

# The Role of the Council of Managers of National Antarctic Programs

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## INTRODUCTION

The Antarctic Treaty of 1959 built on the scientific successes of the International Geophysical Year (IGY) and proposed that the Antarctic Treaty area would be used for peaceful purposes only and for scientific cooperation (Antarctic Treaty, Articles I, paragraph 1, and II). The Antarctic Treaty did not, however, specify how such objectives would be met, except in its Article IX, paragraph 2, where it provides an example of activity that could represent substantial scientific research activity in Antarctica. The example, as we all know, has come to be interpreted as meaning that substantial scientific research activity of a party to the Antarctic Treaty area can be demonstrated by the country establishing a scientific research station there.

This is exactly what has happened since 1959. As participating countries in the Antarctic Treaty System grew from the initial 12 original signatories to the Antarctic Treaty to the present-day membership of 48 parties, the Antarctic Treaty Consultative countries have, individually, established approximately 65 research stations in the Antarctic Treaty area.

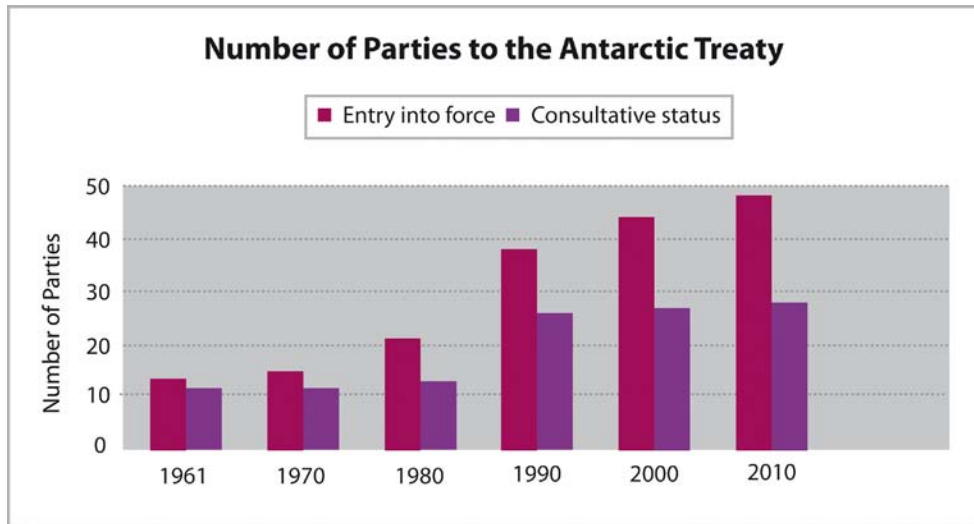
Over the course of the 50 years since IGY, many things have changed in regard to the Antarctic, but a number of things have also remained the same. For example, it was clear from the experiences of countries involved in the IGY that organizing scientific expeditions to Antarctica was an expensive and complex activity. This is still the case today.

What has changed is that then, in order to facilitate the science of the IGY, many countries relied at least in part on assistance from their military, who alone had aircraft and logistics experience and capability to transport people and their equipment to and from the Antarctic. They also often possessed the necessary engineering skills that were essential in building Antarctic stations and required infrastructure. This aspect of Antarctic activity has changed. Although some national Antarctic programs continue to operate in partnership with their military organizations, many do not, opting to develop the necessary logistics and engineering capabilities within their National Antarctic Programs.

In 1958, the Scientific Committee for Antarctic Research (SCAR) was established to “further international organization of scientific activity in Antarctica.”<sup>1</sup>

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**FIGURE 1.** Chart showing the number of countries that are signatories to the Antarctic Treaty, cumulative by decade. It also shows the number of countries who have obtained Consultative State status over the years.

Recognizing that good science required more than good scientists, SCAR established within its framework the Working Group on Logistics (WGL). The WGL existed within SCAR until 1988. During the 1980s, there was significant interest from countries to join the Antarctic Treaty System (Figure 1). A total of 18 countries acceded to the Antarctic Treaty during that decade.<sup>2</sup> Many of these acceding nations were readying themselves to fully participate in the Antarctic Treaty System by obtaining Consultative State status within that system. Furthermore, in order to do this, many were preparing to establish an Antarctic research station and/or launch an Antarctic expedition. In many cases this was achieved through a national Antarctic program. The managers of these national Antarctic programs had much in common, yet they did not have a formal mechanism in place for discussions or meetings concerning items of common interest. Finally, in 1988, the decision to create a separate organization for the managers of national Antarctic programs was implemented. This independent organization would be known as the Council of Managers of National Antarctic Programs (COMNAP).

Today, 22 years on from its inception, COMNAP remains an independent organization for managers of national Antarctic programs. All 28 current Consultative State's national Antarctic programs are COMNAP members. The COMNAP provides a forum for supporting international collaboration in the Antarctic Treaty System.

Whereas national Antarctic programs are governmental organizations, COMNAP is a nonpolitical organization where best practice and advice is shared among members, regardless of a country's political view of the Antarctic.

This chapter explores the role of COMNAP by discussing its inception, the last 20 years, and its recently adopted new objectives. The COMNAP is an organization whose members are very diverse organizations but who share the common goal of supporting and delivering the science that is so fundamental to the success of the Antarctic Treaty.

## THE BIRTH OF COMNAP

Referring to the managers of National Antarctic Programs, Al Fowler, the first executive secretary of COMNAP, noted "it is surprising that these particular individuals had never, prior to 1986, organized themselves into an appropriate regular forum for discussion of their common interests."<sup>3</sup> Many of the issues that were the responsibility of the managers of national Antarctic programs had been formally discussed within the confines of SCAR. From 1972 to 1987 the SCAR WGL met on a regular basis. But, by 1986, there were calls from national Antarctic program managers for their own separate forum for regular and direct formal contact. Discussion of such a forum took

place over several years. By 1987, terms of reference for the meetings of managers of national Antarctic programs were created and agreed to by the then 22 managers of national Antarctic programs that were in existence. The COMNAP was formally created on 15 September 1988 to bring together the officials responsible for carrying out national activity in the Antarctic on behalf of their governments, all of them parties to the Antarctic Treaty.

The Standing Committee on Antarctic Logistics and Operations (SCALOP) was also created at that time to replace the WGL. The SCALOP would be composed of one member from each country as nominated by the respective manager of a national Antarctic program and would usually be the program’s logistics and operations person. The SCALOP remained in existence until 2008, when COMNAP restructured its organization. Even though a formal standing committee no longer exists, discussions on logistics and operations still take place and are still important aspects of COMNAP that are now considered by a number of Expert Groups.

### COMNAP 1988–2008

Two of the topics that preoccupied the managers of national Antarctic programs in 1988 were air operations and telecommunications. They are topics that are still of concern to COMNAP members today. Matters such as these generally became the subject of consideration by SCALOP until it was formally disbanded by COMNAP at its Annual General Meeting (AGM) XX in 2008 in St. Petersburg, Russia. Over the course of its 20 years of existence SCALOP convened 10 symposia that provided an opportunity for members and others to present, orally and via posters, information on a range of topics broadly related to logistics and operations in Antarctica. The topics included innovation, infrastructure and logistics, human resource management, transportation, environmental issues, emergency response, and medical concerns (Figure 2). In addition to the opportunity these symposia provided to those able to attend in person, another result is the published volumes of proceedings from each of these events, which, taken together, provide a valuable source of information on these topics for the future and provide an insight into the evolution of national Antarctic program activity over the past 20 years.

In 1991 at the Antarctic Treaty Consultative Meeting (ATCM) XVI in Bonn, Germany, COMNAP was granted observer status, thereby joining only SCAR and the Commission of the Convention on Antarctic Marine Living

**ANTARCTIC OPERATIONAL INDICATORS**  
Select from our exciting menu!

*Menu*  
First, select your indicator:

- Airfield**
  - Accidents
  - Equipment
  - Incidents
  - Operations and maintenance
- Emergency response**
  - Equipment
  - Personnel
  - Procedures
  - Training
- Seasonal station**
  - Equipment
  - Frequency of operations
  - Personnel
- Heritage/historical site**
  - Equipment
  - Personnel
- Emergency deposit**
  - Equipment
  - Waste
- Powerhouse**
  - Equipment
  - Efficiency
  - Energy generation
- Waste of fuel/boasting facility**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Radar photostations**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Solar hot water heating**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Exotic fuels**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Real chemical spills**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Waste management**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Protected areas**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Spill deposits**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Cleanup and remediation**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training
- Environmental management**
  - Equipment
  - Incidents
  - Operations and maintenance
  - Personnel
  - Procedures
  - Training

What do you want to do with it today?

- Compliance and Strategic Reports**
  - Standard State of the Antarctic Environment Report (SSEER)
  - Standard Information Exchange Annual Report Under Resolution 2, 2001
  - Trends - Protected areas with trends
  - Trends - Footprints, personnel-days and activity levels
- Operational Reports**
  - Use of resources, fuel and power
  - Movements of ships, aircraft and personnel
  - Levels of fuels on ships
  - Accidents, Incidents and Near-Miss Reports (ANMR), including lessons learned and actions taken
  - Waste management - on-site processing and disposal trends
- Environmental management**
  - Response to emergency spills
  - Response to emergency spills
  - Improvement management plans

A number of operational indicators are needed for effective environmental monitoring and input into environmental management decisions.  
Any operational indicator can also be useful for operational reporting and analysing and input into operational management decisions.  
Let's select together operational indicators useful to all, and build up a simple, flexible system that will not become another requirement burden but help us all.  
**Let's do it all together!**

COMNAP

FIGURE 2. An example of outreach material developed by COMNAP in 2006.

Resources (CCAMLR) with this status at ATCMs. Having observer status is important, given that only formally designated observer organizations and the Consultative Parties to the Antarctic Treaty may prepare and present working papers at the annual ATCMs. Thus, COMNAP was given the ability to influence the political side of the system by delivering working papers at meetings that included recommendations to Antarctic Treaty Parties. In the 20 year period from 1988 to 2008, COMNAP prepared and presented a total of 18 working papers and almost 50 information papers, covering a range of topics from education and training to contingency planning and waste management.

The COMNAP also responds to requests from the ATCM. This is especially evident in the number of recommendations and measures of an operational nature which have requested COMNAP action or response that have been adopted by the ATCM over the past two decades.

The recommendations categorized as having an operational nature currently number 47.<sup>4</sup> Many of these are no longer valid given there have been significant changes to the operation environment and capabilities in Antarctica. Some of these recommendations required COMNAP to prepare a product or tool as guidance on matters or in support of the information exchange policy of the Antarctic Treaty System. Two such tools are the Antarctic Telecommunications Operational Manual (ATOM)<sup>5</sup> and the Antarctic Flight Information Manual (AFIM),<sup>6</sup> both of which remain in use, are updated on a regular basis, and are distributed widely.

For the 20th anniversary of the establishment of COMNAP, the members agreed to a proposal prepared by the executive committee to reconsider the role and purpose of COMNAP and to refocus much of COMNAP's efforts on managing the support of science. The change was a reflection of the diversity amongst the role of the managers of national Antarctic programs, most of whom are now assisted by a logistic manager who is in charge of many of the operational areas that were the previous focus of the SCAR WGL and SCALOP.

## THE ROLE OF COMNAP TODAY

The council is still the primary forum for managers of national Antarctic programs. However, the purpose of COMNAP has evolved, reflecting the growing responsibilities of managers of national Antarctic programs. For example, many of the managers are involved in or often lead the development of their countries' Antarctic science strategy. More often than not, the national Antarctic program manager is responsible for the preparation and defense of their countries' Antarctic budget. The nature of national Antarctic program activity in Antarctica means that planning often takes place years before the actual season that is being planned. This requires not only an understanding of the national policy and strategy regarding Antarctica but also an understanding of the international considerations and an understanding of the science that is being proposed. So although there is often the misconception that managers are solely concerned with logistics, many of the managers never deal directly with logistics problems but, of course, need the ability to understand the requirements of logistics and operations since logistics and operations are what physically allow the delivery of scientific observations and results from Antarctica and international cooperation in scientific investigation there.

Even the COMNAP of 1988 recognized these as “matters of top priority and greatest management concern,”

listing the “establishment of scientific priorities and long term scientific goals” as its number one objective on the list from inaugural COMNAP discussions in 1987.<sup>7</sup>

The purpose of COMNAP as stated in its present constitution is to develop and promote best practices in managing the support of scientific research in Antarctica. The COMNAP achieves this purpose by

- serving as a forum to improve effectiveness of activities in an environmentally responsible manner;
- facilitating and promoting international partnerships;
- providing opportunities and systems for information exchange; and
- providing the Antarctic Treaty System with objective, practical, technical, and nonpolitical advice drawn from the national Antarctic programs' pool of expertise.

This is much broader than the role that the SCAR WGL and SCALOP played within the Antarctic Treaty System. Yet the misconception that COMNAP is only about logistics persists. The managers of national Antarctic programs control more than the logistics of their respective programs.

Managers of national Antarctic programs organize and fund the support to research (scientific and wider) that has been evaluated and approved at a national level, usually through a peer-review process, on the basis of the quality of the research and, of course, what they can actually physically support. Therefore, the managers are not just organizing support.

At the national level, the managers of national Antarctic programs are part of the strategic decision-making process about which Antarctic projects that will actually be supported. They are responsible for implementing their national scientific policies in Antarctica, and also, at the international level, they are the officers responsible for promoting and facilitating international partnerships in the spirit of the Antarctic Treaty, enabling scientists to fully participate and operate in the Antarctic as, when, and where their research requires.

The COMNAP is the organization that brings together national Antarctic programs. However, like the managers themselves, national Antarctic programs are diverse organizations with national reporting lines that vary, usually across a range of government ministries and departments. The physical assets of the 28 national Antarctic programs represented by COMNAP vary considerably as well. These assets include a range of aircraft, over 40 vessels, around 30 Antarctic airfields, over 37 year-round stations, equipment that sustains telecommunications and IT capabilities around the continent, and equipment required in support

of deep field operations. Human capacity involves more than 1,100 people in the Antarctic in winter time and over 4,000 in summer time. These people, scientists and support staff, are themselves supported by a network of highly skilled people based in national Antarctic programs' home countries. In some cases the network includes support from military agencies and military personnel. In other cases, the network includes contracts with and support from non-governmental organizations, charitable foundations, and commercial operators.

The roles that COMNAP plays and the tasks it undertakes reflect the diverse nature of its membership. Examples of the diversity of managers' work include

- reviewing scientific proposals and being part of the decision-making process of which projects should get approved every year;
- allocating funds for every scientific project;
- providing logistics in support of scientific research (requires expertise in management, field operations, transport, etc.);
- support in the event of an incident/accident involving human life (search and rescue);

- protecting the environment, which requires expertise in environmental management practices and an understanding of the legal obligations within the Antarctic Treaty System;
- outreach and education as it is often the national Antarctic program personnel who are requested to inform the media of issues related to Antarctica, prepare information for schools, and provide public presentations and displays; and
- data management and coordination (scientific data and other data related to more technical issues and information on vessels and stations).

The COMNAP's objectives to serve as a forum to support best practices and facilitate international partnerships stretch across all these categories.

Increasingly, regional, as opposed to bilateral, alliances are developing. Two examples are the Dronning Maud Land Air Network (DROMLAN) and the coordination of science in King George Island (Figure 3).

The DROMLAN air network facilitates communication and the transportation of scientists and equipment between Cape Town and Dronning Maud Land and between



FIGURE 3. Researchers on the Brazil-Chile-U.S. Climate of Antarctica and South America Deep Ice Core Drilling in the Antarctic Peninsula (CASA) project.

the scientific stations and field locations within Dronning Maud Land. Formally established as an international project at the XIV COMNAP Meeting in Shanghai during July 2002, it is supported by a consortium of the 11 national programs that have stations or operations in Dronning Maud Land. The network connects the 3,000 m ice runway at Novo Air Base, close to the Russian Novolazarevskaya Station, to Cape Town International Airport by an intercontinental flight. The Novo runway acts as a hub from which feeder flights by ski-equipped aircraft can connect to other stations and field locations within Dronning Maud Land. The DROMLAN is available to any member organization of COMNAP and any SCAR country for science-related activities, including logistics. The DROMLAN cooperation includes maintaining, improving, and operating two airfields in Dronning Maud Land close to the Novolazarevskaya (Russia) and Troll (Norway) stations for intercontinental flights from Cape Town; organizing intercontinental flights with appropriate aircraft to transport personnel and cargo between Cape Town and the airfields at Novolazarevskaya and Troll; organizing connecting flights with small ski-equipped aircraft to all stations and field destinations in Dronning Maud Land, including further options such as Vostok, South Pole, and the stations of the East Antarctic coastal region; and organizing the necessary support services, such as weather forecasting, provision of fuel, and accommodation at stations in Dronning Maud Land.

The second example, the King George Island project,<sup>8</sup> involves 10 countries and the collection and analysis of information from each of those countries regarding their activities on King George Island. The goal is to better coordinate science and logistics activities on the island in order to reduce duplication of activities. The project establishes a database that is simply a tool that includes information on research projects proposed, locations of each project, and principle investigators and their contact details. Geographic coordinates for each entry are also included so that the data and information can be analyzed via a GIS interface. This is a new project agreed to at the 2009 COMNAP AGM in Punta Arenas, Chile. Such a tool relies on the goodwill of the staff of national Antarctic programs, who will be responsible for input of data and information in a timely manner.

## SCIENCE-POLICY INTERACTIONS

Aspects of all of these programs are of particular interest as we focus on science-policy interactions. Those aspects are as follows.

- Improving the effectiveness of national activities leads to increased efficiencies, so that we can carry out more science within the budget we get from our governments.
- More international collaboration means more and even better science with the same global budget and less duplication of efforts, that is, similar science output with fewer projects in the field.
- The nature of Antarctic science has evolved from cartographers drawing maps to interdisciplinary research activities that require expertise in foreword planning of complicated Antarctic research programs.<sup>9</sup>
- The decision-making process for the science to be supported has changed enormously in the last 50 years. Now the standard is to have a competitive peer-review system in which the managers and staff of national Antarctic programs are usually involved.

The COMNAP is in the process of becoming a project-oriented organization, more focused and strategic, concentrating on what COMNAP members, policy makers, and even the global general public might expect from such an organization. Presently, the development of a five-year work plan is underway. The work plan attempts to consider the national Antarctic program priorities in the near future and also addresses the key issues that are being considered in both the ATCM and at the Committee for Environmental Protection (CEP). Problems such as the prevention of the introduction of nonnative species into the Antarctic region require a collective response from the various organizations within the Antarctic Treaty System.

Antarctic science is generally more expensive than science in other parts of the world. Undoubtedly, all high-quality science projects deserve to be supported, but neither the money nor the infrastructure will always be available to support them as costs increase. Therefore, unless we can successfully communicate the value of Antarctic science to policy makers and to the general public, we may all have to cancel or defer some important projects until we can dedicate to them some of the limited time and money available. However, COMNAP can assist in this task by looking at what resources can be pooled and/or shared with others and looking at projects to see if they can be modified or associated with similar projects in other countries. The COMNAP has recognized a greater need for collaborative support.

## DEVELOPING STRATEGIC PARTNERSHIPS

Perhaps because of the nature of COMNAP's birth, COMNAP has historically been an organization that has

been inward looking, providing its membership with the framework they need to develop their own, usually bilateral, partnerships but shying away from the formal development of partnerships with other Antarctic organizations. It has also generally been slow to develop and promote strategic relationships with external organizations with goals that also support the spirit of the Antarctic Treaty System or that perform similar roles in the Arctic.

This behavior is changing, with COMNAP actively looking to strengthen its strategic partnerships with other Antarctic Treaty System bodies. Those strategic partnerships include SCAR, the CEP, and the International Association of Antarctica Tour Operators. This change is a reflection of the importance of identifying issues that require common action such as outreach, education, capacity building, data management, sustainability, and supporting the goals of peaceful use of and scientific cooperation in Antarctica.

### **COMNAP'S CONTRIBUTION TO THE SCIENCE-POLICY INTERFACE**

Today, more than ever, COMNAP can be seen to be of value given the complex nature of Antarctic science questions being posed. Science programs often address key research questions, such as how the Antarctic system as a whole is responding to change. Such complex queries are increasingly becoming the norm. Complex science often requires multidisciplinary, multinational science teams and often demands reaching into new parts of the Antarctic, where those parts could be new surface, subsurface, atmosphere, or marine depths. The physical extent of Antarctic science is further than was ever previously possible.

Fifty years ago, Antarctic science was Antarctic presence. Although there is no denying that this is still the case, the ability for a nation to engage in Antarctic research activities is much more than that.

The COMNAP, as an organization, assists its members to successfully deliver their national Antarctic research programs and projects. Such programs are, generally, becoming bigger, are reaching out into previously unexplored areas of the Antarctic region (including into subglacial aquatic environments), and usually involve multinational and often interdisciplinary teams of researchers, support staff, IT/communications experts, health and safety practitioners, environmental consultants, outreach staff, and medical staff.

Member national Antarctic programs and COMNAP, with their wealth of firsthand Antarctic expertise, are well placed to face the Antarctic challenges of the future as they have in the past. National Antarctic programs discovered

the ozone hole over Antarctica,<sup>10</sup> have drilled for the oldest ice core ever extracted,<sup>11</sup> have gathered data on the Census of Antarctic Marine Life covering millions of nautical miles,<sup>12</sup> and have plans to explore Antarctic subglacial lakes.<sup>13</sup> The diversity of activity reflects the diversity of the science questions that require exploration and support.

It seems the challenges of isolation and extreme environmental conditions are no longer an adequate barrier to the Antarctic region. We continue to see an increase in human activity in the Antarctic, whether from tourists, fishing industry personnel, or members of national Antarctic programs. Recognizing and responding to the increase is important not only from an environmental perspective but from the need to protect human life in the Antarctic.

The COMNAP, as one of its recent projects, convened two workshops on improving cooperation in regards to search and rescue (SAR) in the Antarctic. Even collectively, our capacity to respond to a large-scale accident or incident in the Antarctic region, on land and in the maritime environment, is extremely limited. Five marine rescue coordination centers, one each based in Australia, Argentina, Chile, New Zealand, and South Africa, have International Maritime Organization (IMO) responsibility for SAR activities over different areas of the marine area south of 60°S latitude (Figure 4).

However, even given that those SAR authorities had responsibility for certain parts of the maritime area around Antarctica, there was the perception that such authorities did little in the way of developing strategic relationships among themselves and even less between themselves and national Antarctic programs who, along with the fishing and tourist industry, were the primary operators in the waters.

The COMNAP presented the results of its most recent workshop on Antarctic search and rescue to the Antarctic Treaty Meeting of Experts on the Management of Shipborne Tourism in the Antarctic Treaty Area (ATME, December 2009, Wellington, New Zealand) and to ATCM XXXIII (2010, Punta del Este, Uruguay) in support of the COMNAP objective to provide practical and nonpolitical advice to the Antarctic Treaty System. This workshop is in addition to the Ship Position Reporting System (SPRS) that COMNAP developed and introduced. It is simply another example of the range of issues that COMNAP has played a lead role in for the development of guidance and policy on Antarctic issues and concerns.

### **CONCLUSION**

Demonstrating a country's interest in Antarctica has become the role assigned to the national Antarctic

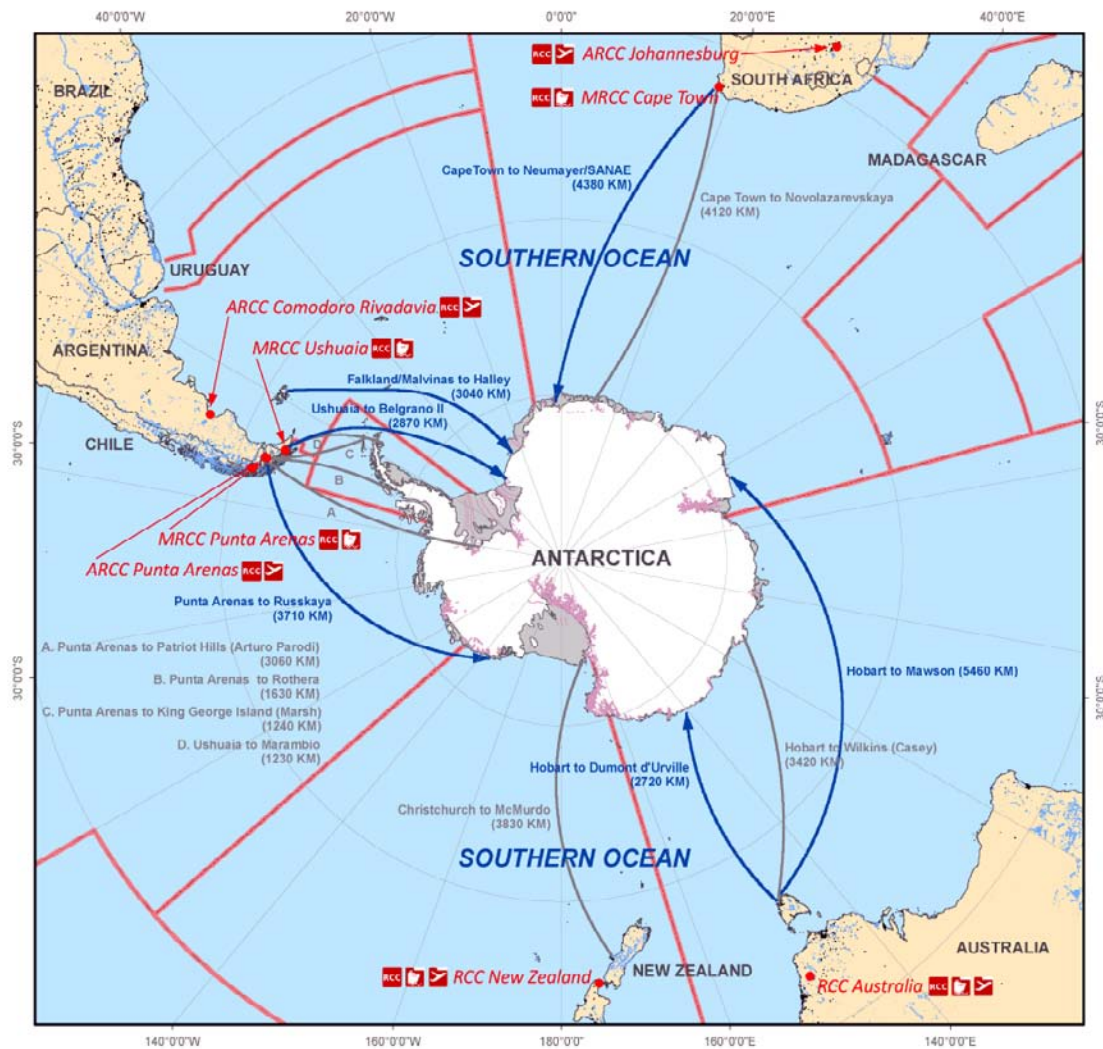


FIGURE 4. Map developed by COMNAP to assist rescue centers with search and rescue operations in the region.

programs of each Antarctic Treaty Consultative State. Many of these national Antarctic programs are broader than the scientific mandates that were the principle Consultative States when the Antarctic Treaty first entered into force. National Antarctic programs often contribute to outreach and education activities, provide input into science strategies and the funding that supports such strategic direction, contribute significantly to the environmental management of the area, and are often the greatest source of information on how the Antarctic is responding to change since their staff spend more time in the Antarctic region than anyone else does. This fundamental understanding of Antarctica from a practical and nonpolitical

perspective will continue to be a strength of national Antarctic programs individually and a strength of COMNAP as an assembly of those programs. It is an understanding that is required of an area currently devoted to peaceful and scientific use and will also be of value in the future should the values we associate with the area be changed.

## NOTES

1. See "History of the Institutionalisation of Antarctic Research," [www.scar.org/about/history/](http://www.scar.org/about/history/), accessed May 2010.
2. A. N. Fowler, *COMNAP: The National Managers in Antarctica* (Baltimore, Md.: American Literary Press, 2000), p. 29.



3. Fowler, *COMNAP*, p. 8.
4. Antarctic Treaty Secretariat, "Review of the Status of ATCM Recommendations on Operational Matters," ATCM XXXIII Paper SP06 (Buenos Aires: Antarctic Treaty Secretariat, 2010).
5. ATCM Recommendation X-3 (1977) "Improvement of Telecommunications in the Antarctic." Note that the original request was for SCAR action since COMNAP did not exist in 1977. The COMNAP now takes responsibility for this publication.
6. ATCM Recommendation XV-20 (1989) "Air Safety in Antarctica."
7. Fowler, *COMNAP*, p. 44.
8. The working title of this project is Antarctic Peninsula Advanced Science Information System (APASI).
9. Antarctica's Gamburtsev Province Project (AGAP), Antarctic Drilling Project (ANDRILL), and the European Project for Ice Coring in Antarctica (EPICA) are only a few such recent projects. The establishment of multinational research stations in the Antarctic is another example of greater international cooperation.
10. See "The Ozone Hole: Science Briefing 2009", British Antarctic Survey, [http://www.antarctica.ac.uk/press/journalists/resources/science/the\\_ozone\\_hole\\_2009.pdf](http://www.antarctica.ac.uk/press/journalists/resources/science/the_ozone_hole_2009.pdf) (accessed 22 November 2010).
11. EPICA, 1996–2006, supported by the European Commission and national contributions from Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom.
12. Census of Antarctic Marine Life (CAML), 2006–2009.
13. Including Lake Vostok, Lake Ellsworth, and Whillans Ice Stream (Whillans Ice Stream Subglacial Access Research Drilling, WISSARD).