPY 1957–1958

The following list of U.S. IGY leadership shows a mixture of disciplinary and professional society representation and the direct involvement of U.S. government agencies (Atwood, 1952).

Chair

J. Kaplan, representing the U.S. National Committee of the International Union of Geodesy and Geophysics

Members

L. H. Adams, Geophysical Laboratory, Carnegie Institution of Washington
Henry Booker, International Scientific Radio Union (URSI)
Lyman W. Briggs, National Geographic Society
G. M. Clemence, U.S. Naval Observatory
C. T. Elvey, Geophysical Institute, University of Alaska
John A. Fleming, American Geophysical Union
Nathaniel C. Gerson, Cambridge Research Directorate, U.S. Air Force
Paul Klopsteg, National Science Foundation
F. W. Reichelderfer, U.S. Weather Bureau and World Meteorological Organization
Elliot B. Roberts, U.S. Coast and Geodetic Survey
Alan H. Shapley, U.S. Bureau of Standards
Paul A. Siple, representing U.S. National Committee of the International Geography Union, Association of American Geographers, and General Staff, U.S. Army
Otto Struve, representing U.S. National Committee of the International Astronomy Union
Merle Tuve, Department of Terrestrial Magnetism, Carnegie Institution of Washington
Lincoln Washburn, Snow, Ice, and Permafrost Research Establishment, U.S. Corps of Engineers, and the Arctic Institute of North America

Ex-officio Members

Wallace W. Atwood Jr., Director, Office of International Relations, National Academy of Sciences-National Research Council
Lloyd V. Berkner, Member, Special Committee for the International Geophysical Year
J. Wallace Joyce, Deputy Science Advisor, U.S. Department of State

NOTE

1. In a similar fashion, the planners of the 2007–2008 International Polar Year came up with a framework that established criteria for participation. This not only provided guidance for researchers who were considering whether to write proposals, but also the existence of criteria conveyed to a broader audience, including policy-makers at the national level, the seriousness and purposefulness of the upcoming science campaign (Rapley et al., 2004).

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