World Climate Research Programme

Launching meeting on a WCRP International Programme for Antarctic Buoys (Helsinki, Finland, 20-22 June 1994)

Contents

1. Opening and organisation of the meeting

1.1 The launching meeting on an International Programme for Antarctic Buoys (IPAB) was opened in the University of Helsinki by Dr. I. Allison, the interim Chairman for the IPAB pilot phase, at 9.00 am on 20 June 1994. Dr. Allison reminded participants to the meeting of the background to its organisation and on the recommendations of the first planning meeting on a WCRP International Programme for Antarctic Buoys (Hobart, Australia, 5-7 April 1993). This second planning meeting of IPAB was expected to be the inaugural meeting of the Programme.

Professor M. Lepparanta from the Department of Geophysics of the University of Helsinki, welcomed participants to the university.

A list of the participants to the meeting is given at Appendix A.

1.2 Dr. I. Allison was nominated by the participants as the Chairman of the meeting. The meeting agreed on the agenda to be followed, the arrangements of its work. Appendix B contains the final agenda of the meeting.

2. Review of the IPAB pilot phase

Dr. Allison presented a report on results of the implementation of the IPAB pilot phase agreed to at the Hobart meeting and commenced in April 1993. This report is attached as Appendix C.

Examples of a prototype data base, using the limited available data for January and May 1993, were demonstrated (see Appendix C).

3. Review of existing and planned drifting buoy deployments in the Antarctic.

The participants in the meeting reported on their recent national/institutional programmes of drifting buoy deployments in the Antarctic sea ice zone and neighbouring regions, for both research and operational purposes. Participants also outlined their plans for future buoy deployments and/or on the logistic support they could provide for such deployments. Summaries of the reports presented are given at Appendix D. One problem identified with the present deployments was that many of the Antarctic buoys were not reporting data via the GTS. The meeting concluded that, provided new deployments were on the GTS, the future prospects for a successful IPAB were very good.

Dr. Allison stated, on behalf of the Co-operative Research Centre for the Antarctic and Southern Ocean Environment (Hobart, Australia), that that Centre had appropriate facilities and was prepared to serve as a co-ordinating centre for the IPAB.

The meeting was informed that the Polar Research Committee for the Royal Swedish Academy of Sciences, the Institut Francais pour Recherché et la Technologie Polaries, and the Servicio Meteorologico Nacional Argentina, which did not participate in this meeting, all expressed interest in the programme and requested to be kept informed of IPAB progress.

Under this agenda item the meeting was also informed that the JSC-XV (March 1994) had endorsed the concept of the IPAB. The WMO Regional Association III (South America) at its meeting at Asuncion (September 1993) emphasised the importance of the IPAB and urged its Members to assist in the provision or deployment of ice-resistant data buoys in the Antarctic sea ice zone. The sixth session of the WMO-EC Working Group on Antarctic Meteorology (Geneva, November 1993) expressed its support of the IPAB. It recommended that WMO Members, in particular those that have active meteorological programmes in the Antarctic, be urged to participate in the IPAB by providing and/or deploying ice-resistant data buoys, or by other means. The WMO Executive Council, at its XLVIth session (Geneva, June 1994), urged Members to spare no efforts in the establishment and implementation of a drifting buoy network in the Antarctic sea ice zone.

4. Establishment of an International Programme for Antarctic Buoys

4.1 IPAB Operating Principles.

The draft Operating Principles for the WCRP International Programme for Antarctic Buoys, prepared at the first planning meeting in Hobart, were reviewed by participants and revised by consensus. The final agreed Operating Principles are attached as Appendix E.

4.2 Participating Organisations

A list of the 15 original participants (defined as those institutions or agencies who indicated at the meeting, or by prior written notice, of their intent to become full Participants, as defined in the Operating Principles, within the next three months) is attached as Appendix F. Since a quorum of more than 50% of these original participants was represented (13 of 15), the meeting was deemed to be the inaugural meeting of the WCRP International Programme for Antarctic Buoys.

4.3 Programme Status

The meeting discussed the possible status and affiliation of the programme in detail. It was agreed that the programme would be best served by affiliation with both governmental and non-governmental organisations, and it was concluded that, because of the strong research component, it should retain association with the World Climate Research Programme, and be entitled the WCRP International Programme for Antarctic Buoys. Accordingly the meeting requested that the WMO/ICSU/IOC JSC for WCRP endorse the Programme as a self-sustaining project of WCRP. At the same time, following the recommendation made by the first planning meeting for IPAB, it was recommended that the Programme should also seek the status of an Action Group of the WMO/IOC Data Buoy Co-operation Panel.

4.4 Administrative Aspects of the IPAB

In accordance with the management structure outlined in the Operating Principles, the meeting elected an Executive Committee of:

Chairman	Dr. Chr. Kottmeier, Germany
Vice-Chairman	Mr. D. Crane, UK.
member	Mr. P. le Roux, South Africa

member Dr. A. Pellegrini, Italy

The meeting also appointed a programme Coordinator:

Coordinator Dr. I. Allison, Australia

The meeting concurred that there was no immediate need to establish a common monetary fund. It also agreed that, in the early stages of the Programme, support for secretarial services and meetings could be met from resources available within the institutes and/or agencies of the Executive Committee members and of the Coordinator. The Executive Committee was requested to keep this matter of resources under review.

4.5 Data Archiving

A sub-group of the meeting developed a number of general guidelines for archiving data from the Programme, and suggested some changes and improvements to the pilot data base established by the interim Coordinator.. These guidelines are shown in Appendix G. The Executive Committee and Coordinator were charged with developing a more detailed data management structure based on these.

4.6 Technical Developments

The meeting discussed technical aspects of maintaining a data buoy network in the Antarctic sea ice zone. It was noted that the two major practical differences between the Antarctic buoy programme and the equivalent Arctic programme were that, in many areas of the Antarctic, buoys diverged north and drifted out of the ice covered area in only a few months, and that it was logistically much more difficult to deploy buoys in the Antarctic at all times of year. An all-season deployment capacity for the Antarctic would be required to maintain an optimum buoy array.

The meeting noted a requirement for some Antarctic applications for a cheap, short-lived buoy with only pressure and temperature sensors. At the same time however, there were also requirements for some deployments of sophisticated well-instrumented buoys for special applications. Some investigations such as heat exchange studies, require detailed information on the atmospheric boundary layer from air temperature profile measurements and a true surface wind. Duplicate sensors were also useful for checking data quality.

The meeting also discussed the difficulty of accurately measuring air temperature, particularly on aircraft-deployed buoys. Results of tests conducted at Barrow, Alaska by the US Ice Center on a number of different buoys were presented: these demonstrated that even during the polar night, air temperature errors could be as high as 5°C for some buoy. For this reason the meeting resolved that air temperature should not be included as one of the basic meteorological variables in the GTS data stream, but that the data should be kept as part of the research data base.

The Executive Committee and the Coordinator were requested to keep these technical issues under review.

5. Future Activities and Other Business

Intending Participants were urged to encourage their agencies or institutions to submit formal Letters of Intent to participate in the Programme as soon as possible. Letters should be submitted to the Chairman of IPAB, with a copy also sent to the Director, Joint Planning Staff for the WCRP. They were reminded that an effective data base could only be established if the necessary formalities were completed to allow the Coordinator to receive data from new buoy deployments, and that the Coordinator must be provided with the appropriate buoy calibration files and information on the type of buoys and sensors used.

It was agreed that the Executive Committee should determine the specific date and place of the next bi-annual meeting in 1986.

No other business was raised at the meeting.

6. Adoption of the Meeting Report

The participants to the meeting reviewed and agreed on the draft report.

7. Closure of the Meeting

The chairman thanked the Geophysical Institute, University of Helsinki for the excellent local arrangements and meeting support that they had provided.

The inaugural meeting of the WCRP International Programme for Antarctic Buoys closed at 1200, Wednesday 22 June, 1994.

Appendix A

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Launching meeting

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Appendix C

Report of the IPAB Pilot Phase.

The planning meeting on a WCRP international Antarctic drifting buoy programme (Hobart, April 1993) resolved to commence a pilot phase for the International Programme for Antarctic Buoys using data from buoys operating in 1993 under several national programmes. This pilot phase would obtain data by informal agreement between Principal Investigators, and assemble this into a prototype research data base.

Unfortunately however, very few ice buoys were operating in the Antarctic sea ice zone during the pilot phase in 1993. The Australian Antarctic Division deployed a total of five buoys, of a new manufacture, late in the 1992 ice season and early in the 1993 season. All of these buoys failed very shortly after deployment in the ice (mostly after less than one month). The Alfred Wegener Institute, Germany , deployed 12 buoys in 1992 in the Weddell Sea, but none in 1993. Five of the 1992 buoys continued to provide data throughout most of 1993, but only one remained within sea ice near the northern tip of the Antarctic peninsula. The others drifted into open water in the Antarctic Circumpolar Current, finally ceasing to provide data when in the Ross Sea in September 1993 after nearly circumnavigating Antarctica. No Antarctic ice buoys were operated by US investigators during 1993, and none are known from other nations. Figure C1 shows the drift tracks of all known buoys operating within the Antarctic ice during May 1993 (the month with the greatest number of buoys).

Besides those buoys deployed within the sea ice, a number of open water buoys provided data from high southern latitudes (greater than 60°S) in 1993. The number of Antarctic buoys operating in 1993 can be compared with earlier years in Table C2.

A prototype data base has been established at the Antarctic Cooperative Research Centre in Hobart, and software has been developed for presentation and dissemination of the data. Examples of the prototype data base, using the limited available data for several months of 1993, were presented at the Helsinki meeting by the interim Chairman for the pilot phase. A prototype summary file of daily average buoy data for May 1993 is shown at Annex C1.

Despite the lack of buoys for the pilot phase, prospects for the future are more encouraging. At June 1994 a number of buoys were operating south of 55°S (Table C1), although many of these were ocean drifters only, with no meteorological sensors. From the 1994/95 Austral summer onwards several institutes plan deployments of instrumented buoys in support of IPAB; for example, the Alfred Wegener Institute has undertaken to deploy at least four buoys to contribute to IPAB for the first and subsequent years of its operation, and the Australian Antarctic Division currently holds a stock of nine buoys (a different design than those used in 1993) and will be deploying these and additional units within the ice over the next few years

Table C1 1994 Antarctic data buoys: buoys operating south of 55°S at June 1994

Responsible Agency*	No.	Sector	GTS	Ice Buoy	Press. Sensor	Air T Sensor

ACRC	1	Indian Ocean	Yes	No	Yes	Yes
BOM	2	Indian Ocean	Yes	No	Yes	Yes
SAWB	1	S. Sandwich Is.	Yes	AWS**	Yes	Yes
IAP	3	Ross Sea	No	No	No	No
JARE	2	Ross Sea	No	No	No	No

* Refer to Table C2 for list of responsible agencies
** AWS = Automatic weather station (fixed platform)

Figure C1 **Monthly drift tracks for all available ice buoys, Pilot Phase, May 1993.**

Table C1 Preliminary inventory of Antarctic sea ice zone data buoys.

Year deployed	Number	Agency
Weddell Sea		
1979	4	CRREL
1980	4	CRREL
1985	1	BAS
1986	2	SPRI
	7	U. Hann.
	11	U. Hamb/AWI
1987	-	
1988	1	BAS
	2	LDGO
1989	7	SPRI
	16	U.Hann.
	3	AWI
1990	2	U.Hels
1991	5	AWI
1992	1	LDGO
	2	U.Hels.
	3	SPRI
	12	AWI
1993	-	
Drake passage/ E. Bellingshausen		
1985-91	*9*	*PROA*

Entries in italics are not specific ice buoys.

Responsible Agencies:

AAD	Australian Antarctic Division, Hobart, Australia (I. Allison)
ACRC	Antarctic CRC, Hobart, Australia (W. Budd)
AWI	Alfred Wegener Inst for Polar and Marine Research, Bremerhaven, Germany (C. Kottmeier)
BAS	British Antarctic Survey, Cambridge, UK (J. King)
BOM	Bureau of Meteorology, Hobart, Australia (H. Hutchinson)
CRREL	USA Cold Regions Research and Engineering Laboratory, Hanover, N.H. (S. Ackley)
HD	Ocean Surveys Division, Hydrographic Dept., Maritime Safety Agency, Japan (M. Hishida)
IAP	Italian Antarctic Programme

Year deployed	Number	Agency
Ross Sea		
1986	3	APL
1987	6	APL
1988	8	APL
East Antarctic		
1985	3	AAD
1987	6	AAD
1988	*2*	*HD*
1989	*1*	*HD*
1991	1	ILTS
1992	2	AAD
1992	*2*	*HD*
1993	3	AAD
1993	*3*	*HD*
1994	*1*	*ACRC*
	2	*BOM(*
	2	*HD*
South Sandwich Islands (Automatic Weather Stations)		
1991	*2*	*SAWB*
1992	*2*	*SAWB*
1992	*1*	*SAWB*
1994	*2*	*SAWB*

ILTS	Inst. Low Temperature Science, Hokkaido, Japan (K. Ohshima)
LDGO	Lamont-Doherty Geophysical Observatory, Palisades, N.Y. (D. Martinson)
NAVO	U.S. Naval Oceanographic Office (D. Benner)
PROA	PROANTAR, Brazil (M Stevenson)
SAWB	South African Weather Bureau (P. le Roux)
SPRI	Scott Polar Research Institute, Cambridge, UK (D. Crane)
U.Hann	Inst. for Meteorology and Climatology, Univ. Hannover, Germany (R. Roth)
U.Hamb	Meteorology Inst., Uni. Hamburg, Germany (H. Hoeber)
U.Hels	Dept. Geophysics, Univ. Helsinki, Finland (J. Launiainen)

Appendix C
Annex C1

Prototype Data Summary
Pilot Project, May 1993

The data presented are daily summaries for each ice buoy operating during May 1993. These data include the interpolated buoy position at 00 GMT, derived easterly and northerly components of the daily displacement velocity (V, 0.1 m/s = 8.64 km/day), the 00 GMT interpolated air pressure, and daily averages, when available, of air temperature (T air), hull temperature (T sea, which is either SST or ice temperature depending on buoy situation), and ocean temperature at 10 m and 100 m depth (ST-10, ST-100). The daily summaries are derived from the main data base which contains all transmitted data from every (reliable) sensor. The daily summaries are intended as a "quick-look" data file for easy dissemination. It is expected that many researchers will require subsequent access to the full data base.

Refer to Appendix G for the general principles of data archiving for the WCRP International Program for Antarctic Buoys.

Appendix D

National/Institutional Programmes

1. Australia

Antarctic Division:

All buoys deployed by the Antarctic Division since 1985 are shown in the following table:

Argos ID	WMO #	Start date	Start lat	long	End date	End lat	long	sensors
1167	56527	02/03/85	-65.5	70.0	30/04/86	-52.1	114.4	p, Ta, Tw, T-100
1168	56528	02/03/85	-65.5	76.0	30/06/86	-60.3	129.9	p, Ta, Tw, T-100
1161	56526	08/03/87	-68.0	73.0	02/08/88	-70.1	230.1	p, Ta, Tw
1162	56527	07/03/87	-68.0	78.0	31/12/87	-64.8	24.3	p, Ta, Tw
1163	56528	09/03/87	-66.0	68.0	16/03/89	-57.9	238.8	p, Ta, Tw
1164	56529	15/03/87	-66.0	73.5	20/03/87	-65.6	74.4	p, Ta, Tw
1165	56530	09/03/87	-67.0	68.0	24/05/88	-65.8	25.3	p, Ta, Tw
1166	56531	15/03/87	-66.0	77.5	20/04/88	-68.3	222.6	p, Ta, Tw
4470	-	08/11/92	-67.1	74.0	17/02/93	-66.6	66.4	p, Ta, Tw, T-200
4471	73501	02/05/93	-65.5	144.0	23/05/93	-63.9	137.1	p, Ta, Tw, T-200
4472	-	08/11/92	-68.8	76.0	18/03/93	-65.5	68.4	p, Ta, Tw, T-200
4473	73502	01/05/93	-66.0	145.9	25/05/93	-64.5	133.7	p, Ta, Tw, T-200
4474	73503	28/04/93	-65.6	147.7	11/05/93	-64.7	139.7	p, Ta, Tw, T-200

sensors: p = pressure Ta = air temperature Tw = water (hull) temperature
T-100 = 100 m thermistor chain T-200 = 200 m thermistor chain

Most recently, two ice buoys were deployed near the Antarctic coast around longitude 70°E in November 1992 and a further three were deployed around longitude 135°E in May 1993. All buoys were fitted with air pressure, air temperature, and SST sensors, plus 200 m thermistor chains. None of these recent buoys survived for more than a few months. The drift tracks of boys deployed in May 1993 are shown in Figure D1.1

Four to six drifting data buoys will be deployed each year for at least the next four years in regions of Australian interest, and to contribute to an optimum array for international networks. Deployments will be from *RSV Aurora Australis* during dedicated late-winter sea ice process studies or from late season Antarctic re-supply voyages in March/April or, possibly in the future, from aircraft. Preferred deployment times are between April and August and preferred deployment locations are south of the Antarctic Divergence.

Ice strengthened drifting data buoys will be used measuring atmospheric pressure measurement and buoy location as minimum requirements. Most buoys will also measure air and surface water temperature, and some will be instrumented to measure ocean temperatures to 200 m depth, and other variables. Data transmission will be via the Argos data system and data will be supplied to the GTS.

For the next 4 years proposed deployments are:

late March 1995	5 deployments between 70°E and 100°E
August 1995	3-4 deployments near 120°E as part of an ice mass budget process study. An additional array of 6-8 high positional accuracy ice buoys (2 with meteorological and oceanographic sensors) will be deployed as part of a meso-scale ice deformation experiment for 3-4 weeks during this study.
March/April 1996	4 deployments between 100°E and 130°E
April 1997	Deployments around 90°E
September 1998	Deployments as part of a possible multi-disciplinary coastal polynya study.

Other opportunities, including deployments from vessels of other nations, will be taken to maintain an optimal array.

Figure D1.1 **Three-hourly positions of three Australian Antarctic Division buoys deployed in the East Antarcticsea ice zone in May 1993.**

Antarctic CRC:

One non ice-strengthened buoy was deployed in support of the SCAR FROST program at 60°S, 83°E (WMO56514) in late February 1994. Further deployments are planned in early 1995.

Bureau of Meteorology:

Two non ice-strengthened buoys were deployed in support of the FROST program at 63°S, 65°E (WMO 74801) and at 62°S, 95°E (WMO 73504) in early February 1994.

2. Finland

Finnish Institute of Marine Research / Department of Geophysics, University of Helsinki:

A drifting buoy program in the Weddell Sea has been carried out as a part of the Finnish Antarctic Research Program (FINNARP). The program is run in co-operation between the Finnish Institute of Marine research (J. Launiainen) and the Department of Geophysics of the University of Helsinki (T. Vihma). Three buoys were deployed in the eastern Weddell Sea during the first FINNARP-expedition (R/V Aranda) in 1989/1990. One of the buoys was deployed in a sea-ice floe, one in the open ocean, and one at the edge of a floating ice shelf (fixed position, GTS transmission). Two more buoys were deployed in sea-ice floes in the western and central Weddell Sea during the second field phase in 1992 (R/V Akademik Fedorov) linked to the activities of the U.S.-Russian Ice Station Weddell-1. The data obtained in 1990-1993 is freely available to the participants of the IPAB.

The buoys had a meteorological mast and measured atmospheric pressure, air temperature and humidity, wind speed and direction, surface temperature, ice orientation, snow thickness (one buoy), and the temperature profile in the oceanic surface layer. The data has been used in studies of ice dynamics and heat exchange between the atmosphere, ice, and ocean. Because our main interest has been in studies of heat exchange, the buoys used in this programme have been well-instrumented and with duplicate sensors.

The next FINNARP field expedition will be arranged in 1995/1996 and we plan to deploy 3 to 5 drifting buoys in the eastern Weddell Sea (approximately 70-73°S, 20°E). We will consider the recommendations of the meeting when planning the number and configuration of the buoys.

3. Germany

Alfred Wegener Institute:

The ship-based winter expeditions in the Weddell Sea during the last decade (WWSP 86, WWGS 89 AND WWGS 92) were used to deploy buoys for the purpose of studies of ice drift dynamics and of meteorological and oceanographic studies. Figure D3.1 shows the total drift tracks of several buoys launched during WWGS 92. Similar studies will be continued by the Alfred Wegener Institute in the next few years.

As a contribution to the newly launched WCRP International Programme for Antarctic Buoys, and to the ANZFLUX experiment, 7 buoys will be deployed in the Weddell Sea in 1994. Six buoys will be equipped with air pressure , air temperature and GPS-position sensors and will be arranged to surround a central drifting station with separation of approximately 100 km between the instruments. The array will be centred at 5°W, 67°S and will comprise three additional meteorological/oceanographic buoys. These will carry temperature strings for sea ice and mixed layer studies, and salinometers. The buoys will be provided by the AWI (1) and US-American institutions (2),

Figure D3.1 Total drift tracks of AWI buoys launched during WWGS 92.

In January 1995 a network of 6-7 buoys will be installed in the Southern Weddell Sea during a cruise of *Polarstern*. The equipment will be similar to that used in 1994, with sensors for air temperature, air pressure and GPS-position. The buoys will be arranged to cover meso-scale to synoptic scale (100 km to 500 km) pressure gradients and ice drift statistics.

In early 1995 two automatic weather stations at the periphery of the Weddell Sea will be replaced. A new AWS is to be installed near the grounding line of the Filchner-Ronne ice shelf at about 81°S, 55°W.

From 1996 onwards 3 to 4 buoys will be deployed on a regular annual basis in the Weddell Sea by AWI. The deployment sites will be dependent on ship cruise tracks.

4. India

The Indian Department of Ocean Development will assist with the deployment of buoys of other agencies participating in the IPAB. The Indian area of operation is in the sea ice zone off Dronning Maud Land along Indian Bay.

5. Italy

The project "Climatic System: sea-ice-atmosphere interaction" was commenced in 1994 within the frame of the Italian National Programme for Antarctic Research (PNRA). The project involves aspects of the physics of the atmosphere and ocean.

During the last Italian expedition (late February 1994) eleven oceanographic research drifters were deployed between 64°S and 50°S, along the route between Cape Adare, Antarctica and New Zealand, in order to better understand the detailed dynamics of the PSACC. Six of these are surface drifters, and measure also the water temperature: drift tracks of these buoys are shown in Figure D5.1. The other five are ALACE floats, drifting at a depth of 900 m and recording pressure. All buoys transmit data and are located via the Argos system.

During the 1994/95 austral summer the Italian Program plans to deploy six moorings equipped with ADCP's and Anderaa current meters, sediments traps and T-C chains, in the Ross Sea area. This study area was chosen because of the presence of polynyas. The moorings will operate for one year and the data will be stored locally on solid state memory. In addition, two ice buoys, equipped with basic meteorological sensors, will be deployed to collect information on the atmospheric parameters in the area covered by moorings. The basic meteorological data will be transmitted through the Argos system and inserted into the GTS; buoys have adequate power supplies to operate for 18 months.

The Italian Program can also support other institutions in deploying buoys along the track of the ship used by the Italian expedition. Early in the Antarctic operational season (late October - early December) Italian aircraft flying from Christchurch (NZ) to Terra Nova Bay could release air-deployable buoys

6. Japan

Japanese Antarctic Research Expedition:

The Japanese Antarctic Research Expedition (JARE) has deployed two to four buoys in the Indian/Pacific Ocean sector of the Southern Ocean every summer since 1987 from the icebreaker Shirase. Last summer, two buoys were deployed at about 55°S, 110°E and 60°S, 148°E.

Figure D5.1 Drift tracks, for March and April 1994, of six Italian buoys deployed in the Southern Ocean between Cape Adare and New Zealand.

Figure D6.1 **Drift tracks of buoys deployed by JARE in the Indian/Pacific Ocean sector of the Southern Ocean between 1990 and 1994.**

Almost all buoys were carried eastward by the Antarctic Circumpolar Current (ACC), and some of the buoys reached to the southern tip of the west coast of South America. Drift tracks of the buoys are shown in Figure D6.1. Data from these buoys are archived in the Ocean Survey Division (Director: Masataka Hishida), Hydrographic Department, Maritime Safety Agency (5-3-1 Tsukiji, Chuo-ku, Tokyo 104, Japan). The data can be requested via e-mail (Omnet) "T.MORI" or via the JOIDES-net "KAIYO.HD".

7. Russia

Arctic and Antarctic Research Institute (AARI):

The present potential contribution of AARI to the IPAB can be logistical support for drifter deployment. Today Russia carries out research programs at 5 coastal and 1 continental Antarctic bases and also in the Southern Ocean (including WOCE Core 2 Project: The Southern Ocean). The logistical support for Russian operations in Antarctica are realised by a branch of the AARI - Russian Antarctic Expedition (RAE). AARI uses 2 to 3 ships for Antarctic logistics: "Academic Fedorov" (16,000 T), "Michail Somov" (12,000 T), and "Professor Multanovsky" (2,000 T). Two of these ships have successfully operated in ice covered areas around Antarctica for many years. They have also been used for deployment of various automatic drifters. For example, "Michael Somov" was used to deploy Argos transmitters on icebergs around Antarctic continent, and "Academic Fedorov" has many times deployed drifters (both automatic and manned) in the Weddell Gyre. Both ships have onboard heavy helicopters (MI-8) which can carry 2-3 tons of cargo over a radius 100-300 km.

Taking into account also the fact that RAE usually operates in Antarctica until late autumn, both "Akademik Fedorov" and "Michail Somov" are very useful platforms for deploying buoys for IPAB purposes. In the 1994/95 Austral summer RAE plans to have extensive logistical operations in Antarctica using both ships mentioned above. Preliminary ship tracks and schedules are shown in Figure D7.1. Visits to 5 Russian and 1 U.S. Antarctic bases on the coast of the southern Atlantic, Indian and Pacific Oceans are planned between December 1994 and March 1995, so the ships can be used for drifter deployment in most places around Antarctica for any agency involved in IPAB activities.

Although Russia has no Antarctic buoy program at present, AARI has a long tradition and experience with drifters in the Arctic. Hence there are within AARI, well educated and experienced specialists in drifter design and construction. Therefore a second potential contribution of Russia (AARI) to IPAB could be jointly producing and deploying buoys with another agency.

During the past two decades Russia has conducted an extensive field research program in the Southern Ocean. Through such efforts much data from previously un-investigated ice covered regions has been collected and analysed. In 1993, in cooperation with AWI (Germany), AARI issued a new atlas of the Southern Ocean which is accompanied by data sets from approximately 3000 hydrographic stations. Hence a third potential contribution of AARI to IPAB could be scientific consulting and support for Southern Ocean buoy programs; for example recommending deployment areas, interpreting buoy tracks, etc..

8. South Africa

Weather Bureau:

South Africa has been developing a drifting meteorological data buoy programme since after FGGE (1978/79). Deployments are mostly concentrated in the South Atlantic, from where the buoys move with ocean currents to the south or west of southern Africa. Some buoys are also deployed in the South Indian Ocean, south of South Africa. In addition South Africa maintains manned weather stations on Marion and Gough Islands. Automatic weather stations, reporting

Figure D7.1 **Proposed Russian Antarctic Expedition ship routes and schedules for the 1994/95 Austral summer.**

through the ARGOS system, are also maintained on Inaccessible Island (of the Tristan Island group) and on the north and south islands of the South Sandwich group.

At present some 25 weather buoys are deployed annually by the South African Weather Bureau. The main bulk of these deployments takes place in September/October during the personnel relief voyage to Gough island. During the coming year *Agulhas,* the South African research vessel will deploy 20 SVP buoys in the South Atlantic. Deployments will be made during personnel relief voyages from Sanae station in Antarctica in October-January, and during the personnel relief voyage from Marion Island in March.

This year South Africa will be installing two fully equipped meteorological stations, communicating through the ARGOS system, on the South Sandwich Islands. Like all buoy and other meteorological data, data from these will be disseminated on the GTS. The format will be synoptic at 3-hourly intervals.

The South African Weather Bureau intends to participate in the IPAB as a buoy deployer, as well as providing support to other Participants as required. This assistance could include handling buoys in Cape Town from ship to shore, or shore to ship; providing airport facilities for air deployment; or deploying by air or ship on request.

9. United Kingdom

Scott Polar Research Institute:

Since 1986 the SPRI has maintained an interest in data collection from the Antarctic sea ice zone. During that time we have deployed 14 Argos platforms into sea ice floes (Figure D9.1) collecting over five and a half PTT years of data.

In February 1986 2 drifting buoys were deployed in the southern and eastern Weddell Sea under a joint programme with the British Antarctic Survey (BAS). These buoys drifted around and up the western side of the Weddell Sea, lasting until early 1987.

In 1989 a total of 8 Argos tracked platforms were deployed by the SPRI. Six of these were put out in February, five in the eastern Weddell Sea from the *F.S. Polarstern* and one in the south west corner, air-dropped from the BAS Twin Otter. Two further buoys were deployed in the north eastern Weddell Sea in October, again from the *F.S. Polarstern*.. The lifetimes of all of these drifters varied considerably, the shortest lasting for just 15 days but the two longest transmitting for over 2 years, drifting around the Weddell Sea into the Antarctic Circumpolar Current and as far as 90°E.

In early 1992 2 air drop beacons were deployed by ship in the south western Weddell Sea as part of the AnZone/WWGS buoy programme. These beacons had a relatively short life span totalling less than 50 PTT days. In April of the same year a drifting buoy, heavily instrumented with meteorological, ice and oceanographic sensors, was deployed in the western Weddell Sea from the National Science Foundation ship *Nathaniel B. Palmer*. This was part of a joint project with Woods Hole Oceanographic Institute. Unfortunately this high cost platform survived for only 50 days and technical problems resulted in sensor data being collected only from an in ice thermistor string.

In November 1992 a position only station was deployed on a floe in the Bellingshausen Sea. This simple ice drift indicator survived for 6 months.

All of the drifters deployed by the SPRI, either singly or in arrays, have been used to examine the nature of the ice motion and the ice field deformation in the Antarctic. To this end most of the drifters have been equipped with sensors to measure atmospheric pressure, air, ice and water temperature, wind speed and direction, current speed and direction and buoy orientation (Figure D9.2), in order to determine the forcing parameters.

Figure D9.1 **Drift tracks of Argos platforms deployed by SPRI into sea ice floes in the Weddell Sea region since 1986.**

Figure D9.2 Sensor data for SPRI buoy 5345, 1990.

Figure D9.3 **Proposed cruise track of *Nathaniel B. Palmer,* and SPRI buoy deployment locations, in the Bellingshausen, Amundsen, and Ross Seas in September/October 1994.**

To improve our database on ice drift and forcing in the Antarctic the SPRI will deploy 7 Argos tracked stations in the Bellingshausen, Amundsen and Ross Seas (Figure D9.3) during the cruise of the *Nathaniel B. Palmer* in September/October 1994. One of these will be a fully sensored ice strengthened buoy, one a PTT plus basic meteorological sensors and the remainder will be position only PTTs used to determine the sea ice kinematics.

British Antarctic Survey:

The British Antarctic Survey (BAS) can offer logistic support for IPAB and will be willing to launch buoys from our ships on their normal voyages to and from the Antarctic. The BAS, however, has no plans to purchase any buoys itself.

The BAS can collect data from any buoys that are deployed in the Antarctic, either by using the HRPT receiving system at our Rothera station (67.6°S, 68°W), or by collecting BUOY messages from the GTS through our link with the UK Met Office at Bracknell. Data from existing buoys will be collected as part of the FROST project and will be used to assist in model validation.

10. United States of America

U.S. Antarctic Program (USAP):

Background:
The U.S. Antarctic Program has long been concerned about the sparseness of the Antarctic observation network, and has supported a number of programs concerned with improving the level of available environmental data. In separate experiments, the program has specifically supported the placement of data buoys in both the Ross Sea and the Weddell Sea, has supported the deployment of oceanographic buoys for research purposes, and has established a network of automatic weather stations on the Antarctic continent and on off-shore islands.

Support Capabilities:
During the austral winter, at the time of maximum sea ice extent, the U.S. Antarctic Program currently has the capability to airdrop buoys from U.S. Air Force transport aircraft that annually resupply McMurdo station in June, and from USAP LC-130 aircraft that fly into McMurdo station in late August. In addition the RVIB *Nathaniel B. Palmer* will operate well within the seasonal sea ice zone in the Austral winter for the foreseeable future, and can be used to emplace buoys in her area of operations. The icebreakers operated by the U.S. Coast Guard support the USAP in the Austral summer, but may also be used to set out buoys on the ice.

Current Plans:
The U.S. Antarctic Program has issued a statement of support for IPAB, and expects to convene a workshop to develop a science plan for U.S. participation in IPAB, with the expectation that a number of buoys will be deployed by air in the Ross Sea Sector in late June, 1995. We also intend to support a Scott Polar Research Institute project to deploy drifting buoys from the RVIB *Nathaniel B. Palmer* in the Amundsen and Bellingshausen Seas in September, 1994.

However the major effort of the USAP in obtaining meteorological data in the Antarctic region is the Automatic Weather Station program, which consists of unattended equipment to measure and

report surface air pressure and temperature. Some of the approximately 40 units have been placed on off-shore islands in the Ross Sea sector of the Southern Ocean. At this time such units are located on Young Island in the Balleny group, Scott Island, and Possession Island, while a standard unit, which includes wind speed and direction, is located on Franklin Island. These units report through System Argos at approximately ten minute intervals. The data is currently archived at the University of Wisconsin as three-hourly averages. It is our intention to continue to maintain this network.

Polar Science Center (PSC), University of Washington:

The Polar Science Center, University of Washington, will apply to become a Participant of the IPAB. During the summer of 1994 PSC will seek a consensus among U.S. scientists regarding the merits of an Antarctic data buoy program. Based on these recommendations PSC will prepare a proposal to monitor the fields of ice motion, air pressure, and temperature in the Ross Sea.

11. Data Buoy Cooperation Panel (DBCP)

The ninth session of the DBCP was held in Athens, 25-27 October 1993. The DBCP is more particularly involved in the following issues of potential interest to the IPAB:

1. Successful implementation in September 1993 of phase 2 of the new Argos GTS data processing sub-system. This offers more flexibility and particularly permits processing IPAB buoys which could not be distributed on GTS from Service Argos with the previous system.

2. Successful completion of the first evaluation phase of the new low-cost SVP barometer drifter. This device meets both meteorological (operational) and oceanographic (research) requirements since it is a good Lagrangian drifter, able to measure air pressure and sea surface temperature. In order to make the commitment cost effective, this device could well be used in common meteorological and oceanographic buoy programs.

3. The preparatory meeting for an International South Atlantic Buoy Program (ISABP) was held in Buenos Aires at the headquarters of the Servicio Meteorologico Nacional from 13 to 15 December 1993. The meeting was particularly successful since all the participants in the meeting supported the establishment of a formal ISABP and indicated their willingness to become participants in the program. An interim Steering Committee was established immediately for taking care of various tasks, including the deployment of up to 60 buoys in the region in 1994. The meeting adopted a draft program proposal for further consideration by the interim Steering Committee and the second preparatory meeting. The issue of implementing a Local User Terminal (LUT) in the area (either in Buenos Aires or Gough Island) is being studied. The LUT data would be transferred in real time towards the Argos Global Processing Centres in order to take advantages of better location quality and of all the data processing options offered by the Argos GTS sub-system. A second preparatory meeting should be held within 12 months at the latest. Date and place of this second meeting are not decided yet,.

4. Deferred-time Quality Control Guidelines (for real time GTS data only) implemented by the DBCP were operated by the Principal Meteorological or Oceanographic Centers responsible for

buoy data Quality Control (PMOC). Principal Investigators have been contacted by the Technical Coordinator of the DBCP when the PMOCs detected erroneous data circulating on GTS.

Real-time GTS Distribution of Antarctic Data:

For information, the following GTS bulletin headers are presently used for global real-time GTS distribution of Antarctic buoy, ice float, and Automatic Weather Station (AWS) data processed at the Argos centers of Toulouse (FRGPC) and Landover (USGPC):

SSVX02 KWBC:	Southern Hemisphere buoy data inserted from the USGPC and Quality Controlled at the NDBC (NOAA)
SSVX10 KARS:	Southern Hemisphere buoy data inserted from the USGPC.
SSVX14 KARS:	Antarctic buoy or ice float data inserted from the USGPC.
SSVX03 LFPW:	Southern Hemisphere buoy data inserted from the FRGPC.
SSVX09 LFPW:	Antarctic buoy or ice float data inserted from the FRGPC.
SMAA19 LFPW:	Antarctic AWS data inserted from the FRGPC, main synoptic hours.
SIAA19 LFPW:	Antarctic AWS data inserted from the FRGPC, intermediary synoptic hours.
SNAA19 LFPW:	Antarctic AWS data inserted from the FRGPC, non synoptic hours.

Figure D11.1 **Percentage of required sea surface temperature observations actually received on the GTS for April 1994.**

Data availability index maps (GTS):

The Technical Coordinator presented new products compiled by Meteo-France which show clearly how WCRP and WWW requirements are met. All data received from the GTS during a month in any ocean area is used to produce a map showing, for each variable in any Marsden square, how well the requirement of 8 observations a day in an area of 500 km x 500 km are satisfied (index 100). Also indicated is the percentage of data coming from drifting buoys. The map for April 1994 (Figure D11.1) shows clearly that the requirement in the Antarctic for sea surface temperature is far from being met. The situation with regard to air pressure data is similar. The Technical Coordinator of the DBCP therefore urged IPAB Participants to as far as possible make their data available for real time distribution on to the GTS.

12. Marine Environmental Data Service (MEDS)

Being the Responsible National Oceanographic Data Center for Drifting Buoys for the world's ocean, MEDS continued to archive data flowing daily on the Global Telecommunication System. Overall in 1993, MEDS has received and archived 1,176,703 messages, which is on the average more than 98,000 per month. For the Antarctic region, south of 60°S, MEDS has received 22,598 messages from 15 different drifting buoys, which is considerably less than for the previous year (1992) as shown in Figure D12.1. Figure D12.2 illustrates the fact that for the Antarctic region, air temperature and pressure are the two main environmental variables being measured by drifting buoys. In fact, almost every drifting buoy has an air temperature sensor on board.

To achieve its goal as an RNODC, MEDS has developed and maintained several archives which are illustrated in Figure D12.3. It is worth noting from this figure, that the GTS data archive is by far the biggest archive in terms of volume, as it contains all the GTS messages dating back to the FGGE years. The volume of the archive is now over 7.4 million messages. An inventory of this data is kept on line for the most frequent requests. The SVP deployed mode data archive contains 6-hourly positions and sensors data interpolated by NOAA/AOML, Miami, while the SVP meta data archive is now in development under the leadership of the Scripps Institute of Oceanography, San Diego. To manage its data holdings, MEDS maintains a small archive of administrative information about drifting buoys (WMO, ARGOS and experiment numbers). It has also for the past 2 years maintained an archive of the quality control information provided by the buoys operators, and found daily on an OMNET Bulletin Board. Finally, MEDS receives drifting buoy data from other international sources. Data from all of these archives are available on different computer media, including transmission through Internet, and can be requested by contacting our office in Ottawa

13. System Argos

The Argos system keeps improving to match users' needs. On the hardware side, PTT manufacturers now provide smart mini-transmitters which open new applications. Some new transmitters detect the satellite VHF downlink frequency and transmit only when the satellite is overhead. This is particularly useful to save power. It can also be used to manage data transfer when large amount of data are collected, by updating the messages after each satellite pass is

detected by the PTT. Also notable is the availability on the market of combined GPS/Argos equipment.

On the Argos service side, the latest enhancements consist of:

- Three satellite service: Today Argos data are obtained from NOAA H and NOAA F data sets. Since mid-1994 CLS Argos has increased the capacity of the system by offering the possibility to process, as an option, data gathered by a third satellite, NOAA D. This option will be available for the oncoming satellites and provides an increase of about 50 % in data capacity and in the number of daily locations.

Figure D12.1 (top) **Number of platforms providing data south of 60°S, and number of messages archived by MEDS, 1989-1993.**

Figure D12.2 (bottom) **Environmental sensors on Antarctic buoys contributing data to MEDS, 1989-1993.**

Figure D12.3 Data archive structure for the MEDS RNODC for drifting buoys.

- New Argos location: On June 15th 1994, CLS Argos implemented a set of enhanced location processing routines. The main advantage of these for IPAB applications are:
  - Satellite orbit determination has been improved. As a consequence, for a stationary (or slow motion) transmitter whose oscillator meets the stability specifications, the calculated positions are within 100 m of the true position.
  - Location accuracy estimate has been improved to take into account the measured quality of the PTT oscillator and the velocity of the mobile.
  - Argos and GPS: Standard formats to transmit GPS positions through Argos messages have been defined. For those formats GPS positions are processed and presented in the same format as Argos locations, with a "(G)" class indicator for GPS.

  As a global consequence, the above enhancements tend to increase Argos data capacity, location frequencies and accuracies.

Appendix E

OPERATING PRINCIPLES of the WCRP INTERNATIONAL PROGRAMME FOR ANTARCTIC BUOYS

1. This paper sets forth the principles and a set of operating procedures for the WCRP International Programme for Antarctic Buoys (IPAB).

2 Objective

The objective of the WCRP International Program for Antarctic Buoys is to establish and maintain a network of drifting buoys in the Antarctic sea ice zone in order to:

(i) support research in the region related to global climate processes and to global change, and, in particular, to meet research data requirements specified by the WCRP and by the SCAR GLOCHANT and FROST programmes

(ii) meet real-time operational meteorological data requirements of the World Weather Watch (WWW) programme

(iii) establish a base for ongoing monitoring of atmospheric and oceanic climate in the Antarctic sea ice zone.

The Program will build upon co-operation among those agencies and institutions with Antarctic interests.

3 Programme principles

The IPAB will:

3.1 Promote the development of an adequate Antarctic buoy network through National Antarctic programme agencies, research and operational institutions, SCAR National Committees, and other relevant bodies.

3.2 Coordinate the development and maintenance of an optimum observational network for near-surface meteorological and oceanographic data within the Antarctic sea ice zone, using drifting buoys and other appropriate *in-situ* data collection platforms.

3.3 Distribute in real-time over the Global Telecommunication System (GTS) the buoy position and air pressure data from the network, plus relevant additional real-time data approved by the principal investigators for public dissemination;

3.4 Ensure that all data from the network are appropriately archived; and

3.5 Liaise and co-operate with other operators of Antarctic buoys and *in-situ* data collection platforms..

4 Observation Programme

4.1 Operational Area:

The operational area of the Programme includes that region of the Southern Ocean and Antarctic marginal seas within the maximum seasonal sea ice extent (see Figure E1).

4.2 Variables:

Position, air pressure and (for those buoys in water) sea surface temperature will be collected as basic data. Some systems will be equipped to additionally measure other parameters such as air temperature, ice and/or snow temperature atmospheric pressure tendency, wind speed and direction, snow and sea ice properties, and oceanographic variables.

4.3 Basic Network Density:

Requirements stated by international environmental programmes (in particular, by WCRP, WWW, GLOCHANT, FROST) are for a basic network with observational points spaced at about 500 km. It is the aim of IPAB to have sufficient buoy deployments to achieve and maintain this density over the operational area.

4.4 Duration of Programme:

The programme is proposed as a long-term ongoing one. After a five year initial phase (1994/95 - 1999/2000) subsequent development will be as agreed by the Participants.

5 Data Distribution

5.1 Transmitters:

All buoys in the basic network will be equipped with transmitters to enable basic meteorological data to be transmitted in real time (synoptic and asynoptic mode). As a preferred approach, data will be collected and located via CLS - Service Argos using the TIROS-N series of satellites or their replacement.

5.2 Coding:

Data will be coded in a form suitable for extraction of basic meteorological parameters. Participants will provide CLS - Service Argos, and the IPAB Coordinator, with necessary information to decode these data.

5.3 Global Telecommunications System:

Data will be inserted by CLS Argos to the Global Telecommunication System (GTS). Data collected by Participants by other means may also be inserted into the GTS.

6 Data Archiving

6.1 Operational Archiving

All basic data transmitted on the GTS will be archived by the Marine Environmental Data Service (MEDS) in Canada, as the IOC/WMO Responsible National Oceanographic Data Centre for drifting buoy data.

6.2 Research Data Base:

A uniform, quality-controlled data base for ice motion and surface meteorology and oceanography, as required by the Antarctic research community, will be established. Periodically this data base will be submitted to appropriate data centres for archiving (in particular, to MEDS and WDC-A for Glaciology).

7 Management Structure

7.1 Participants:

Participants in the International Program for Antarctic Buoys will be national Antarctic programme agencies, meteorological and oceanographic institutes, research and operational agencies, and non-governmental organisations who are interested in Antarctic sea ice zone studies and who contribute actively to the Programme. Participants will indicate their involvement in the Programme by means of a Letter of Intent (Annex E1).

7.2 Management:

The Programme will be coordinated by the Participants. The Participants will arrange for the implementation of the Programme within the framework of the stated objectives. On a bi-annual basis the Participants will elect a Chairman and Vice-Chairman and appoint a Coordinator. The Chairman and Vice Chairman plus two other elected persons from the Participants shall form the Executive Committee.

Elections shall be decided by a simple majority provided that a quorum of Participants is present. A quorum shall consist of at least fifty percent of Participants. In case a quorum is not present, at a bi-annual meeting of Participants, elections shall be decided by unanimous vote.

A Participant who is unable to attend the bi-annual meeting may register a proxy vote delivered by an attending Participant if such authority is signified in writing to the Chairman.

7.3 Executive Committee:

7.3 Executive Committee:

The Executive Committee will be responsible for the management of the programme within the guidelines set at the bi-annual meeting of Participants, and will provide guidance and support to the Coordinator. The Executive Committee will share responsibility with the Coordinator for encouraging participation in the IPAB, and in liasing with Principal Investigators of individual buoy programmes and with International Scientific Organisations. During intersessional periods however, the Coordinator will act as the focal point for matters related to the operation of the Programme .

7.4 Coordinator:

Specific responsibilities and duties of the Coordinator are contained in Annex E2, Terms of Reference for the Coordinator of the International Programme for Antarctic Buoys.

7.5 Funding Provisions:

The Programme will be self sustaining, supported by contributions in the form of equipment, services (such as communications, deployment, archiving, coordination, scientific or technical advice) or monetary contributions. As necessary, the Participants shall establish a budget and make appropriate provisions for the management of this budget in order to implement the Programme. Other funding arrangements made between Participants will be recognised as contributions to the IPAB if they further the objective of the Programme.

7.6 Programme Review:

The management structure and operation of the Programme shall be reviewed at the bi-annual meeting of Participants.

8 Meetings

A bi-annual meeting of the Participants will be held at a time and location to be determined by them.

Figure E1 **The Antarctic sea ice zone, showing the maximum seasonal sea ice extent.**

Appendix E
Annex E1

Suggested form of Letter of Intent

Dear Colleague:

I propose that our agency will participate in the WCRP International Programme for Antarctic Buoys to pursue the maintenance of a network of data platforms within the Antarctic sea ice zone.

This participation is regulated by the terms of the Operating Principles of the IPAB and other terms attached to this letter.

I expect that our Agency's contribution to the Programme will take the form of .....* during the first year of our participation, and .....* in subsequent years.

The contribution is made with the understanding that it be applied to the objectives of the Programme.

Yours faithfully

---

* Please specify likely Agency contribution to the Programme. Contributions might take the form of:

- data buoys (detail probable number and parameters measured) and associated data acquisition and processing charges,
- monetary contribution
- logistic support for deployment,
- data communication services,
- data archiving,
- scientific or technical advice,
- etc.

Appendix E
Annex E2

Terms of Reference for the Coordinator of the WCRP International Programme for Antarctic Buoys

The Coordinator shall facilitate the implementation of the WCRP International Programme for Antarctic Buoys. The Coordinator will be appointed at the bi-annual meeting of the Participants and will be directed by the Executive Committee. Specific responsibilities include:

1) monitor and receive appropriate Argos and non-Argos data from the buoy network and prepare bi-monthly status report of buoy positions;

2) coordinate with operators of non-Argos buoy programmes and other field operations;

3) liaise with Principal Investigators and managers of individual buoy programmes in the Antarctic sea ice zone**;

4) arrange for the establishment and maintenance of a research quality data base of ice motion and surface meteorological and atmospheric data from the buoy network, and regularly submit it to the appropriate Data Centres for archiving;

5) develop a deployment strategy to maintain an optimal buoy network in the Antarctic;

6) coordinate opportunities for buoy deployment;

7) liaise on technical aspects of buoy development;

8) prepare an annual summary of resources committed to the Programme;

9) liaise with Technical Coordinator of the WMO/IOC Data Buoy Cooperation Panel to ensure that Antarctic data are properly quality controlled and distributed over GTS;

10) arrange for the purchase of buoys and ancillary equipment, and for the payment of expenses for Argos data acquisition and Argos processing fees, as authorised;

12) prepare and distribute an annual data summary;

13) maintain a distribution list for bi-monthly status reports and annual data summaries;

14) respond to requests from WCRP, WMO, and the Scientific Committee on Antarctic Research (SCAR) for technical and scientific information on the programme**;

15) prepare and distribute a semi-annual newsletter of activities and plans;

16) organise the bi-annual meeting of Participants, present a report of the preceding 2 years' activities, and prepare a plan for the following 2 years;

17) promote the WCRP International Programme for Antarctic Buoys to potential participants**.

**The Executive Committee will share responsibility with the Coordinator in liasing with Principal Investigators of individual buoy programmes and with International Scientific Organisations, and for promoting the Programme..

Appendix F

List of original participants

Original participants are those agencies who indicated at the meeting, or by prior written notice, of their intent to become full Participants, as defined in the operating principles, within the next three months. The original participants are listed.

Organisation	Possible contribution*
Alfred Wegener Institut, Germany	a, b
Antarctic Cooperative Research Centre, Australia	a
Arctic and Antarctic Research Institute of the Federal Service for Hydrometeorology and Environmental Monitoring, Russia	b, d
Australian Antarctic Division	a, b
CLS Argos, France	e
Hydrographical Dept., Maritime Safety Agency, Japan	a
Marine Environmental Data Service, Canada	c
National Ice Center, U.S.A.	e
National Institute of Polar Research, Japan	a, b
National Program for Antarctic Research, Italy	a, b
Polar Science Center, U. Washington, U.S.A.	a
Scott Polar Research Institute, UK.	a
South African Weather Bureau	a, b
University of Helsinki, Finland	a
World Data Center A for Glaciology, U.S.A.	c

* Possible contribution:

- a Data buoys
- b Logistic support for deployment
- c Data archiving
- d Scientific advice
- e Other

Appendix G

General principles of data archiving for the WCRP International Program for Antarctic Buoys.

As outlined in the Operating Principles of the IPAB, data from the network will be archived in two data streams: an operational data archive, and a research data base.

Operational Archive:

The operational archive will include all basic data from the programme transmitted in real-time on the GTS. Participants should ensure as far as possible that all platforms deployed for the programme are issued with an WMO ID number, and that data is inserted to the GTS. These data will be archived routinely by the Marine Environmental Data Service (MEDS) in Canada, as the IOC/WMO Responsible National Oceanographic Data Centre for drifting buoy data. The DBCP Technical Coordinator will assist IPAB investigators in getting their data on to the GTS.

Research Data Base:

A uniform, quality-controlled data base for ice motion and surface meteorology and oceanography, as required by the Antarctic research community, will also be established. The Programme Coordinator will be responsible for maintenance of this data set at a designated data assembly centre.

This data set will take the form of time series, for each platform, of data from all available sensors and for all valid transmissions from the platform. The set should be established to include all data from buoys deployed after the inaugural IPAB meeting: available data from earlier buoy deployments should be retrospectively included in the data set. Consideration needs to be given to including a flag indicating whether the platform is in ice or open water at each observation time. Data will be input to the data set directly from the Argos files, and participants should issue the appropriate authority for the Coordinator to obtain the monthly 'Dispose' format files for their platforms from CLS Argos. Participants should also provide the Coordinator with all necessary information to decode the data, information on the buoy and sensor characteristics, and notification of any change in sensor status.

A meta data base, containing information on buoy characteristics and history, will be established and maintained for each platform.

A data summary containing daily values of position at 00 Z (interpolated by spline), daily mean drift velocity, interpolated air pressure at 00 Z and 12 Z, and daily mean air temperature and ice/water temperature (the average of interpolated 3-hourly values) will be generated from the primary data set. Monthly mean values of these variables will also be derived. These data will form the basis of the annual data summary produced by the Coordinator. The annual data summary might also include mean monthly pressure fields generated by one of the numerical meteorological centres.

All research data base products will be periodically submitted to appropriate data centres for archiving and public access (in particular, to MEDS and to WDC-A for Glaciology). No data will however be released to the data archiving agencies, or publicly disseminated by the Coordinator,

until at least 6 months after collection. Participants may request the Coordinator to withhold data dissemination for a longer period, up to a maximum of 2 years, or to exclude inclusion of data from specific additional sensors in the research data base.