Minutes of the
Tenth Annual Meeting of the Participants of the
INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)
International Arctic Research Center
University of Alaska Fairbanks
Fairbanks, Alaska, USA, 26 - 28 June, 2000

1.0 Opening of the Meeting

The tenth annual meeting of the Participants of the IABP opened at 9:00 on June 26, 2000 at the International Arctic Research Center (IARC), University of Alaska Fairbanks, USA. This meeting was held concurrently with the biennial meeting of the International Programme for Antarctic Buoys (IPAB). The Chairman of the IABP, Tim Goos (TG), called the meeting to order. Syun-Ichi Akasofu, the Director of IARC, welcomed the IABP and IPAB attendees and stressed the importance of the buoy data for validation of climate models. Roger Colony provided logistic information for the meeting, and offered a tour or the Alaska SAR Facility (ASF) and IARC. The list of IABP and IPAB attendees is attached (Attachment 1).

2.0 Agenda Approval

The draft of the agenda was presented. Ignatius Rigor (IR) mentioned that the agenda item "Review and Approval of the IABP Operating Principles" was moved to later in the meeting pending discussions during the meeting and the joint sessions with IPAB. The draft was reviewed, amended and approved (Attachment 2).

3.0 Review of the action items from the 9th Annual Meeting of the Participants of the IABP, 1999.

As decided at the last meeting, the minutes from that meeting were finalized a few months after that meeting and are available from the IABP web server. IR and TG noted that there were 4 action items from that meeting, which have been resolved as follows:

3.1 The terms of Reference for the Coordinator in the IABP Operating Principles were amended to state in item 15 that the Coordinator will "maintain a web page that promotes the IABP, provides access to the IABP datasets, and provides news and information to the Participants and general community."

3.2 A business item for the current meeting will be to discuss provisions for withdrawal from the IABP. This item was included in the Agenda as item 8.1.

3.3 Victor Savtchenko (VS) suggested adopting an International Programme for Antarctic Buoys (IPAB) practice of producing a "Contributions Page." A draft of the IABP Participant Contributions List has been distributed, and IR asked each Participant to review this list and make comments to the Coordinator for the final version, which will be included in the final minutes of this meeting and placed on our web pages. Please refer to section 8.1 of these minutes for the

decisions of the participants (The Participants Contributions table is given in attachment 6).

3.4 A discussion of the status of the UKMO as an IABP Participant was noted for item 6.0 of the Agenda, "Status of Membership and Letters of Intent."

4.0 Coordinator's Report

IR reported on: 1.) the developments in the buoy array during the past year, 2.) deployment plans for the year, 3.) improvements to the IABP Web pages, 4.) CDROMs, and on 5.) the progress of publications related to the IABP.

On our last meeting, 25 buoys were reporting in the Arctic. Since then, 13 buoys ceased transmitting, and 21 buoys were deployed:

- 7 by WHITE TRIDENT (ICEX-AIRS contributed by AWI, EC, NIC, NPI, UKMO) in August 1999.
- 2 by AARI/NAVO in Spring 2000.
- 5 by EC (2 EC, 2 NIC/CES, 1 Calib) in Spring 2000.
- 7 by PSC (1 JAMSTEC, 2 AWI, 2 PMEL, 2 CRREL) in Spring 2000.

The current map shows 33 buoys. A map of the planned deployments was shown. A list of other deployment opportunities was also shown.

It was noted that the Beaufort and the North Pole (NP) was saturated with buoys, but a big hole in the array exists in the East Arctic. VS also stated a need found by the WCRP ACSYS SSG to deploy buoys in the Marginal Seas of the Arctic Ocean. It was decided that the need to discuss strategies for deployment in the East Arctic and the Marginal Seas will be added to the Agenda as item11.2.

Ed Hudson (ETH) noted that the "AARI" buoys on the Buoy table have been listed as "NAVO." EH also asked if variations of the buoy maps could be made regularly. IR agreed to use different symbols on the buoy map for buoys with Pressure and Temperature sensors, and will make special maps when requested.

The IABP web server is currently visited by 1000 different users each month. A number of new web pages have been added, most notably: 1.) a page collecting all of the ocean buoy data, 2.) a page summarizing the last 20 years of buoy data which will be updated regularly, 3.) a page of animations of the buoy data, and 4.) a page of "News" on the IABP. IR requests that the Coordinator be notified of any news items that are related to the IABP so the web pages can be updated.

IR also reported that the IABP SAT and ice motion fields will be on the EWG Arctic Ocean Meteorology and Sea Ice digital atlases. A CD on Animations of the buoy data is in preparation with IARC. RC reported that the intention for this CD is to make a product that could be use to as a teaching aid to study air, sea and ice interaction.

A draft of the 1999 buoy report and reprints of the recent J. Climate paper on "Variations in SAT" were made available.

The powerpoint presentation of this report is available on the web (Reports\Coord.ppt).

5.0 Report from Data Buoy Co-operation Panel (DBCP)

The full report of the DBCP is given in attachment 4.

6.0 Status Report on the Membership and Letters of Intent

IR reported that the IABP currently has 26 Participants, from 10 different countries and 1 international organization. The IABP has a new member, IARC, who will be represented by Roger Colony.

IR noted that the UKMO was not represented at the meeting. It was decided that Elizabeth Horton (EH) would contact Wynn Jones to discuss their intentions.

The list of IABP Participants is given in attachment 5.

7.0 Status Report from each Participant

7.1 World Climate Research Programme (VS)

The ACSYS SSG-VIII (Louvain-la-Neuve, Belgium, 15-19 November 1999) underlined that the International Arctic Buoy Programme (IABP) was the mainstay of the ACSYS sea-ice motion climatology. The Group noted that the IABP was focused on the perennial pack of the Arctic Basin. With its present deployment strategy, it provides little ice-drift information for the seasonal sea-ice zone that constitutes more than half of the ice cover of the Northern Hemisphere. The Group, therefore:
(i) encouraged continued efforts under IABP and, though recognizing EEZ sensitivities, consideration of extension of buoy network to marginal seas (e.g. Chukchi Sea, Baffin Bay, Sea of Okhotsk, etc); and
(ii) recognizing that its main rationale for implementation is for operations, emphasized the importance of the IABP network for both operations and climate, and so its relevance to the GCOS.

At its recent session in Tokyo, Japan (March 2000) the Joint Scientific Committee (JSC) for the World Climate Research Programme (WCRP) recommended that a Climate and Cryosphere (CLIC) project be established as a major scientific component of WCRP. A CLIC Science and Co-ordination Plan (version 1.0) is available at WCRP Arctic Climate System Study (ACSYS) home pages. It may be downloaded from the following web site:
ftp://scott.npolar.no/Out/acsys

An ACSYS Implementation and Achievements document is also available electronically at the following ACSYS web site:
http://www.npolar.no/acsys/impplan/index.htm
To lead the implementation of both ACSYS and CLIC projects, the JSC-XXI has established an ACSYS/CLIC Scientific Steering Group (SSG) chaired by Dr H. Cattle (United Kingdom).

7.2 Environment Canada (ETH)

The full report of the DBCP is given in attachment 7.

7.3 Polar Science Center (IR)

The primary contribution of the PSC to the IABP is the Coordination and Data Management of the IABP. Please see the Coordinator's Report, section 4.0 of these minutes.

This year the North Pole Environmental Observatory (NPEO), which IR will report on during the Technical Sessions, deployed 7 buoys for the IABP. This is a 4+ year project funded by NSF, the observations for the IABP at the North Pole will be covered by this project for the foreseeable future, and will be an deployment opportunity for the IABP.

7.4 Foundation Alfred Wegener Institute for Polar and Marine Research (AWI, C. Haas, CH)

In 1999, AWI contributed 2 ICEXAIR buoys to the White Trident program, both deployed in the eastern Sibirian Sea. The buoys are still operating, as of 12 July, 2000, at positions 84.089N, 163.883E and 77.748N, 169.982E. No buoys were deployed by ship because of inappropriate cruises of RVIB Polarstern to the Arctic Ocean.

In 2000, two sea ice drifters (Sellmann&Kruse GbR) were deployed near the pole at 90W as part of the North Pole Environmental Observatory of the Polar Science Center, University of Washington.
We would like to emphasize again that RVIB Polarstern is available for use by IABP participants for buoy deployment. NIC (C. O'Conners) accepted this offer by providing one Coastal Environmental Buoy, to be deployed next year in the central Arctic Ocean (see attached cruise map).

7.5 NIC (C. O'Connors)

In 1999-2000, the U.S. Interagency Arctic Buoy Program (USIABP) received fiscal support, manpower resources, and other services from seven U.S. Government agencies. Presently, the USIABP has eleven buoys operating in the buoy network covering the central Arctic Basin and/or adjoining seas. This

number includes seven Coastal Environmental System (CES) buoys, three Christian Michelsen Research (CMR) ICEXAIR buoys and one MetOcean buoy.

During the past year, the U.S. Navy provided aerial assets and funding for the annual White Trident deployment exercise. All ICEXAIR buoys deployed by White Trident were provided through the cooperative procurements of IABP Participants. Other USIABP activities and IABP contributions included:

1. Continued funding for the IABP Coordinator / Data Management function.
2. Data processing costs for a U.K. Meteorological Office ICEXAIR buoy.
3. Management for the NICOP / U.S. Navy funded Russian buoy development program.
4. Support 1999 Arctic Research activities including the U.S. Navy Submarine Science mission (SCICEX).

Anticipated 2000 USIABP activities include:

1. U.S. Navy Science deployment.
2. Coordination of the 2000 White Trident deployment.
3. Coastal Environmental buoy sent to AWI for deployment opportunity.
4. Discussions with CRREL on buoy engineering support and modifications.
5. Management for the NICOP / U.S. Navy funded Russian buoy development program.

7.6 Marine Environmental Data Service (MEDS , E. Coutoure)

The Marine Environmental Data Service (MEDS), Canada, continues to capture, conduct preliminary quality control and archive the data from GTS as part of its mandate as the Responsible National Oceanographic Data Center (RNODC) for drifting buoys. Statistics from the area north of 66ºN were presented.

MEDS new web site (http://www.meds-sdmm.dfo-mpo.gc.ca) was briefly presented to the participants. MEDS converted the yearly annual report of the RNODC to electronic form, which is now available on-line at http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Int/RNODC/RNODC_e.html . These web pages show monthly statistics of the number of messages received though the GTS and statistics on the number of buoys reporting on the GTS, monthly maps of drifting buoy tracks and monthly tabular inventories of all data received at MEDS. This information is displayed for each individual action group as well as for the whole world. MEDS will enhance the maps of the drifting buoy tracks by providing more information on each of these tracks such as WMO number, ARGOS ID, etc...

MEDS produced a CD of 20 years of drifting buoy data for the area North of 66oN.

7.7 Japan Marine Science and Technology (JAMSTEC, T. Kikuchi)

JAMSTEC have been developing a new drifting buoy, J-CAD (JAMSTEC Compact Arctic Drifter), in order to monitor the change of the Arctic Ocean. J-CAD has oceanographic and meteorological sensors, especially ADCP (Acoustic Doppler Current Profiler) that can measure ocean current structure. Using ORBCOMM satellite communication system, J-CAD reports real-time and *in-situ* oceanographic and meteorological data to our laboratory. In 2000 JAMSTEC have two deployment opportunities of J-CAD. J-CAD 1 has been installed near the North Pole on 24th April 2000, as a component of North Pole Environmental Observatory. The real-time data of J-CAD is provided on our web site (URL, http://w3.jamstec.go.jp:8338). J-CAD 2 will be installed in the Beaufort Sea by helicopter operation in the 2000 Arctic cruise of CCGS Sir Wilfred Laurier.

7.8 Norwegian Polar Institute (NPI, T. Løyning)

The intention of the NPI is to keep one buoy operative in the Polar Ocean. The buoy that was deployed on behalf of the NPI in 1998 is still operative, and no buoys were deployed in 1999.

The Norwegian Ministry of Environment, other political agencies and the Norwegian Research Council, seems to have changed their views on long time series and monitoring. They have realized that in order to get information about the state of the Arctic environment as a basis for proper environmental management decisions, the need for long time series is huge. The future Norwegian support of the IABP project looks therefore prospective.

7.9 CMR (T. Kvinge)

7.10 NMI (T. Loyning)

7.11 ROSHYDROMET / AARI

In the period between 9-th and 10-th IABP business meetings AARI of Roshydromet have completed the following IABP tasks have been done:

1. Two NAVOCEANO experts have visited AARI in December 1999 for modernization of the LUT software including "Year 2000 problem" elimination
2. Four so called "fixed buoy" conception have been developed and construction for 4 of them have been done
3. Two drifting buoys for Arctic ocean have been constructed
4. In April, 2000 two these buoys have been deployed during Arctic and Antarctic museum expedition to the North Pole
5. In May, 2000 three of four "fixed buoys" have been installed on Cape Arctichesky, Ushakov and Uedinenia Islands. The fourth, on Zhochov Island in August planned for installation

6. As a continuation of the digital Arctic ocean atlases series - The Arctic ocean meteorology atlas have been issued under EWG of US-Russian Joint Commission on economical and technological cooperation activities
7. In cooperation with IARC Frontier Program the Project, aimed to produce historical data sets and objective analysis fields for Arctic ocean hydrochemistry is under work now
8. Under the same Cooperation the Project, aimed to collect 1930-th Arctic warming evidences is also carrying now.
9. The Items 1-3 done under financial support of US-Interagency Arctic Buoys Program.

7.12 International Arctic Research Center (IARC, R. Colony)

7.13 Argos

7.14 NAVO

During the intersessional period, the Naval Oceanographic Office (NAVOCEANO) deployed 7 ICEX-AIR drifters for IABP member nations at locations provided by the IABP technical coordinator, in addition to drifters supporting a Commander-In-Charge, Atlantic Fleet requirement and for the European Group on Ocean Stations (EGOS) in August. NAVOCEANO also provided funding to the Arctic and Antarctic Research Institute (AARI)for 2 drifting ice buoys and 4 ice weather stations which have been deployed by icebreaker in the same locations as the original Russian ice station network in the Arctic in order to provide continuity of data collection. NAVOCEANO was especially pleased to be contacted by DBCP members regarding a monument erected by the Dutch on Novaya Zemlya in memory of Dutch sailors who ship-wrecked there 400 years ago in their quest to find a northwest passage to the Far East. AARI coordinated with the Russian government on behalf of the Ukraine and the Netherlands to install one of the weather stations funded by NAVOCEANO at the Dutch monument.

Last year's WHITE TRIDENT deployment was completed without incident. Coordination at the ICEX-AIR pick-up site at Patunxent River, Maryland, was excellent. It took less than an hour to load the buoys onto the aircraft, so that the crew could maintain a tight schedule. The only difficulty occurred at the drop locations south of 77N. NAVOCEANO's representative reports that south of 77N in August, the surface is obscured by a thick blanket of ice fog. The aircraft descends as low as possible to check for open water, in order to avoid deploying through a hole in the ice, but in most cases, it is impossible to see the surface. NAVOCEANO appreciates the assistance provided by the technical coordinator and Environment Canada for providing updates on ice conditions, and hopes that this support will continue in the future.

8.0 New Business

8.1 Provisions for withdrawal from the IABP (T. Goos)

8.2 Maintaining WHITE TRIDENT (I. Rigor)

IR thanked the U.S. Navy for deploying buoys for the IABP during the WHITE TRIDENT flights each year. He also thanked the Participants who have contributed to buoys for this deployment (AWI, EC, JAMSTEC, NPI, NMI, UKMO, and US-IABP).

The buoy deployed by these flights account for more than half of the data currently collected by the IABP, thus providing buoys to maintain this opportunity is crucial to the success of the IABP. A minimum of 7 buoys are needed each year.

The figures IR showed are available on the web at (WTpitch.ppt).

8.3 Reports and Representation at the DBCP Annual Meeting (E. Horton)

The IABP was represented at the 15th DBCP meeting by E. Horton. The full text of our report is given in attachment 8.

8.4 IABP Poster and Brochure (E. Hudson)

8.5 DBCP 16 in Victoria, B.C., Canada, on 16-17 October 2000 (T. Goos)

TG and IR will represent the IABP at this meeting.

8.6 Location of 11th meeting (T. Goos)

TK and VS reexpressed the invitations to Japan and Geneva respectively. The Executive Committee will discuss these options during the intersessional period and will notify the Participants and prospective hosts.

8.7 Review Participant Contributions (T. Goos)

Contributions will be tabulated for the past 3 intercessional periods. Planned contributions for the following intercessional period will also be tabulated.

Contributions further the objectives of the IABP and are defined in the Operating Principles of the IABP, section 6.5.

The Participants Contributions table is given in attachment 3

9.0 Joint IPAB and IABP Session

9.1 Status Reports from each Programme

9.1.1 IPAB (I. Allison)

9.1.2 IABP (I. Rigor)

The powerpoint presentation of this report is available on the web (IABP-Status.ppt).

9.1.3 CLIC (I. Allison)

9.2 Joint IPAB and IABP Technical Session

9.2.1 JCAD buoy (T. Kikuchi)

Changes of the Arctic Ocean and its impacts on the global climate system are important issues. In order to understand the on-going changes and their mechanism, sustained observations with large spatial coverage in all seasons should be required. Buoy observation is effective method to accomplish these purposes, especially in the multiyear ice region where the underlying oceanographic circulation and its influence on the surface heat budget between atmosphere and ocean. JAMSTEC and WHOI conducted buoy observation in the Arctic Ocean using Ice-Ocean Environmental Buoy (IOEB) consisting of meteorological, ice, ocean sensors. From the IOEB observations, spatial distributions of the summer shelf water in the Canadian Basin have been clarified. The acoustic doppler current profiler (ADCP) mounted on the IOEB measured the eddies and their characteristics.

Based on the experience of IOEB, JAMSTEC began development of a new drifting buoy for the Arctic multiyear ice zone in 1999, in collaboration with METOCEAN Data Systems Limited. The new drifting buoy is named J-CAD, JAMSTEC Compact Arctic Drifter. The J-CAD consists with oceanographic sensors (CT sensor (Sea-Bird SBE-37IM) and ADCP (RDInstruments WHM 300)), meteorological sensors, system controller (monitoring system for buoy condition, CPU, and power supply), data communication system, and platform. The oceanographic data are sent to CPU via "Inductive Coupling Modem (ICM)" system. The data processed by the CPU are transmitted through the ORBCOMM satellite communication system to our laboratory. Also we can send commands from the laboratory to the J-CAD using the ORBCOMM satellite "communication" system. The small weight and size make us possible to have quick installation. Real-time and *in-situ* oceanographic and meteorological data can be obtained from the Arctic multiyear ice zone via satellite.

In April 2000, we installed J-CAD 1 near the North Pole (89.683 ^{o}N 130.333 ^{o}W), as a component of the North Pole Environmental Observatory (NPEO). The installation of J-CAD 1 was completed on a multiyear ice with a thickness of about 2.6 meters within a day. Recent buoy position is 87.500^{o}N 2.167^{o}W at 0:00 (GMT) 23rd June 2000. J-CAD 1 is now moving to the Fram Strait. The real-time data of J-CAD is provided on our web site (URL, http://w3.jamstec.go.jp:8338). The installation of the second J-CAD is scheduled in the Eastern Beaufort Sea from the Canadian Coast Guard Ice-breaker, Sir Wilfred Laurier, in September 2000.

In order to monitor the change of the Arctic Ocean, the simultaneous buoy observation should be required in the two major basins of the Arctic Ocean, i.e., the Eurasian Basin and the Canadian Basin. We have started a long-term monitoring using J-CAD in the Eurasian Basin as a component of NPEO. In the Canadian Basin, we are planning to maintain J-CAD observation in collaboration with Canadian scientists. There still remains uncovered region by J-CAD observation such as the Eastern Arctic Ocean, i.e., Laptev and Eastern Siberian Seas. We need both scientific collaborations and logistic supports to install J-CADs in these regions.

9.2.2 ICEX buoy (T. Kvinge)

9.2.3 IABP and Arctic Drifting Buoy data CD (E. Couture)

MEDS produced a CD that includes IABP interpolated data sets (1979-1999), data sets that have not been interpolated (1979-1999), ocean buoy data (1985-1994), Arctic Surface Velocity Program Krig data (1991-1999), related products and documentation, and finally, IABP documents such as programme description, meeting reports, data reports and buoy diagrams. The CD will be ready for distribution in September 2000.

9.2.4 IPAB buoy development (M. Doble)

9.2.5 Twenty Year Review of IABP data. (I. Rigor)

The International Arctic Buoy Programme has maintained a network of drifting buoy in the Arctic Basin since 1979. These buoys measure sea level pressure (SLP), surface air temperature (SAT), and other geophysical quantities. Ice Motion can be estimated from positions taken by the Argos satellite system. Over twenty years of buoy data have been collected. We present the climatology of SLP, SAT, and ice motion, as well as show how the data vary seasonally and

interannually. Finally we show how the changes in the data are related to changes noted in the Arctic Oscillation.

9.2.6 North Pole Environmental Observatory. (I. Rigor)

The NPEO is an international, collaborative effort between PSC, PMEL, JAMSTEC, and OSU funded by NSF. It is a long term project designed to study the changes in Arctic Climate.

The projects hopes to measure just about everything from ocean salinity to ice thickness and meteorology. This year the project deployed 5 buoys at the pole and deployed 2 AWI buoys for the IABP.

Some results have already started flowing in:

- The onset of melt began on julian day 165, a week earlier than the climatology from the IABP.
- The ocean temperatures show that the Atlantic warm water core over the Lomonosov Ridge is still warmer than climatology, the temperature maximum during the 90s has moved a little deeper, and the water below 500 m is warmer than we have ever seen it before.

10.0 New Directions

10.1 Things we learned from IPAB (T. Goos)

Christian Hass (CH) noted that the problems that IPAB has in the Antarctic are similar to the problems that IABP would have in deploying buoys in the marginal ice zones (MIZ).

RC reminded the group that much of the ice that is not fast, quickly drifts into the central Arctic basin. In terms of meteorology, this fast ice is close to the coastal met. stations and thus additional observations are not necessary. RC believes that measurement of sea ice motion in the MIZ can be better estimated from satellites. The IABP shares this opinion and recommends the ACSYS SSG investigate the derivation of ice motion for the Marginal Seas from satellite data.

VS asked about the domain of the IABP, do we wish to extend this domain to such areas like the Bering Sea or the Sea of Okhotsk. RC reminded the group that our domain of interest as stated in the Operating Principles is the Arctic Ocean and its Marginal Seas. If a need to monitor meteorology in these adjacent seas is found, then the IABP may consider extending its domain of interest.

VS suggested that the Chairman name a representative of the IABP to attend the first meeting of the ACSYS/CLIC SSG in October 23 - 27, 2000 in Kiel, Germany. RC agreed to represent the IABP at this meeting.

VS initiated a discussion of the contribution of the IABP to goals of GCOS/GOOS/JCOMM and asked what the group wished to do in terms of long term climate monitoring. VS suggested that the IABP amend their Operating Principles to included support of these programs. RC reminded the group that GCOS/GOOS has not clearly indicated interest to the IABP. EH asked what would change in the way the IABP operates if we changed our Operating Principles. CH and EH asked what does "monitoring" mean for GCOS/GOOS/JCOMM. Is not this something that we already do? RC noted that GCOS/GOOS has not approached the IABP for support suggested that if these groups did, then we should reconsider this issue.
Until the IABP understands the needs of GCOS/GOOS/JCOMM

VS asked if we found that a joint meeting with IPAB was beneficial. The IABP found the joint session valuable. EH noted that another option to having joint meetings would be to have the Chairman or Coordinator of both programmes attend each other's meetings. This would also facilitate the exchange of knowledge. It was agreed that we would invite the Chairman and Coordinator of the IPAB to our annual meetings and welcome joint meetings in the future.

RC recalled that this question may also be restated as "should we merge with IPAB?" Pros: more opportunities from NSF. VS noted that IPAB is a primarily research driven group, unlike the IABP which is a mix of operations and research, and the IPAB has different concerns in order to monitor the Antarctic. He suggested not to merge the two groups.

Torgny Vinje asked if we could amend the Operating Principles to clearly state that observations from coastal stations were part of our mandate. Operating Principle 2.1 was already amended to include coastal stations.

10.2 Deployment strategies in the East Arctic and MIZ

Buoy costs: ICEX $13K, S&K (AWI) $9K, CES $10K, JCAD $300K, AARI $8-10K. Manufacturers of buoys were advised to send their information to the Technical Coordinator of the DBCP.

How can we take advantage of the Polarstern? CH noted that AWI will deploy 2 buoys, and has talked to TK about possibly deploying a JCAD. CO also noted that NIC has sent a CES to AWI, which could be available for the fall 2001 cruise. It should be noted that buoy deployments are not the highest priority of this cruise.

SP noted that the Laptev Sea is in the economic zone of Russia. He noted that the Federov will be in the area north of the East Siberian Sea and may be an opportunity to deploy buoys. CH and CO will check into the possibility of deploying buoys using this asset.

SP noted that there would also be opportunities to deploy buoys in the East Arctic during spring 2001.

11.0 Election of Officers

A nominations committee consisting of EH and IR determined that each member of the Executive Committee was willing to serve another year. They therefore nominated them to their current positions. Nominations were solicited from other attendees.

In accordance with the IABP Operating Principles, the following officers were elected:

Chairman: Timothy Goos, Canada
Vice Chairman: Thor Kvinge, Norway
Member: David Benner, USA
Member: Ivan Frolov, Russian Federation

Ignatius Rigor was re-appointed as the Coordinator of the IABP.

12.0 Review and Approval of IABP Operating Principles

The IABP Operating Principles are given in Attachment 3.

13.0 Draft and Approve Meeting Minutes

Participants reviewed the summary report and approved the minutes pending final contributions.

Attachment 1

List of Attendees

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Attachment 2

Agenda
Tenth Annual Meeting of the Participants of the INTERNATIONAL ARCTIC BUOY PROGRAMME
International Arctic Research Center
Fairbanks, Alaska, 26 – 29, June, 2000

Monday, 26 June 2000

0900 - 1200 IABP Business Meeting

1.0 Meeting Opens -- Chairman, T. Goos

- 1.1 Welcome (R. Colony).
- 1.2 Call to order (T. Goos)
- 1.3 Meeting Information (R. Colony)

2.0 Agenda Approval (T. Goos)

3.0 Review Action Items from Ninth Meeting (T. Goos or I. Rigor)

4.0 Coordinator's Report (I. Rigor)

5.0 Report from Data Buoy Co-operation Panel (DBCP) (E. Horton)

6.0 Status Report on Membership and Letters of Intent (I. Rigor)

Monday, 26 June 2000

1300 - 1700 IABP Business Meeting (Continued)

7.0 Status Reports from each Participant (T. Goos)

8.0 New Business (T. Goos)

- 8.1 Provisions for withdrawal from the IABP (T. Goos)
- 8.2 Maintaining WHITE TRIDENT (I. Rigor)
- 8.3 Reports and Representation at the DBCP Annual Meeting (E. Horton)
- 8.4 IABP Poster and Brochure(E. Hudson)
- 8.5 DBCP 16 in Victoria, B.C., Canada, on 16-17 October 2000 (T. Goos)
- 8.6 Location of 11th meeting (T. Goos)
- 8.7 Review Participant Contributions (T. Goos)

Tuesday, 27 June 2000

0900 – 1200 Joint Session of IABP and IPAB

9.0 Status Reports from each Programme

- 9.1 IPAB (I. Allison)
- 9.2 IABP (I. Rigor)
- 9.3 CLIC (I. Allison)

10.0 Technical Session

- 10.1 JCAD buoy (T. Kikuchi)
- 10.2 ICEX buoy (T. Kvinge)
- 10.3 IABP CD (E. Couture)
- 10.4 IPAB buoy development (M. Doble)
- 10.5 Twenty Year Review of IABP data. (I. Rigor)
- 10.6 North Pole Environmental Observatory. (I. Rigor)

1300 - 1700 Joint Technical Session (Continued)

- 10.7 Tour of Alaska SAR Facility
- 10.8 Tour of IARC

Wednesday, 28 June 2000

0900 - 1200 IABP Business Meeting (Continued)

11.0 New Directions (T. Goos)

- 11.1 Things we learned from IPAB
- 11.2 Deployment strategies in the East Arctic and the MIZ

12.0 Review and Approval of the IABP Operating Principles (I. Rigor)

13.0 Election of Officers (T. Goos)

1300 - 1700 Conclusion

14.0 Draft and Approve Meeting Minutes

Attachment 3
INTERNATIONAL ARCTIC BUOY PROGRAMME

Operating principles
(Revised, June 1999)

1. Objective

   The objective of the International Arctic Buoy Programme (IABP) is to establish and maintain a network of data buoys in the Arctic Ocean to provide meteorological and oceanographic data for real-time operational requirements and research purposes, including support to the World Climate Research Programme (WCRP) and the World Weather Watch (WWW) Programme. The Programme will build upon cooperation among those agencies and institutions with arctic interests.

2. Programme Responsibilities

   The IABP will:

   2.1. Maintain an observational data network over the Arctic Ocean using data buoys;

   2.2. Distribute basic meteorological data (atmospheric pressure, air temperature) and buoy location from the network in real time over the Global Telecommunication System (GTS) and distribute relevant additional real-time data approved for public dissemination;

   2.3. Ensure data from the network are archived; and

   2.4. Cooperate with and provide results of the Programme to other related programmes.

3. Observation Programme

   3.1. Operational Area

   The operational area of the Programme will include the central Arctic ocean and its marginal seas, excluding economic zones except where agreements of the Coastal States have been obtained.

   3.2. Variables

   Basic meteorological variables will be measured. Additional variables such as atmospheric pressure tendency, wind speed and direction, snow, and sea-ice properties, as well as subsurface oceanographic characteristics are desirable.

   3.3. Basic Network Density

   The Programme will strive to establish and maintain a basic network with observational points no more than 500 kilometers apart. As far as practical, buoys will be deployed to achieve and maintain this density over the operational area.

4. Data Acquisition and Distribution

   4.1. Transmitters

   All buoys in the basic network will be equipped with transmitters to enable transmission of basic meteorological data in real time (synoptic and asynoptic

modes). The preferred approach is to collect and locate data via Service Argos using the TIROS N series of satellites or their replacements.

4.2. Coding

All basic meteorological data and buoy location will be coded in the approved WMO code for data buoys.

4.3. Global Telecommunication System

Data will be inserted by Service Argos into the Global Telecommunication System (GTS). Data collected by Participants by other means should be inserted into the GTS.

5. Data Archiving

5.1. Operational Archiving

All data transmitted on the GTS will be archived by the Marine Environmental Data Service (MEDS) as the Responsible National Oceanographic Data Centre (RNODC) for Data Buoys, on behalf of both the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO).

5.2. Research Data Base

A uniform, quality-controlled data base for ice motion and surface meteorology has been established for use by the Arctic research community. Periodically these data will be submitted to World Data Centre A (Glaciology), World Data Centre B (Sea-Ice), and to MEDS.

6. Management Structure

6.1. Participants

Participants in the IABP will be operational agencies; meteorological and oceanographic institutes; research agencies; data centres; and non-governmental organizations interested in the Arctic Ocean and contributing actively to the Programme. Participants will indicate their participation in the Programme by means of a Letter of Intent.

Participants may withdraw from the Programme with a letter to the Chairman of the IABP.

On an annual basis, the Participants will review the membership to identify potential new Participants and to re-affirm the intent of existing Participants.

6.2. Election of Programme Executives

The Programme will be coordinated by the Participants. The Participants will arrange for the implementation of the Programme within the framework of the Programme objective.

On an annual basis, the Participants will elect a Chair and Vice Chair and appoint a Programme Coordinator. The Chair, Vice Chair, and two representatives elected from the Participants will form the Executive Committee. Elections will be held at annual meetings of the Participants and will be decided by a simple majority if a quorum of Participants is present. A quorum will consist of at least nine Participants. If a quorum is not present at the annual meeting of Participants, elections will be by unanimous vote.

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

6.3. Executive Committee

The Executive Committee will be responsible for the day-to-day management of the Programme within the guidelines set at the annual meeting of Participants. The Executive Committee will provide guidance and direction to the Coordinator.

6.4. Coordinator

The Coordinator will act as the focal point for the Programme and will carry out the directives of the Executive Committee during intercessional periods. Specific responsibilities and duties of the Coordinator are contained in Appendix 1.

6.5. Funding Provisions

The Programme will be self sustaining, supported by contributions of equipment, services (such as communications, deployment, archiving, and scientific or technical advice), coordination, and monetary contributions. As necessary, the Participants will establish a budget to implement the Programme. Other funding arrangements made between the Participants will be recognized as contributions to the IABP if they further the Objective of the Programme.

6.6. Programme Review

The management structure and operation of the Programme will be reviewed at the annual meeting of Participants. The operating principles and procedures will be reviewed and updated as necessary at the annual meeting.

7. Meetings

An annual meeting of the Participants will be held at a location to be determined by the Participants.

APPENDIX 1 to

The International Arctic Buoy Programme (IABP) Operating Principles

Terms of Reference for the Coordinator of the IABP

The Coordinator will facilitate the implementation of the IABP. The Coordinator will be appointed at the annual meeting of the Participants and will be directed by the Executive Committee. The Coordinator's specific responsibilities will be as follows:

1. To monitor and receive appropriate Argos and non-Argos data from the buoy network and to prepare a monthly status report of buoys;
2. To stay informed of the activities of non-Argos buoy programmes and other field operations and to make those data available, as possible;
3. To liaise with Principal Investigators and managers of individual buoy programmes in the Arctic Ocean;
4. To arrange for the maintenance of a research quality data base of ice motion and surface meteorological data, and to submit through the World Data Centre A (Glaciology) to World Data Centre B (Sea-Ice) and MEDS;
5. To develop a deployment strategy to maintain an optimum buoy network in the Arctic;
6. To coordinate opportunities for buoy deployment;
7. To liaise on technical aspects of buoy deployment;
8. To prepare an annual summary of resources committed to the Programme;
9. To liaise with the Technical Coordinator of the Data Buoy Cooperation Panel to ensure that; a) the proper quality control of arctic data is maintained and; b) the data are distributed over GTS;
10. To arrange for the purchase of buoys and ancillary equipment, as authorized;
11. To arrange for the payment of Argos data acquisition and Argos processing fees, as authorized;
12. To prepare and distribute an annual data report;
13. To maintain a distribution list for monthly status reports and annual data reports;
14. To respond to requests from WMO, WCRP, and the International Arctic Science Committee (IASC) for reports on arctic climatology, global change, and advice on experiment design;
15. To maintain a web page that promotes the IABP, provides access to the IABP datasets, and provides news and information to the Participants and general community;
16. To organize the annual meeting of Participants, present a report of the preceding year's activities, and prepare a plan for the following year; and
17. To promote the IABP so as to attract potential Participants.

NOTE: Additional contractual duties of the Coordinator that may be required in the future will be approved through the Executive Committee.

Attachment 4

Report from the Data Buoy Cooperation Panel

DBCP current activities and highlights

Data Buoy Co-operation Panel
Current DBCP activities and highlights
August 2000

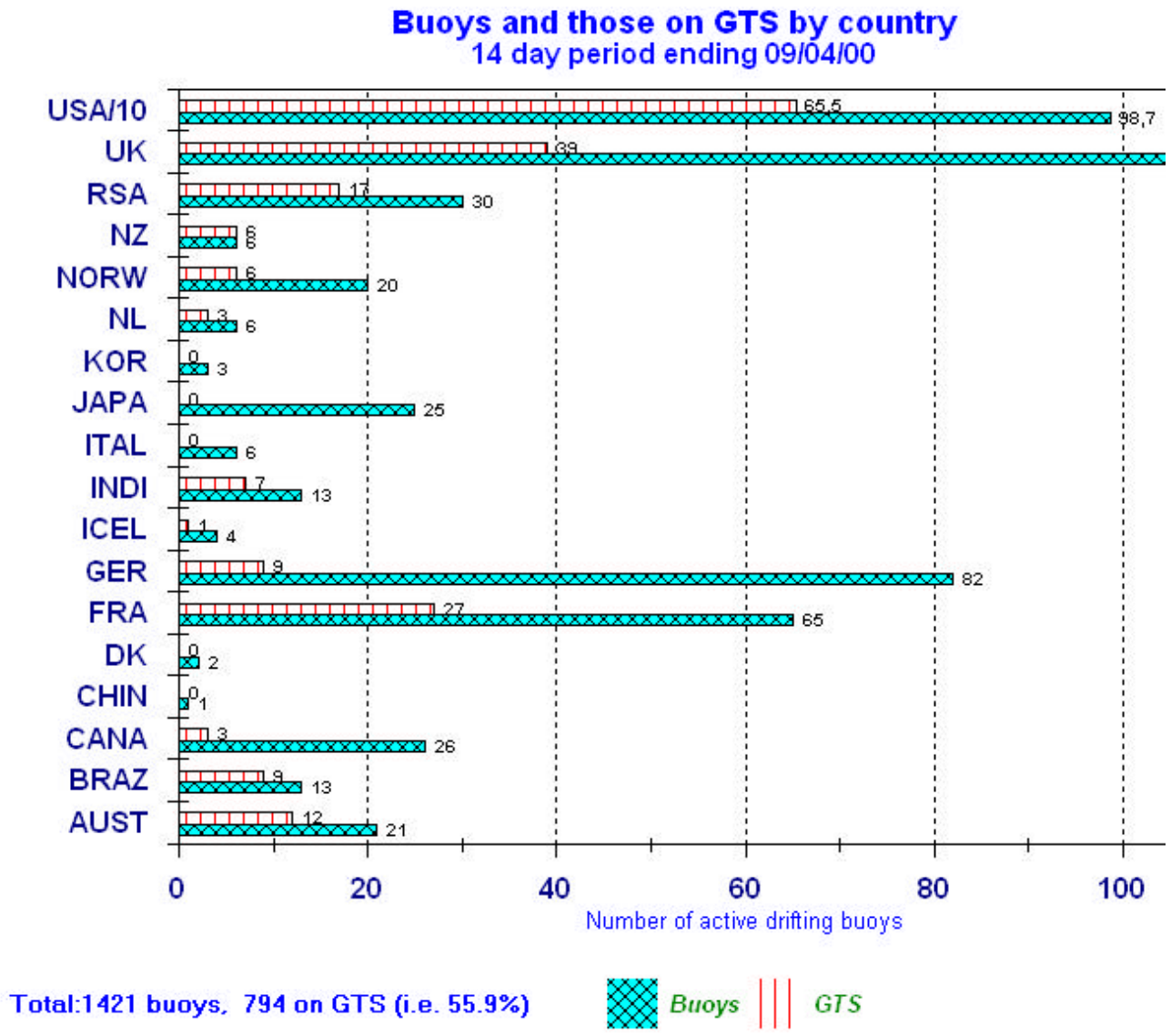
New:

- List of impact studies regarding data buoys
- Vandalism on data buoys
- BUOY, BUFR, and CREX codes issue
- Information on buoy deployment opportunities, including air deployment
- Metadata
- Argos GTS sub-system processing sub-surface float data
- Southern Hemisphere barometers
- Proposal for a JCOMM Observing Platform Support Centrer (JCOMMOPS)

Contents

- **Present status of buoy programmes**

Graph-1: Buoys and those on GTS by country:

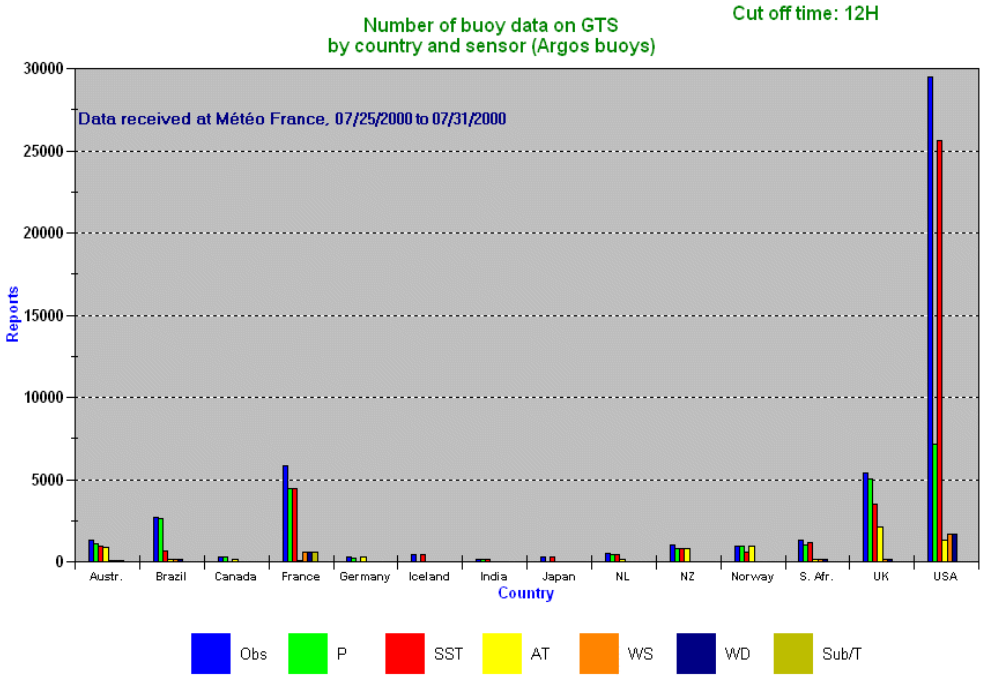


Among the drifting and moored buoys which are reporting on GTS, the following variables are being measured (valid for buoy data received from GTS at Météo France during the period 25-31 July 2000):

Variable	Buoys	Reports/day	Remark
Air pressure	225	4255	
Sea Surface temperature	769	6669	
Air temperature	132	1441	
Wind	100	693	Mainly moored buoys
Air pressure tendency	171	2679	
Air relative humidity or dew point temperature	67	217	
Sub-surface temperatures	79	209	Mainly TAO array moored buoys; small number of drifting buoys with thermistor strings
Waves			Small number of buoys

Distribution by country is summarised in graphic below:

Graph-2: Number of drifting buoy data on GTS by country and sensor:



- **DBCP session and workshop**

  15th DBCP session was held in Wellington, New Zealand, 26-29 October 1999.
  Scientific and Technical workshop was a success since 24 presentations were made covering subjects such as (i) developments in moored and drifting buoy design, programmes, sensors, and communications, (ii) data requirements, applications and case studies relating to operational oceanography and meteorology, and (iii) SVPB and SVPBW/Minimet evaluation.
  DBCP Action Groups reported on their specific activities. National reports were presented. Requirements for buoy data in support of operational meteorology and oceanography were reviewed. Many technical issues have been debated and solutions proposed (QC, GTS codes, Argos system, new communication techniques, meta data, SVPB upgrade). It was particularly:

  - Recommended that NDBC, PMEL, SAWB, and ECMWF resume their activities as PMOCs in the DBCP QC guidelines
  - Decided to tentatively make a small modification of the BUOY code to include certain meta-data (e.g. anemometer height)
  - Decided to make a proposal for a more comprehensive BUOY code modification so that moored buoys which currently report in SHIP code can report in BUOY code.
  - To work on the format in which to submit meta-data to the JCOMM sub-group on marine climatology.
  - To continue evaluation of the SVPB, and SVPBW/Minimet drifters.

  The Panel did the following recommendations to the JTA:

  - Connecting LUTs in support of the ISABP to the Argos Global Processing Centres.
  - Integration of Brazilian SCD satellites in the Argos system through negotiation between the Argos Operations Committee and INPE.
  - Continue emphasis on cost control, and increased system efficiency.

  16th DBCP session will be held in Victoria, British Columbia, 16-30 October 2000.

- **Global Implementation**
  - **JCOMM**
    - **GOOS/GCOS Implementation plan and JCOMM**

      Final version of the "Global Physical Ocean Observations for GOOS/GCOS, an Action Plan for Existing Bodies and Mechanisms" document was presented and discussed at the first transition planning meeting for the Joint WMO-IOC Commission for Oceanography and Marine Meteorology (JCOMM), St. Petersburg, 19-23 July 1999. The Action Plan is however considered as a dynamic document which will be updated as requirements and implementation status develop. Implementation of the plan as a whole will be undertaken under JCOMM, which would thus be the mechanism for integrating the DBCP's work into an overall ocean observing system. The DBCP agreed to regularly update its own implementation strategy to be consistent with the GOOS/GCOS Action Plan. The strategy will be updated during the coming intersessional period, for consideration by DBCP-16. DBCP members and Action Groups are therefore invited to submit proposals and comments in that regard to the Chairman of the DBCP and the Technical Coordinator.
      Since the DBCP is now reporting to JCOMM, it changed its terms of reference consequently.

    - **Proposal for the creation of a JCOMM Observing Platform Operations Center (JCOMMOPS)**

      See proposal at http://dbcp.nos.noaa.gov/dbcp/jcommops_proposal.html

At the first transition planning meeting for JCOMM, Saint Petersburg, July 1999, it was agreed that with regard to the future structure of JCOMM, and in the context of the overall JCOMM objectives and terms of reference, a process should begin in which oceanography and marine meteorology would transition from the existing largely unconnected set of monitoring, data management and services activities to a fully integrated system. The meeting recommended that this process should be incremental and evolutionary, not revolutionary, and should ensure the preservation of existing essential activities of CMM and IGOSS.

In this perspective, the DBCP, SOOP, and Argo are providing a number of similar services which can be integrated to a large extend. This is facilitated by the fact that the DBCP and SOOP are presently coordinated by the same person in Toulouse, France. Besides, Argo will soon have a coordinator working under the DBCP&SOOP Coordinator's supervision in Toulouse at the Argo Information Centre (AIC).

A typical example were integration is possible and to some extend actually a reality is the coordination of deployment opportunities for buoys, Argo floats, and XBTs: a ship of opportunity can be used for the deployment of drifters and floats, air deployments are offered for both drifters and floats using the same facilities, etc.

Another example is the delivery of programme status maps and comparison of those with the requirements in the view to adjust the deployments. In the JCOMM integrated approach, evaluation of how requirements are met should be done to a large extend, independently of platform type but when it comes to implementation and more practically to filling the gaps in data sparse area, specific platforms may do better than others in terms of deployment, data transmission, cost effectiveness, etc. Relevant products are crucial in terms of programme planning and deployment strategy for decision makers.

Such products should therefore be proposed to (i) evaluate observing systems effectiveness on a meteorological or oceanographic variable basis, independently of platform type, and (ii) make it possible to suggest adequate platform deployments. Météo France is presently producing integrated SHIP/BUOY Data Availability Index maps for the DBCP which show indexes of how World Weather Watch requirements are met for 4 basic meteorological variables (SLP, surface AT, SST, surface Wind) based upon SHIP and BUOY reports received from the GTS. Maps also show to what extend ship and buoy data contribute to the index. These maps are useful tool for planning the deployment of buoys taking other observing systems such as VOS into account. When considering sub-surface temperature measurements, similar products could be proposed for integrating XBTs, Argo, thermistor strings on drifting or moored buoys (e.g. TAO), CTDs, etc.

In the same spirit which lead to the merging of CMM and IGOSS into JCOMM, it is proposed to integrate those activities or products into one entity which we would call the JCOMM Operations Centre (JCOMMOPS).

Centre would be located in Toulouse using DBCP, SOOP, and Argo facilities, and managed by the Technical Coordinator of the DBCP. JCOMMOPS would basically include products and services which (i) relate to in-situ physical oceanography and/or meteorological marine observations, (ii) can be integrated, (iii) require coordination at the international level in an implementation and operational perspective, and (iv) are presently provided by the Coordinator or the DBCP and SOOP, plus those which will be provided by the Argo Information Centre (AIC). If desired and provided that some other resources are available, JCOMMOPS can consider Volunteer Observing Ships (VOS) in its activities.

JCOMMOPS would run a web site which will deliver above products plus links to important JCOMM facilities such as the JCOMM Electronic Products Bulletin. New activities or products will gradually be proposed using existing resources from the DBCP, SOOP, and Argo. In case

other JCOMM operational products which can assist in the implementation of considered observing systems are offered by Member States, links to those products will be added.

Complete proposed definition of JCOMMOPS, including activities, services, and products is given in annex A. JCOMMOPS proposed structure is given in the annex B.

From the activities of JCOMMOPS, it is expected to achieve the following goals:

⇨ **Facilitating decision making by programme managers thanks to**

- Information provided on data requirements in support of GOOS, GCOS, and WWW
- Analysis of how current relevant observing systems meet the requirements
- General information provided regarding various telecommunication systems

⇨ **Facilitating programme implementation by**

- Assisting with the insertion of data onto the GTS and their delivery to appropriate archives
- Identification of adequate deployment opportunities and how and under what conditions these can be used
- Assisting in the standardisation of data formats

⇨ **Enhancing operational and monitoring aspects by**

- Collecting quality control information and suggesting solutions to correct problems
- Acting as a clearinghouse on operational aspects
- Providing information on the status of relevant observing platforms

JCOMMOPS concept was recently discussed and strongly endorsed at the second JCOMM transition planning meeting which was held in Paris, 14-16 June 2000. Pending formal endorsement from the DBCP and SOOP which will provide the resources to operate the centre, and from the first JCOMM meeting, Akureyri, Iceland, 19-29 June 2001, JCOMMTRAN-2 meeting agreed that the centre could operate immediately on an interim basis.

o **Deployment opportunities**

TC DBCP updated DBCP web server Global Implementation page and created a new page on buoy deployment and recovery (http://dbcp.nos.noaa.gov/dbcp/1bdr.html) which can be directly accessed through it. The new page on buoy deployment includes information such as:

- Deployment Opportunities:
    1. Ship lines or deployment plans, and contact points for
    2. IABP, IBPIO, Australia, New Zealand, South Africa, and USA.
    3. List of DBCP National focal points for logistic support
    4. Air deployments
    5. Ship Of Opportunity Lines (SOOP)
    6. Port Meteorological Officers
    7. Research ship schedules
- Buoy deployment methods
- Buoy recovery

You'll particularly notice that new detailed information on air deployments (http://www.jcoomops.org/air_depl.html) is available thanks to information recently provided by Elizabeth Horton of the US Naval Oceanographic Office.

DBCP participants are invited to check the information on deployment web page (http://dbcp.nos.noaa.gov/dbcp/1bdr.html) and report on any discrepancy or new information they think would be useful to appear on it.
With the advent of the Argo programme (sub-surface floats, http://www-argo.ucsd.edu/), it becomes rational, and cost-effective to integrate within JCOMM information on deployment opportunities for drifting buoy and float deployments, servicing of moored buoys, and ship of opportunity cruises (SOOP may assist for deployments of buoys and floats, and may require using "DBCP" deployment ships for XBT drops). Such information is useful for DBCP, SOOP, Argo, TAO, TRITON, PIRATA, and possibly for national programmes dealing with such platforms. This new web page is a start in this regard but it will be very valuable to develop information on the subject with more precise information and to establish it as a new JCOMM integrated product. TC drafted a JCOMM circular letter to seek information on deployment opportunities from member states. Meanwhile, TC DBCP encourages buoy operators to use the information among other things to plan deployments. TC would be interested to know the sentiment of DBCP members on the issue (integration).
Particularly, for buoy operators involved with buoy deployments, it would be useful to know whether they would be in a position to provide the TC regularly with detailed information regarding the following topics:

- Buoy deployment plans (point of contact, area of deployment, maps, periods of deployment)
- Possibility to use deployment opportunities you are currently using for sub-surface Argo float deployments.

For SOOP operators, although we know about recent cruises, it would be useful to have more detail about planned cruises (point of contact, frequency, periods, SOOP lines covered by cruise), and whether specific cruises might be used for buoy or float deployments. Indication whether a SOOP operator is on board would be useful.

- **Southern Hemisphere barometers**

At its last session, the DBCP was informed that under budgetary pressures coupled with increasing prices for expendables, and considering other priorities, AOML decided to stop purchasing barometer drifters for deployment in the Southern Hemisphere. At the same time, AOML kindly offered to upgrade standard drifters (SST only) with barometers for $US 1000 per unit (see SVPB upgrade offer)
Following discussion on the subject at the last DBCP session, the WMO Secretary, Prof. G.O.P. Obasi, wrote a letter to the US Permanent Representative with WMO, Brigadier General John Kelly Jr., in order to raise Member States concerns about the issue. The Technical Coordinator also visited NOAA in Washington-DC in February 2000 and particularly met with Mike Johnson (OGP), David Evans (Director, OAR), and Steve Piotrowicz (OAR) to discuss the issue. It is clear that the US is still discussing the issue internally, including with scientists involved in climate variability and predictability studies (E. Harrisson, A. Leetma). The programme was originally defended on Numerical Weather Prediction grounds, but thanks to discussions with scientists it appears that the in-situ sea surface barometer data from drifters in the SH are in fact instrumental for climate related studies:

- Validation/calibration of altimeters
- Fluxes
- Antarctic circumpolar waves (White and Peterson, 1996, Nature)

The number of barometer drifters operational in the Southern Hemisphere is now declining

and will probably continue to do so in year 2000 unless either AOML resumes deployment of barometer drifters, or other agencies consider the AOML offer and purchase barometer upgrades.

Good news: Latest news indicate that as an interim measure, AOML will deploy 30 barometer drifters over the coming year after July 2000. Issue will again be discussed at the 16th DBCP session in Victoria, October 2000.

- **Vandalism on data buoys**

As requested by the DBCP at its 15th session, WMO wrote to the International Hydrographic Organization (IHO) with a view that IHO promulgates navigational warning messages messages on the presence of data buoys in the seas and the necessity of their safety for assistance to mariners, in particular during bad weather times.
IHO replied that it would be discuss the issue at the next meeting of the IHO Commission on the Promulagation of Radio Navigational Warnings (CPRNW), Monaco, 29-19 June 2000.
The Technical Coordinator therefore prepared a document on vandalism on data buoys which includes proposed text for promulagation to mariners. The document was written based partly upon input from the TAO array. The document will be submited to the CPRNW meeting. A web version is available for DBCP members to use as needed.

- **DBCP Action Groups**
  - **EGOS**
    - **Chairman**: Wynn Jones, UK Met. Office
    - **Vice-Chairman**: Wil. van Dijk, KNMI, Netherlands
    - **Technical Secretary**: Torleif Lothe, Christian Michelsen Institute, Norway
    - **Technical Coordinator**: Pierre Blouch (deployment co-ordination and GTS matters), Meteo France
    - **Meetings**: 30-31 May 2000, De Bilt, NL

At the last EGOS meetings in Paris, December 1999, the EGOS Technical sub-group was merged with the Management Committee so only one meeting was held this time.
Status: EGOS activity is high with a well spread network of 43 operational EGOS buoys in the North Atlantic Ocean in December 1999. Average life-time of EGOS buoys excluding early failures has slightly decreased to 243 days (281 days in 1998) due to the large number of SVPB buoys with shorter life-time now being used. Concerns were however expressed with regard to the life-time of the SVPBs. Considering present life-time of buoys, Pierre Blouch showed that cost per observation was about the same for FGGE type buoys and SVPB buoys.
In 2000 UK will commit 7 moored buoys and a large number of buoys to EGOS (26 SVPBs are in storage, 24 are ordered). France will commit 3 moored buoys, 7 drifting buoys, and upgrade 5 drifters with barometers in cooperation with Iceland. Netherlands will commit 2 to 3 SVPBs, Ireland 1 drifting buoy, Iceland drifters (MRI), 1 PTT*Year, deployment opportunities, and BUOY-QC mailing list server, Germany 2 buoys, Norway 1 buoy. Norway and Denmark will provide LUT service. EGOS will tentatively maintain a network of about 40 drifting buoys in the North Atlantic Ocean in 2000.
LUTs: Concerns were expressed regarding the efficiency of the LUT services: timeliness for status changes, quality of the locations, computation of observation time, geo-magnetic variation correction, detection of bit errors, and consistency of calibration curves and coefficients implemented for each individual buoy as compared to those implemented at Service Argos. For example, it was shown that LUTs distributed about 10 times more gross errors on GTS than Service Argos.

Pierre Blouch will write a report summarising the situation in this regard. The EGOS Chairman will write to the LUT operators and suggest that Pierre Blouch should travel to Oslo and Copenhagen to discuss the issue directly with them.
Associated participants: The group decided to accept so called associated participants in the programme. Associated participants have no voting rights but can attend the EGOS meetings and can actively participate in the Programme. They are accepted provided that all EGOS Parties agree. This for example permits formal recognition of US Navoceano air deployments.
EGOS operational area: During its May 1999 meeting, EGOS decided to include adjacent seas such as the North Sea, Baltic Sea, and the Mediterranean Sea in its operational area. The Committee discussed the issue again and decided the following:

- No specific strategy for deployments should be defined by EGOS in those area (except maybe in the future in the context of EUCOS).
- Existing national contributions in those area are considered in EGOS provided that there is an interest in short term or long term weather forecast and possible support to climate prediction.
- Only surface drifters and moored buoys are considered for participation in EGOS in those area.

Metadata: EGOS did provide the Technical Coordinator of the DBCP with comments regarding format of the metadata catalogue prepared by the JCOMM sub-group on Marine Climatology. Comments have been included in DBCP report to JCOMM sub-group.
Poster: An EGOS poster will be produced and printed by Netherlands.
EGOS 1999 Activity
EGOS presently operates and maintains a network of about 40 drifting buoys and 10 moored buoys. Operational lifetime of drifting buoys in the EGOS programme that had failed is 221 days (263 days when excluding early failures). The group continues to express concerns regarding SVPB higher failure rates.
Through cooperation with Navoceano, 22 buoys has been deployed by air. This collaboration has extended significantly the areas that EGOS buoys can be deployed giving an improved spatial distribution to benefit all drifting buoy data users.
EGOS continues operating two LUTs in Sondre Stromfjord and Oslo. This permits to reduce GTS delays significantly. On average the data are received in the NMCs about 20 to 30 minutes after the observations are made.
The Group has continued to investigate technical developments which may improve the buoy performance or make for efficiencies within the overall buoy operation. The Technical Subgroup chairman has continued to undertaken a study of buoy message formats with the aim of standardisation; a common format is now specified by at least 3 of the buoy contributors to the EGOS programme.
EGOS primary area of interest was extended to cover the sea area from the European coastline out to 50 · W, between 30· and 65· N. It is also discussing the possibility of including adjacent seas, such as the Baltic and Mediterranean Seas. The group is also discussing mechanisms for formalising the closer collaboration that has developed in recent years with operational buoy operators in North America, and at the request of the DBCP, is investigating possibilities for closer collaboration with climate research institutions with interests in the North Atlantic.
Two of the members had upgraded standard SVP drifters operated by the Icelandic Marine Research Institute with barometers.

- **IABP**
  - Chairman: Tim Goos, Environment Canada
  - **Vice-Chairman**: Thor Kvinge, Norway

- **Coordinator**: Ignatius Rigor, University of Washington
- **Next IABP meeting:** Fairbanks, Alaska, 26-29 June 2000.

Ninth IAPB meeting was held in Bremerhaven, Germany, and was hosted by the Alfred Wegener Institute for Polar and Marine Research. The technical session was well organized and productive. There was one change in countries and organizations participating in the IABP: an official letter was received from the United Kingdom reporting that, regrettably, they would no longer be able to participate. The UK has, however, recently offered to contribute an ICEX drifter for this coming year also, so the IABP members hope that the UK will be able to re-join, as their participation has been greatly appreciated. The arctic ice grid has been well maintained. Of continuing concern is the requirement for 7 ICEX drifters for deployment during NAVOCEANO's annual arctic exercise "WHITE TRIDENT". IABP hopes that participants will be able to provide the minimum 7 drifters, as there are some deployment locations accessible only by air. Germany and Russia (Alfred Wegener Institute and Arctic and Antarctic Research Institute) have time available on their icebreakers for IABP deployments. Japan (JAMSTEC), Germany (AWI) and Russia (AARI) are building new ice drifters.

- **ISABP**
  - Chairman: Alaor Moacyr Dall'Antonia Jr. , MHS, Brazil
  - **Co-ordinator**: Louis Vermaak, SAWB, South Africa

AOML deployed 161 drifters, SAWB 21, PNBOIA 22, while PIRATA moored 12 Atlas buoys in the Tropical Atlantic. Numerous buoys in the South Atlantic operated between 600 and 800 days, while some failures occurred with air deployments off the east coast of South America. Organisations in the South Atlantic operating Local User Terminals are planning to distribute the buoy data on the GTS through Service Argos.
ISABP held a successful joint Technical Workshop and Programme meeting with IBPIO in Cape Town at the end of July 1999 and are planning to continue with these joint meetings with the IBPIO in the future.

- **Next ISABP meeting** (ISABP-VII), Salvador, Brazil, 31 July - 4 August 2000.

- **IBPIO**
  - Chairman: Graham Jones, BOM, Australia
  - **Co-ordinator**: Pierre Blouch, Météo France

A large array of SVP drifters was deployed in the Tropical Indian Ocean by AOML between February and May 1999. Most of the 120 drifters deployed since the last Programme Committee meeting have been lagrangian drifters. However, 40% of them have been measuring air pressure. Also, of the 18 SVP-B drifters deployed in November 1998 by NAVOCEANO, only 5 survived. As a consequence, the number of buoys carrying out air pressure measurements is actually decreasing in the Indian Ocean, although the overall number of drifting buoys remains stable.
The IBPIO is particularly concerned about deployment status of buoys in the Indian Ocean area, especially regarding a potential drop in the number of barometer drifters deployed by the GDP in the Southern Hemisphere, including in the South Indian Ocean. The lack of buoys in the tropical region, between 10°S and 20°S, is less acute than in the past, however, there remain serious gaps in other regions, mainly in those located to the south of 40°S.

- **IPAB**

- Chairman: Christoph Kottmeier, Univ. Karlsruhe
- **Coordinator-1**: Ian Allison, Australian Antarctic CRC
- **Coordinator-2**: Peter Wadhams, SPRI, UK
- **Next IPAB meeting** (IPAB-III), Fairbanks, Alaska, 26-28 June 2000.

The WCRP IPAB is presently a consortium of 18 agencies and institutions with interests in near-surface meteorology and oceanography in the Antarctic and Southern Ocean. It seeks to develop and maintain an observational network of drifter buoys and other appropriate data collection systems south of 55°S, a region within the maximum Antarctic seasonal sea-ice extent. The objective of the WCRP International Programme for Antarctic Buoys is to establish and maintain a network of drifting buoys in the Antarctic sea-ice zone in support of research (WCRP, SCAR) and operational programmes (WWW).

Participants are urged to ensure that, as far as possible, all platforms deployed for the programme are issued with a WMO ID number, and that data are inserted to the GTS. A uniform, quality-controlled research database for ice motion and surface meteorology and oceanography is maintained as required by the Antarctic research community. Data in the research database for the period 1995 to 1997 have been archived with the World Data Center A for Glaciology, Boulder, Colorado and will also be submitted to the RNODC/DB.

Even at a peak, the number of active drifters falls far short of the optimum requirement. Seasonally, buoy numbers show a peak in late autumn when most are deployed from vessels. A second peak in August is the result of a large number of short-term drifters deployed as part of winter sea-ice process studies in 1995 and 1998. Buoy numbers drop steadily after the maximum due both to instrument failures, and to northward divergence, which takes many buoys out of the region of interest to IPAB. Although many drifters have sufficient battery power to operate for 2 or more years, only very few survive within the Antarctic pack for a second winter. In 1999 (up to September) 24 platforms were deployed, but many of these were for ice drift studies and only 6 buoys measured meteorological variables and reported on GTS. All of these deployments were off the coast of East Antarctica. The number of active platforms also decreased in 1999 as buoys from earlier deployments came to the end of their life.

Almost all IPAB drifters have been deployed as part of individual institution research programmes, and there has been very little activity from operational meteorological agencies. This makes it difficult to guarantee a long-term buoy network meeting synoptic requirements. Data from most IPAB buoys are however contributed to forecasting agencies via the GTS. At the present time, the IPAB coordinators know of only 8 planned deployments in the first half of 2000 (in the Weddell Sea and east Antarctica).

- **GDP**
  - Chairman: Mark Swenson, AOML, USA
  - **Manager, GDC**: Steve Cook, AOML, USA

During the one year period October 1998 to October 1999, GDP drifter network increase from about 650 to 820

The GDP continues to deploy about 40 buoys per month with 18 going into the tropical Pacific, 4 into the tropical Indian, 7 into the Southern Oceans and 12 into the tropical Atlantic.

Participating international members of the GDP are presently Australia, Brazil, France, Iceland, Korea (Republic of), New Zealand, South Africa and United Kingdom. The US national efforts include the US Navy, the National Science Foundation, the National Weather Service, the Oregon State University, the University of Maine, the University of Miami and the Woods Hole Oceanographic Institute.

The GDP is finishing its Year Of The Ocean (YOTO) deployments, increased its cooperation with South Africa, India, France, Brazil, as well as with the US Navy and private industry. It has finalized a Memorandum of Understanding with France

and is in the process of finalizing another one with Fugro GEOS Inc. that will allow it to make more efficient use of its resources.
Co-operation is expected to continue with the National Weather Service, Météo France and the Navy to deploy SVPW buoys into the most active hurricane development areas in the tropical Atlantic.
The Operational (i.e. metadata) Database is being improved by merging it with a more efficient Data Base Management system. The diligent data processing personnel within the Data Assembly Centre (DAC) have improved the processing of the Delayed Mode Data processing so that it is only two months behind the Real-Time Data processing.
The use of standard data formats is encouraged for all new deployments, which reduces the problems of having to write new decoders for just a few buoys. The GDC presently does not have the resources to devote to this type of processing.
As buoys evolve (depart from the original area of interest) from other nations' or organizations' programmes and are then absorbed into the GDC tracking responsibilities, it is most important that GDC know the individual specifications for those buoys and, as such, it encourages the flow of this information in a timely manner.

- **TAO**
  - Chairman: Mike McPhaden, PMEL, USA
  - **Coordinator**: Paul Freitag, PMEL, USA

TAO is in the second year of a 4-year plan to modernize and enhance ATLAS mooring hardware, electronics, and sensors, by replacing standard ATLAS moorings with Next Generation (NX) ATLAS moorings. NX ATLAS moorings are modular in design, giving the option to add enhanced sensors such as shortwave and longwave radiation, rainfall, barometric pressure, conductivity and/or current meters. NX instrumentation also offers an increase in temporal resolution for delayed mode data. At present, about 40% of sites have been converted to the new systems.
TAO has continued to collaborate with other research projects, which include: PIRATA (Pilot Research Moored Array in the Tropical Atlantic; EPIC (Eastern Pacific Investigation of Climate Processes in the Coupled Ocean-Atmosphere System; NOPP (National Ocean Partnership Program; NASA/TRMM(Tropical Rainfall Measurement Mission); DOE/ARM (Atmospheric Radiation Measurement), and EqPROBES (Equatorial Pacific Real-Time Oceanic Biogeochemical and Environmental Sensors.
TRITON (Triangle Trans-Ocean buoy network) moorings have been deployed by JAMSTEC (Japan Marine Science and Technology Center) in tandem with TAO moorings along 156E and westward since February 1999. The TAO moorings will be removed in fall 1999, after which JAMSTEC will solely maintain these sites. Inter-comparisons are being made between TAO and TRITON data to insure a seamless transition. Data will be shared, displayed and disseminated by both institutions.
TAO data return remains good, with an overall value for real-time data availability of 85%. Damage to moorings and sensors continues to be of concern, which accounts for a significant amount of data loss, especially in the far eastern and far western portions of the Pacific basin, presumably due to a higher density of fishing activity.
TAO data displays have been enhanced to provide more selectable options, so that users may tailor displays to their needs. In addition, emerging technologies are being utilized to access and visualize TAO data.

- **Information exchange**
  - DBCP Web server (http://dbcp.nos.noaa.gov/dbcp**)**

The South African Weather Bureau provided the Technical Coordinator with a captivating buoy recovery report (for SVPB drifter Argos 25790). The report was placed under the Global Implementation menu item (http://dbcp.nos.noaa.gov/dbcp/SAWB_Rec.html).
The new list of GTS bulletin headers plus rationale regarding why it was changed was placed on the web site as well (http://dbcp.nos.noaa.gov/dbcp/1gbh.html). A new document describing benefits of authorising GTS distribution of buoy data was added (http://dbcp.nos.noaa.gov/dbcp/gts_benefits.html). Another document explaining why distributing and how to practically insert buoy data on GTS was substantially modified and reedited (http://dbcp.nos.noaa.gov/dbcp/1gtsinfo.html).
Information also available on the web site includes description and access to the monthly buoy monitoring statistics, status graphics, information regarding the GTS and how to practically insert buoy data on GTS, data flow monitoring tools, DBCP publications in electronic form, and a document describing existing and planned data collection and/or location systems potentially available for buoy applications. MEDS now provides access to archived QC messages produced by PMOCs in the context of the DBCP QC Guidelines.
The map ((http://dbcp.nos.noaa.gov/dbcp/dbcp_ag.html) showing the DBCP Action Groups is clickable with links to the AG web sites (e.g. ISABP for the South Atlantic Ocean) depending upon where you click on the map.
The list of DBCP recommended Argos message formats is available (http://dbcp.nos.noaa.gov/dbcp/1ramf.html) on the DBCP web site. Those recommended formats presently include:

- Format proposed by Météo France
- SVPB so called 2-page format
- SVP standard drifter

The panel is reminding interested members and Action Groups (AG) to provide the technical coordinator with their annual reports (i.e. national reports and AG reports respectively) and deployment opportunity information in electronic form for inclusion in the DBCP web site. For 1998, only annual reports from Brazil, New Zealand, USA, and EGOS have been included. Only deployment opportunities from Australia, New Zealand, South Africa, USA, and IBPIO were available so far.

- **DBCP Internet technical forum**

In May 1999, the DBCP did open an Internet technical forum (http://www-dbcp.cls.fr) as a mean of debating on technical issues, answer technical questions, and exchange information among buoy operators or actors. The forum is a good complement to the DBCP web site and is directly linked to it. Documents, questions and answers can be exchanged over the forum while being accessible to anybody in the buoy community.
The forum presently includes the following themes:

- Argos (open to everyone)
- DBCP (open to everyone)
- GTS (open to everyone)
- SVPBW evaluation (reserved for DBCP evaluation group)

And "Teams":

- DBCP team (reserved to DBCP members, including Action Groups).
- EGOS team (reserved to EGOS members).

If desired, new teams dedicated to DBCP Action Groups could be created on the forum with privileged access for AG Participants and administration privileges for the AG Coordinator (please

contact the Technical Coordinator of the DBCP in that case). An EGOS team has been created which is managed by Pierre Blouch.

- **New DBCP publications:**

  The DBCP recently published the following documents within its Technical Document series:

  - No. 11: DBCP annual report for 1997
  - No. 12: October 1997 DBCP Workshop's report (La Réunion)
  - No. 13: DBCP annual report for 1998
  - No. 14: October 1998 DBCP Workshop's report (Marathon)
  - No. 15: DBCP implementation strategy

  The following documents will soon be published:

  - DBCP Document No. 4 (SVPB construction manual) is being updated. New version will be published as a DBCP publication and will be available via the web.
  - DBCP annual report for 1999
  - October 1999 DBCP Workshop's report (Wellington)

- **Buoy monitoring statistics**

  Algorithms for computing the buoy monitoring statistics produced by ECMWF, NCEP, UKMO, and Météo France have been substantially modified for greater consistency. A comprehensive report describing algorithms and remaining discrepancies is available via the DBCP web site at http://dbcp.nos.noaa.gov/dbcp/monstats.html.

- **SVPBW evaluation group**

  A DBCP sub-group on SVPBW/Minimet has been created by the DBCP. Purpose of the sub-group is to deploy test drifters in all sorts of sea conditions, evaluate data, suggest hardware/software design changes, share experience, etc...
  Sub-group works mainly through mail exchange and use the newly established DBCP technical forum (http://www-dbcp.cls.fr) for basic open discussion, record of those discussions and publication of intermediary or final results.
  A "SVPB/SVPBW evaluation" sub-forum has been created in the DBCP technical forum where only sub-group participants can upload discussion topics and documents while all documents posted are available to everybody.
  The sub-group met at the DBCP workshop in Wellington, October 1999.
  Sub-group presently includes the following people:

  - Elizabeth Horton, Navoceano (Chairperson)
  - Pierre Blouch, Météo France
  - Wynn Jones, UKMO
  - Graeme Brough, BOM
  - Peter Niiler, SIO
  - Etienne Charpentier, DBCP
  - Ray Mahr, Metocean
  - Jeff Wingenroth, Technocean
  - Gary Williams, Clearwater Instrumentation
  - Sergey Mothyzev, MARLIN
  - Louis Vermaak, SAWB

  The group is open to anybody who can provide something for the evaluation, namely:

- Drifters to deploy
- Deployment opportunities
- Archived data
- Expertise
- Software development (e.g. by buoy manufacturer)
- Design suggestions according to evaluation

Any other person interested in participating in the evaluation group should contact Elizabeth Horton. Report from the evaluation sub-group presented at the DBCP-15 workshop in Wellington, October 1999, can be found on the DBCP technical forum at http://www-dbcp.cls.fr under "SVPB/SVPBW evaluation sub-group".

- **Impact studies regarding data buoys:**

The Technical Coordinator is compiling a list of impact studies regarding data buoys which is available through the DBCP web site. Anybody with information on past, present or future studies which are not listed here is invited to submit details to the Technical Coordinator.

- **GTS**
  - **BUOY code, BUFR, CREX**

After discussion and consulation among buoy data users, plus a specific study contracted by the National Data Buoy Center, the DBCP sub-group on BUOY code submitted a proposal for a modification of the BUOY code to CBS. The proposal was two-fold:

- Adding a few new groups in Section 4 to include certain Meta-data in buoy reports (anemometer height, buoy type, drogue type) plus hydrostatic pressure data from lower end of thermistor string cable when available.
- Adding a new Section 5 to include variables measured by moored buoys and that can be encoded in SHIP but not in BUOY. This would permit to switch a number of moored buoys presently reporting in SHIP to BUOY.

To defend the proposal, the Technical Coordinator(TC) attended the meeting of the CBS Implementation Co-ordination Team on Data Representation and Codes (ICT/DRC), 10-14 April 2000. In the last few years, CBS has been increasingly reluctant to implement character code changes in order to encourage use of table driven codes such as BUFR or CREX. Hence, the DBCP proposal was not particularly welcomed especially considering that the BUOY code and its predecessors (DRIBU and then DRIFTER) have been substantially modified every other year or so in the last few years. Discussion was difficult but the TC stressed that strong requirements had been expressed by the user community and that the DBCP doesn't presently have the resources to implement BUFR or CREX. At the same time, he explained that the DBCP favoured table driven codes and that it had been active in the last few years to modify BUFR tables in order to accommodate all variables presently available from data buoys. This will facilitate transition once (or if) BUFR or CREX is implemented. In order to reach some agreement with CBS for proposed modifications, the TC had to state that the DBCP would agree on the following:

- BUOY code would be frozen afterwards. In other words, the DBCP would not suggest anymore modification of the code.
- The DBCP will commit itself in implementing BUFR or CREX for all buoy data as soon as possible. Once BUFR or CREX will be implemented, distribution of buoy data in BUOY format will still be permitted and encouraged during a transition period or about 5 years

Of course, this will be debated in detail at the next DBCP session in Victoria, but the TC strongly recommends that the DBCP accepts above principles.

TC also stressed that in order to realise this and find the resources to implement this, strong requirements should be expressed by the user community. USA already expressed such requirements but other countries are encouraged to look into this and express their own requirements.

The CBS therefore recognising that strong requirements for metadata had been expressed by centres operating global models endorsed the proposal to add new metadata fields in Section 4. CBS however rejected all other proposed modifications to deal with moored buoys reporting in SHIP code. In other words, it rejected the proposed modification of Section 1, and a new National Section 5.

New fields in Section 4 will be implemented on 8 November 2001, and are indicated in red below:

SECTION 4 444 ($1Q_pQ_2Q_{TW}Q_4$) ($2Q_NQ_LQ_aQ_z$)
{($Q_cL_aL_aL_aL_a$) ($L_oL_oL_oL_oL_o$) o (YYMMJ Gggg/)}
($3Z_hZ_hZ_hZ_h$ $4Z_cZ_cZ_cZ_c$) ($5B_tB_tZ_tZ_t$)
($6A_hA_hA_hA_t$) ($7V_BV_Bd_Bd_B$) ($8V_iV_iV_iV_i$) ($9i_dZ_dZ_dZ_d$)

Existing i_d field (drogue type) will be coded "/" because a new 2 character field (Z_tZ_t) was proposed for drogue type.

Remark: WMO Secretariat will propose formal names for the new fields as names proposed above might not be consistent with present denomination rules.

Latest changes to BUFR tables proposed by the DBCP have been adopted by CBS for implementation in May 2000.

- **New GTS bulletin headers**

  New list of GTS bulletin headers was implemented on 13 October 1999 at 15 UTC:

  - Table 1: Data distributed from the US Argos Global Processing Centre, Largo, USA

Bulletin header	Deployment area	Remark
SSVX02 KARS	GDP	New
SSVX04 KARS	North Atlantic and EGOS	Same
SSVX06 KARS	Northern Hemisphere	Same
SSVX08 KARS	TAO, PIRATA	Was SSVX40 for TAO
SSVX10 KARS	Southern Hemisphere and ISABP	Same
SSVX12 KARS	Arctic, Antarctic, sea ice	Arctic, Antarctic merged
SSVX14 KARS	Indian Ocean and IBPIO	New
SSVX16 KARS	Navoceano	Same
SSVX18 KARS	Pacific Ocean	New
SSVX20 KARS	Navoceano	Same
SSVX22 KARS	Mediterranean sea	New
SSVX42 KARS	NOAA/NDBC, Southern Hemisphere	Was SSVX02
SSVX44 KARS	NE Pacific Ocean (USA, and Canada)	Was SSVX18
SSVX48 KARS	NOAA/NDBC, Northern Hemisphere	Was SSVX08
SSVX96 KARS	NDBC	Same

  -

- Table 2: Data distributed from the French Argos Global Processing Centre, Toulouse, France

Bulletin header	Deployment area	Remark
SSVX01 LFPW	North Atlantic and EGOS	Same
SSVX03 LFPW	Southern Hemisphere and ISABP	Same
SSVX05 LFPW	Northern Hemisphere	Same
SSVX07 LFPW	Arctic, Antarctic, and sea ice	Arctic, Antarctic merged
SSVX09 LFPW	Indian Ocean and IBPIO	New
SSVX11 LFPW	TRITON	New
SSVX13 LFPW	GDP	New
SSVX15 LFPW	Pacific	New
SSVX21 LFPW	Mediterranean Sea	New
SSVX39 LFPW	French West Indies	Was SSVX19

Remark concerning GDP: since GDP drifters deployed world-wide may also participate in a DBCP regional action groups (e.g. ISABP if deployed in the South Atlantic), we have to agree on a policy on what GTS bulletin header to choose. Considering that GDP header was created basically for tracking Lagrangian drifters, it sounds reasonable to recommend to have all Lagrangian drifters participating in GDP report under GDP bulletin header and not under the other DBCP Action Group it is participating in. For example, a Lagrangian drifter participating in both GDP and ISABP (South Atlantic) and which data are distributed from the French Argos Global Processing Center would report under SSVX13 LFPW (i.e. GDP) bulletin header, and not under SSVX03 LFPW (i.e. Southern Hemisphere).

Backup procedure: Backup procedure in case one of the two Argos global processing centres fails does not change. If one centre fails, the other centre processes all the data, i.e. the data it normally processed plus the data the other centre normally processes. Hence, when an Argos centre is in backup mode, it will generate bulletins with even and odd numbers (in normal mode, only even numbers are used by Largo, and odd numbers by Toulouse). In other words:

- In case the French Argos Global Processing Center in Toulouse fails, the US Argos Processing Center in Largo is switched to backup mode. In that case, GTS bulletins normally distributed from Toulouse under TTAAii LFPW bulletin headers are distributed from Largo under TTAAii KARS bulletin headers (e.g. SSVX01 LFPW becomes SSVX01 KARS and is sent out from Largo).
- In case the US Argos Global Processing Center in Largo fails, the French Argos Processing Center in Toulouse is switched to backup mode. In that case, GTS bulletins normally distributed from Largo under TTAAii KARS bulletin headers are distributed from Toulouse under TTAAii LFPW bulletin headers (e.g. SSVX04 KARS becomes SSVX04 LFPW and is sent out from Toulouse).

- **GTS Sub-system**

Recent improvements that have been realised with the Argos GTS sub-system:

- Rounding observation times to the nearest 5, 10, 15, 30 minutes or synoptic time (to avoid duplicates).
- Specific algorithms for eliminating quasi duplicates (i.e. difference between observation times for the same platform less than a few minutes).
- Interpolation between localizations (for XBTs)
- Name of used template PTT added in each PTT Technical File

Data processing of sub-surface float data for GTS distribution:
Developments had been conducted at CLS, Service Argos, to upgrade the Argos GTS sub-system for processing sub-surface float data for GTS distribution in real-time. **New system was operationally implemented on 20 March 2000** but some tests with actual floats (UK, Japan) are still being conducted. With this kind of instrumentation, it would be unrealistic to aim an universal data processing system so standards based upon existing formats have been proposed (e.g. PROVOR). There is however substantial room for flexibility within the new system which include:

- Processing profile points, up to 120 initially, each point comprising up to 4 sensors (depth, conductivity, temperature, salinity).
- Delayed mode GTS distribution (e.g. waiting until a profile is complete after several satellite passes before actually distributing the data on GTS).
- Dynamic Argos message formats: Argos message format is described to some extent by the message itself. This permits high compression of the data. However, a limited number of dynamic formats will be recognised and proposed as standards.
- Quality control. Specific QC checks are not defined yet, but doors will be opened in the system to easily permit this. CLS oceanography group will develop specific QC procedures.

- **Meta-data**

  At its 15th session, the DBCP decided the following:

  - DBCP members should provide the technical coordinator with their comments regarding the proposed format for a catalogue of Meta-data for buoys by the end of November 1999. The panel requested the technical coordinator to prepare a set of DBCP recommendations based on those comments and to submit it to the JCOMM Sub-group on Marine Climatology which is in charge of compiling the catalogue. The sub-group will meet in early 2000 and take the DBCP recommendations into account. To assist in preparing the compilation of the final catalogue, the panel urged its members and the Action Groups to compile their own metadata catalogues, with a view to submitting them when required in a format as close as possible to the one that will be proposed by the JCOMM sub-group. In addition, as required by the AOPC/OOPC Workshop on Global SST Data Sets (2-4 Nov. 1998, NY), the DBCP recommended that calibration procedures for buoys should be adequately documented and archived and urged its members to provide the JCOMM Sub-group on Marine Climatology with related information as well.
  - Meta-data in BUOY code: The panel agreed in principle with a proposed code change. It requested members to pass comments and suggested modifications regarding the proposal to the technical coordinator by the end of November 1999. The technical coordinator finalized the proposal and pass it to the WMO Secretariat for consideration and approval by CBS. Proposal was submitted to CBS along with other proposed modification of the BUOY code (see BUOY code issue).

- **Data collection and location systems**
  - **Argos**
    - **Argos message formats**

The DBCP decided to publish a list of recommended Argos formats via its web server, and encouraged new buoy operators looking for advice or expertise to use one of those. Advantages of listed formats are detailed. Although buoy operators are free to develop and use their own formats, usage of existing formats permits to substantially speed up insertion of buoy data onto the GTS through the Argos users' guidance offices.
Present list is available on the DBCP web site and includes the following formats:

- DBCP-M1: Format proposed by Météo France
- DBCP-O2: SVPB so called 2-page format
- DBCP-O1: SVP standard drifter (SST only)

- **Argos Joint Tariff Agreement**

The 19th session of the Argos Joint Tariff Agreement meeting was held in Wellington, 1-3 November 1999.

- The JTA supported proposed DBCP recommendations and requested CLS, Service Argos to take necessary actions in response to the needs identified, in conjunction with appropriate bodies.
- Regarding Argos Tariff, the meeting agreed on the following:
- To continue the bonus system. 60% of the countries could take advantage of the bonus in 1999. This represented about 26% of the 82% compound bonus.
- To put a 5 year plan in place (2000-2004) to eliminate the annual operating deficit, and to effectively remove the accumulated losses. This will be realised during the period 2000 to 2004 through an allowed 2% inflation increase in Argos operating costs, a JTA share of these costs to decrease from 58% in 2000 to 52% in 2004, a monthly active platform fee to phase in from FRF 10 in 2000 to FRF 50 in 2004, the basic PTT*Year cost to increase from FRF 26200 in 2000 to FRF 27000 in 2004, the unused ID charge to be phased out over the period, and free access to the third satellite immediately for animal trackers and possible introduction for all users later.
- For year 2000, basic tariff for standard location and data collection is therefore slightly increased to FRF 26200 and a small FRF 10 monthly active platform fee introduced.

- **Other telecommunication systems**

The Panel is continuing to review and report on new developments in telecommunication systems potentially useful for buoy programmes.
A paper outlining these developments is available on the DBCP web site at http://dbcp.nos.noaa.gov/dbcp/1smms.html. The panel noted that many of the new systems did not offer a true global or oceanic coverage, and so were unlikely to be of use to buoy operators. Of the six or so that remained, many were experiencing severe financial difficulties and were unlikely to diversify their service, in the near future at least, in a way that would cater for the requirements of many buoy operators. Furthermore, adequate technical information on which to base a proper evaluation was often seriously lacking, even for those systems that were currently in operation. Panel members were therefore encouraged to share any operational experience with the new systems by use of the electronic DBCP Forum facility.
The panel further noted that the operators of the Orbcomm system, which was of considerable interest to many buoy programmes, were undecided as to whether to launch the next batch of satellites into a low inclination or a polar orbit. Accordingly, in recognition of the need to improve communications in high latitude areas such as the Southern Ocean, the panel requested its chairman to write to Orbcomm to describe the panel's activities and

concerns, and to request that they increase the numbers of satellites in polar orbits whenever possible.

As regards the prospects for the eventual use of alternative satellite systems by the operational buoy community, the panel observed that little real progress was likely to be made until service providers were able to offer communication and data processing services equal or superior to those offered by current systems such as Argos, GMS, GOES, Inmarsat and Meteosat

Attachment 5
IABP Participants
Membership and Letters of Intent

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Attachment 6
IABP Participant Contributions† 1998 – 2000

Participant, Country	1998	1999	2000	Plans for 2001
AWI, Germany	4 ICEXAIR, Argos Data Processing (ADP)	2 ICEXAIR, ADP	1 ICEXAIR and 2 Sellmann & Krause buoys, ADP	ADP
AC, U. Lapland, Finland				
Meteorological Service of Canada	3 CALIBs 3 buoys deployed for US NIC special poster	2 EC buoys 1 ICEXAIR	2 EC buoys 1 buoy deployed for US NIC 1 ICEXAIR	2 CALIBs (Sep 2000) 1 EC
	Chair IABP, operate LUT; make Argos Summary Report of buoy data going to GTS from Edmonton (and Gander) LUTs, produce IABP brochures and promotional material, submit annual report for DBCP, do deployments of EC and other Participants buoys via Twin Otter landing on ice.			
CMR, Norway	Buoy research and production.			
CLS, France	Data Collection and support for meetings.			
IOS, Canada				
IO / CAS, China				
IARC / UAF, USA	Joined IABP in 2000		Partial funder of the US-IABP. Scientific and technical advise	
JAMSTEC, Japan	3 ICEXAIR buoys, 1 IOEB buoys, ADP.	3 ICEXAIR buoys, 1 IOEB buoys, ADP.	2 J-CAD buoys, ADP.	3 J-CAD buoys, ADP.
MEDS, Canada	Data Archive	Data Archive	Data Archive; IABP CDROM; IABP Monthly Inventories, Maps and Statistics (on web).	Data Archive
NERSC, Norway				
NIC / US-IABP, USA	Coordinates and represents the US-IABP (NASA, NOAA NESDIS, NOAA OAR, NOAA OGP, NSF, ONR, USN, USCC). Funds the Coordinator of the IABP. Provides 5-7 ICEXAIR and CES buoys/year and logistics support. ADP.			
NAVO, USA	WHITE TRIDENT buoy deployments.			

NPI, Norway	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.
DNMI, Norway	1 ICEXAIR, ADP, LUT.	1 ICEXAIR, ADP, LUT	1 ICEXAIR, ADP, LUT.	1 ICEXAIR, ADP, LUT.
PMEL, USA	7 buoys at SHEBA		2 buoys at NPEO	2 buoys at NPEO
PSC/APL/UW, USA	Data Management and Coordination of the IABP. Research on/using buoy data. Deployed 15 buoys at SHEBA.	Data Management and Coordination of the IABP. Research on/using buoy data.	Data Management and Coordination of the IABP. Research on/using buoy data. Deployed 7 buoys @ NPEO.	Data Management and Coordination of the IABP. Research on/using buoy data. Deploy 5 buoys at NPEO.
ROSHYDROMET/AARI Russian Federation	Buoy Development	Buoy Development	Buoy Development, 2 AARI buoys.	Buoy Development
SPRI, U. Cambridge United Kingdom				
Service Argos, USA	Data Collection and support for meetings.			
UKMO, United Kingdom	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.	1 ICEXAIR, ADP.
WHOI, USA	IOEB	IOEB	IOEB	IOEB
World Climate Research Programme	Travel support for some participants. Scientific advice.			

[†]Contributions further the objectives of the IABP and are defined in the Operating Principles of the IABP, section 6.5.

Some abbreviations:

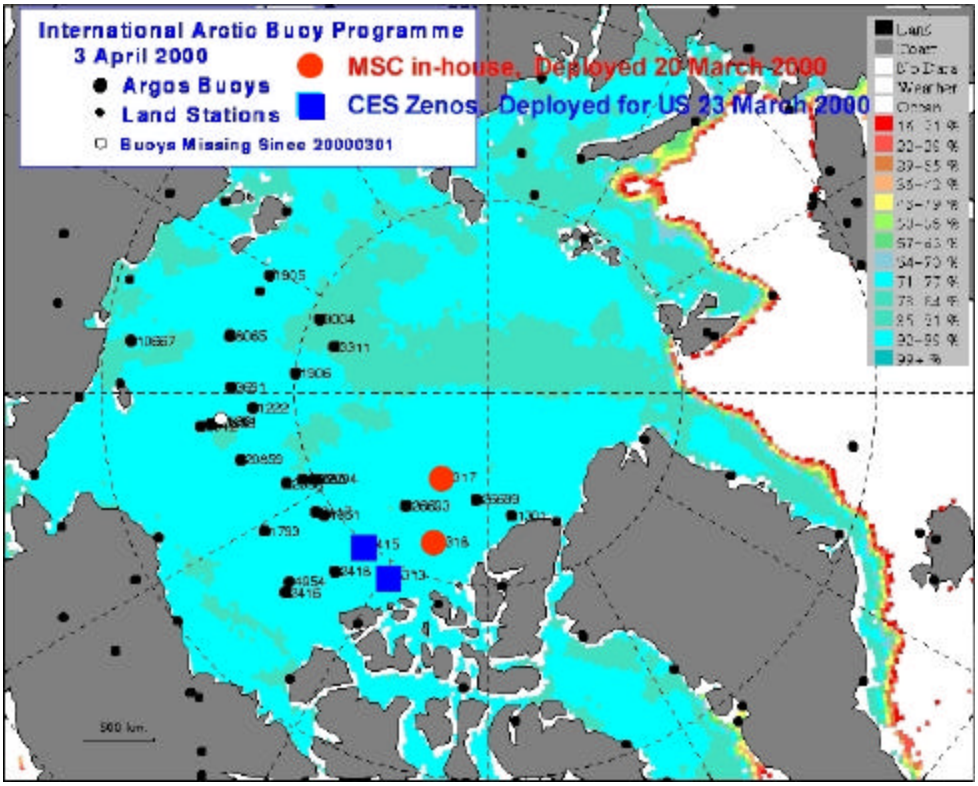
ADP: Argos Data Processing
IOEB: Ice-Ocean Environment Buoy
LUT: Local User Terminal

Attachment 7
Environment Canada Participant Report for IABP-10

Submitted by Edward Hudson, Arctic Weather Centre
for Summary Report of Tenth Meeting of International Arctic Buoy Programme
Fairbanks, Alaska, June 2000
edward.hudson@ec.gc.ca 780 951-8878 fax 780 951-8602

Deployments July 1999 to 20 June 2000 inclusive (from IABP-9 to IABP-10)

The annual spring deployment Twin Otter flights were conducted March 2000 out of Eureka. Environment Canada receives support from Polar Continental Shelf Project for these flights. 2 in-house assembled buoys were deployed 20 March and 2 CES Zeno buoys were deployed for the US National Ice Center 23 March.



Additionally, a CALIB was deployed mid May at approximately 85.8 N 65.4 W.

Deployment Plans July 2000 to June 2001

ICEX - Environment Canada has contributed 1 ICEX-Air for the year 2000 White Trident deployment.

CALIBS - CALIBS have been dispersed to optimize deployment opportunities. One resides on the western Arctic bound icebreaker Sir Wilfrid Laurier, another resides with the Canadian Forces and yet another is being held for deployment by the Canadian Ice Service Dash-7. Depending on ice conditions and the buoy array in place across the Beaufort late September, one or more of these buoys will go on-ice.

Landing on ice - Twin Otter deployment flight(s) are anticipated via Eureka out of Isachsen, Ward Hunt Island, or the on-ice camp / fuel cache established each spring at about 86N 70W. The flights will go late March or early April 2001. The buoy array in place and ice conditions at that time will dictate where the deployment(s) is done from, the number of flights and the number of buoys deployed. For the past few years there have been two flights with each flight deploying one or 2 buoys provided by the US National Ice Center and/or Environment Canada.

LUT Acquisition, Processing and Transmission of Buoy Data onto GTS

Environment Canada, Edmonton, continues to operate a LUT. At meeting time, EC was acquiring, processing, and transmitting onto GTS the meteorological data from four EC buoys - ARGOS ids 5300 5313, 5317 and 5318 - and from four US National Ice Center CES Zeno buoys - ARGOS ids 1301, 2416, 2417 and 4954.

Status of Buoy Data onto GTS

An ARGOS Summary Report for WMO is prepared monthly by Dennis Oracheski and emailed out. Recipients include Etienne Charpentier, Technical Coordinator, Drifting Buoy Cooperation Panel. The summary outlines buoys / data being transmitted to GTS from the ARGOS Direct Readout Stations at CWEG ... Edmonton, Alberta, Canada and CYQX ... Gander, Newfoundland, Canada (data from Gander uses the CHWX identifier). Included is the latitude (deg N) and longitude (deg E) position and the list of sensors for each buoy. The report also includes the "status" of some of the data.

IABP Brochures and Poster

Brochures - The IABP brochure was updated October 1999 for distribution at the DBCP Australia meeting. The brochure was updated again November 1999 for limited distribution at a special December JCOMM/GOOS meeting for ice covered water specialists in Geneva. Yet another update was done in April for an Arctic Council meeting in Fairbanks at the request of Roger Colony. The brochures now feature a "centerfold" of the latest monthly buoy array mapping on the colored ice background.

Posters - To date, only 2 posters have been done - bear poster of 1996 and the history/array poster of 1998. Copies of the 1998 poster are still available. Environment Canada is open to producing a poster for the year 2001 meeting.

Partner with Canadian Oceanographers

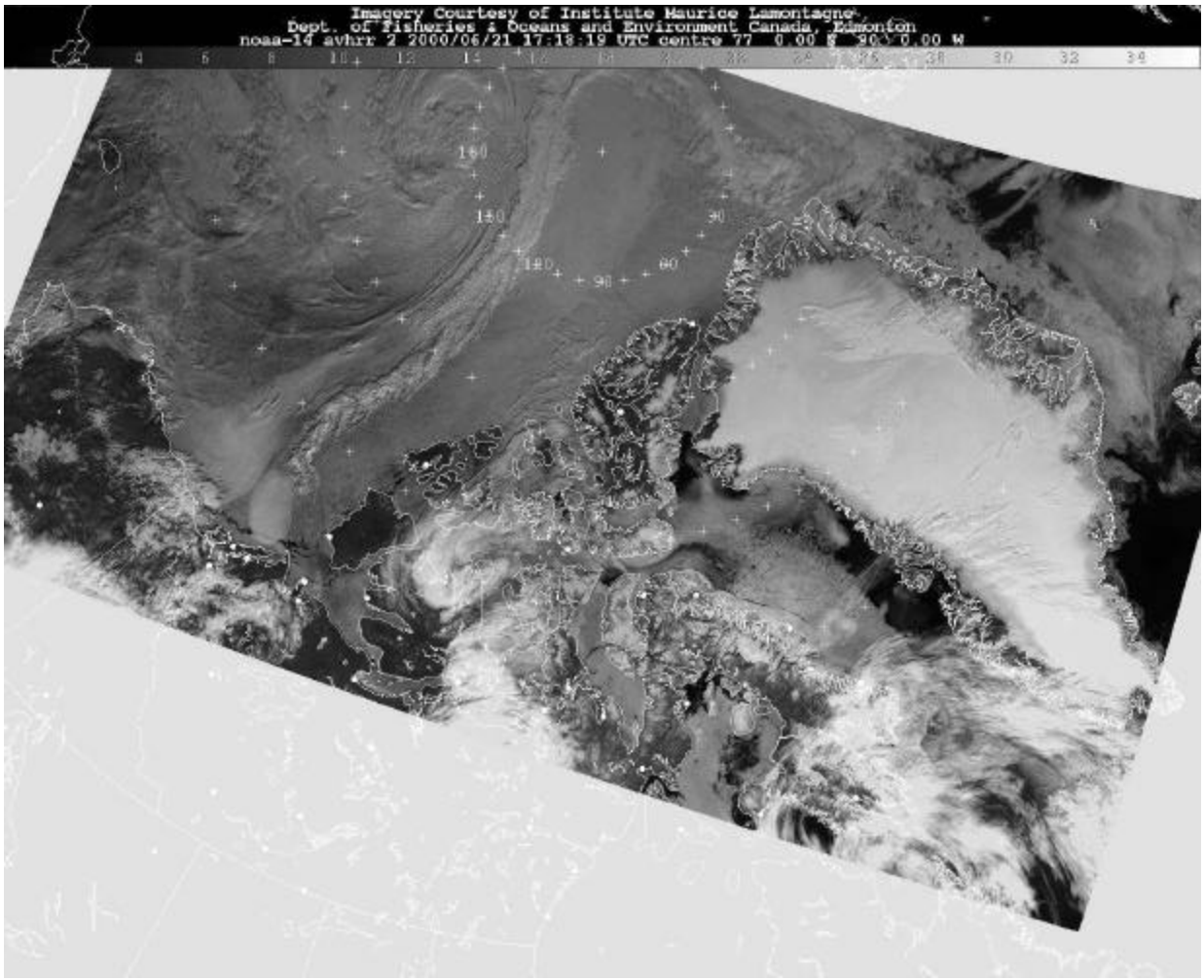
In our on-ice deployments, EC seeks to work with Canadian oceanographers: :

- have oceanographers accompany deployments flights and do water profiles at the deployments sites.. as we did for the 1999 deployments but not the year 2000 deployments
- share deployment flights where we land at sites for both our deployments and their oceanography
- share buoy hulls.

Satellite Imagery from Resolute

The Arctic Weather Centre has access to polar orbiting satellite data from Resolute. We have our own software and hardware in place Resolute and use a raw data feed from the Department of Fisheries and Oceans acquisition station. Their primary interest is SeaWifs imagery. We continue to use phone lines to acquire jpeg images from this system BUT a high speed satellite link is being pursued. The Meteorological Service of Canada gives free access to the current IR and visual imagery from this system. **http://www.cmc.ec.gc.ca/cmc/htmls/satellite.html** When/if we acquire a permanent high speed data link to the Resolute system, we will consider shifting our LUT from Edmonton to Resolute and thereby the processing of arctic buoy data.

This sample image - 1718 UTC 21 June 2000 - gives an idea of how much of the Arctic Basin we can "see" from Resolute.



Attachment 8

INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)
CHAIRMAN'S AND COORDINATOR'S REPORT
for the Fifteenth Session of the DATA BUOY CO-OPERATION PANEL
Wellington, New Zealand, 26 to 30 October 1999

prepared by Ed Hudson 13 August 1999

This report focuses on activities of the International Arctic Buoy Programme that have occurred since the report filed August 1998 for the 14th session of the Data Buoy Co-operation Panel.

Up-to-date listing of IABP participants, monthly maps of the IABP buoys in place and their status, buoy diagrams, IABP images and plots to browse and borrow, IABP data animations, pointers to ice charts, and more are available on the IABP web site maintained at the Polar Science Center, Applied Physics Laboratory, University of Washington: http://IABP.apl.washington.edu

INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP) NINTH ANNUAL MEETING, BREMERHAVEN, GERMANY, JUNE 1999 - Members of the International Arctic Buoy Programme met 2-4 June in Bremerhaven, Germany, for the ninth annual business meeting of the program. The meeting was hosted by the Alfred Wegener Institute for Polar and Marine Research. Meeting "minutes" and participants' reports can be viewed at : http://IABP.apl.washington.edu/IABP-9/Minutes.html. The year 2000 meeting will be held in Geneva, Switzerland.

IABP EXECUTIVE AND COORDINATOR - The elected IABP executive and appointed coordinator are:

Chairman: Tim Goos, Environment Canada, Canada
Vice Chairman: Thor Kvinge, Christian Michelsen Research, Norway
Member: Ivan Frolov, Arctic and Antarctic Research Institute, Russia
Member: Dave Benner, U.S. National Ice Centre, U.S.A.
Coordinator: Ignatius Rigor, Polar Science Centre, U.S.A.

BUOY ARRAY 02 JUNE 1999 AND 02 AUGUST 1999 - A total of 16 buoys were deployed since the IABP meeting of July 1998, the majority of which were deployed summer of 1998. However, 25 buoys ceased functioning during the same time period leaving 22 buoys "operational" at the time of the June 1999 IABP meeting. The map of 02 August 1999 which accompanies this report shows 23 operational buoys of which 14 provide atmospheric air pressure and atmospheric air temperature, 3 provide atmospheric air pressure only and 1 provides atmospheric air temperature only, leaving 5 buoys which are position only.

PARTICIPANTS OF THE IABP - Participants of the IABP remain a mix of operational agencies, meteorological and oceanographic institutes, research agencies and non-government organizations that are interested in the Arctic Ocean and who contribute actively to the program. The UK Meteorological Office (UKMO), a Participant of the IABP since the IABP came to be 1991, has withdrawn from the IABP. The UKMO graciously provided an ICEX buoy for the August 1999 "*White Trident*" exercise. The UKMO's and their representative's, Anthony Bentley, contributions to the IABP will be missed.

PARTNERS AND NEW PARTICIPANTS SOUGHT - IABP participants continue to seek partners within their respective countries and internationally who are willing to supply additional buoys or sensors for existing buoys so that the IABP can grow. Provision of an ICEX buoy(s) is particularly useful to the program as a minimum of 7 ICEX buoys are required to make the "*White Trident*" exercise happen.

1999 DEPLOYMENTS TO COME - The following outlines deployments planned for later in August 1999. The proposed deployment sites have been pasted on the buoy array map of 02 August 1999.

- 2 CALIB buoys provided by Environment Canada via air drop on ice the Beaufort (blue ●) courtesy Canadian Forces late August
- 7 ICEX air buoys provided by Alfred Wegener Institute for Polar and Marine Research (AWI) (2), US National Ice Center (NIC) (2), UK Meteorological Office UKMO (1), Norwegian Meteorological Institute (NMI) (1), and Environment Canada (EC) (1) via air drop courtesy U.S. Naval Oceanographic Office C-130 "*White Trident*" exercise (red ●)

RECENT PUBLICATIONS

Reviewed Journal articles

Rigor, I., R. Colony, and S. Martin, Variations in surface air temperatures over the Arctic Ocean from 1979 to 1997, J. Climate, in press, 1999.

Jones, P.D. , M. New, D.E. Parker, S. Martin, and I.G. Rigor, Surface air temperature and its changes over the past 150 years, Rev. of Geophysics, v. 37, no. 2, pp. 173 - 199, 1999.

Thomas, D., The quality of sea ice velocity estimates, J. Geophys. Res., in press, 1999.

Zhang, J., D.A. Rothrock, and M. Steele, Recent changes in arctic sea ice: The interplay between ice dynamics and thermodynamics, J. Clim., submitted, 1998.

Buoy Reports

Rigor, I., and M. Ortmeyer, International Arctic Buoy Program (IABP) data report, 1 January 1997 - 31 December 1997, APL-UW TM 05-99, Applied Physics Laboratory, University of Washington, 1999.

Rigor, I., and M. Ortmeyer, International Arctic Buoy Program (IABP) data report, 1 January 1998 - 31 December 1998, APL-UW TM 06-99, Applied Physics Laboratory, University of Washington, 1999.

Rigor, I., and M. Ortmeyer, A Summary of Observed Sea Level Pressure, Surface Air Temperature and Ice Motion from the International Arctic Buoy Programme, APL-UW TR 9902, Applied Physics Laboratory, University of Washington, 1999.

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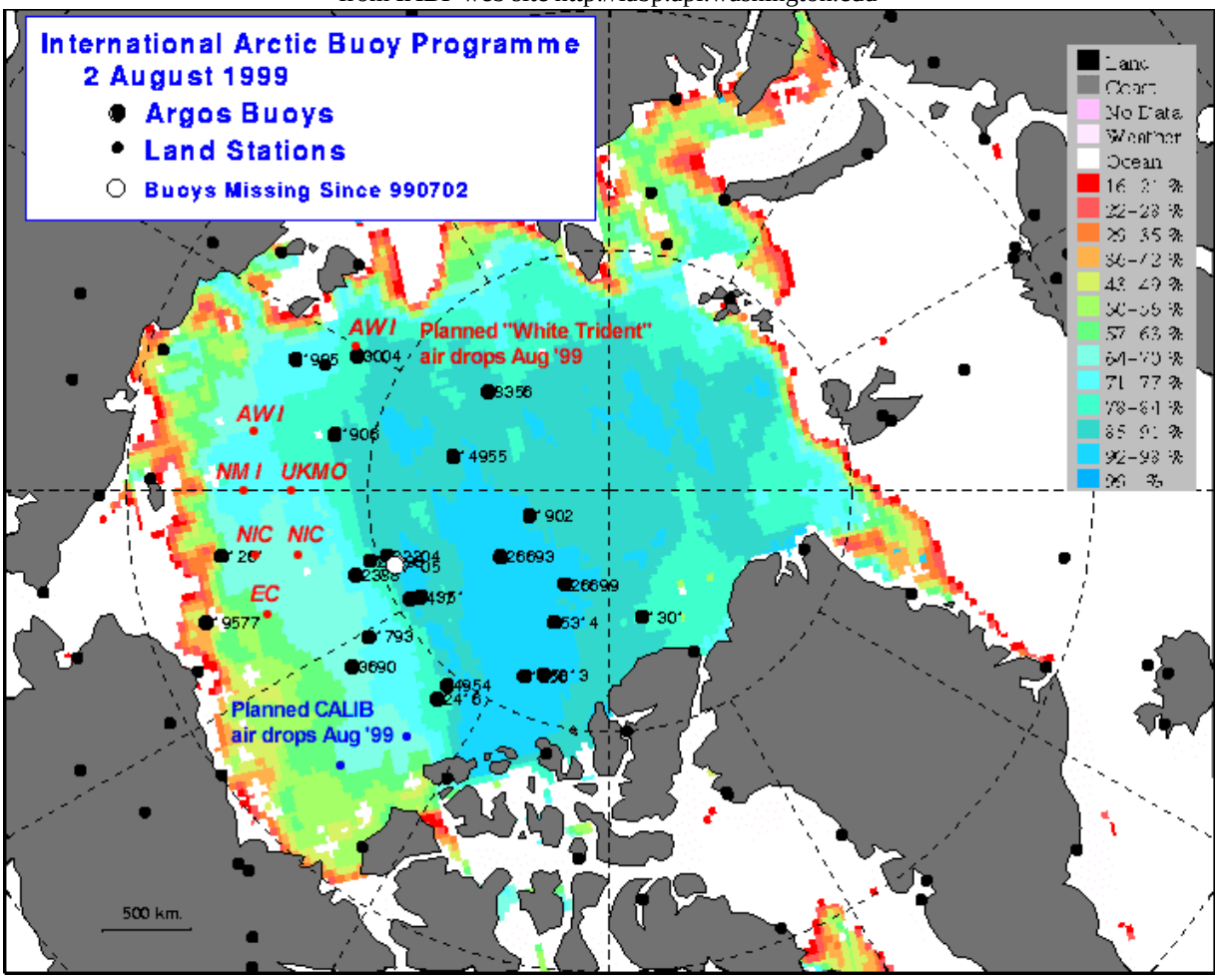
Figure 1. **IABP Buoy map and table - 02 August 1999**
from IABP web site http://iabp.apl.washington.edu



DATE DEPLOYED	ARGOS ID	WMO ID	YPR NUMBER	GTS HEADER	POSITION LAT	POSITION LONG	DATA BYTES	P	T	BUOY DESCRIPTION
Aug 96	1261	48102	484	SSVX01-LFPW	73.711	-170.465	17			ICEX-AIR
Apr 98	1301	48581	1053	SSVX02-CWEG	84.604	-75.753	16	Y	Y	Metocean TOGA
Aug 98	1351	48532	484	SSVX01-LFPW	81.050	-150.618	17	Y	Y	ICEX-AIR
Aug 96	1556	48111	314	SSVX01-LFPW	81.539	-114.697	16			ICEX-AIR
Aug 98	1793	48533	29	SSVX01-LFPW	78.344	-148.716	17	Y	Y	ICEX-AIR
Aug 97	1902	25522	557	SSVX12-KARS	86.533	-163.020	21	Y	Y	ICEX-AIR
Aug 98	1905	25525	557	SSVX12-KARS	75.897	157.230	21	Y	Y	ICEX-AIR
Aug 98	1906	25526	557	SSVX12-KARS	78.379	168.320	21	Y	Y	ICEX-AIR
Sep 98	2388	25557	1053	SSVX12-KARS	78.915	-161.605	32	Y		CES/Zeno Ice Buoy
Apr 98	2416	47523	1053	SSVX02-CWEG	78.798	-129.568	32		Y	ZENO-3200
Aug 98	3004	25535	1053	SSVX12-KARS	78.156	151.736	17	Y	Y	ICEX-AIR
Aug 98	3690	25011	314	SSVX01-LFPW	77.098	-145.590	17	Y	Y	ICEX-AIR
Apr 98	4954	48580	1053	SSVX02-CWEG	79.492	-129.860	32	Y	Y	ZENO-3200
Mar 99	**5313**	**47538**	**627**	**SSVX02-CWEG**	**81.900**	**-109.700**	**16**	**Y**		**EC**
Mar 99	**5314**	**48521**	**627**	**SSVX02-CWEG**	**84.100**	**-112.800**	**16**	**Y**	**Y**	**EC GPS**
Jul 98	8356	25537	282	SSVX06-KARS	83.514	140.536	12	Y	Y	AARI Air Drop
Aug 98	14955	25574	919	SSVX01-LFPW	83.370	167.598	21	Y	Y	ICEX-AIR
Aug 96	19577	47601	1053	SSVX12-KARS	72.430	-161.930	16			ICEX-AIR
Mar 96	26693	48578	1053	SSVX02-CWEG	84.718	-148.818	32	Y	Y	CES/Zeno Ice Buoy
Jul 96	26699	48573	1053	SSVX02-CWEG	85.704	-115.657	32			CES/Zeno Ice Buoy
SHEBA										
Sep 97	2417	48572	1053	SSVX02-CWEG	80.589	-151.541	32	Y		CES/Zeno Ice Buoy
Sep 97	22204		695		80.406	-163.742	32			PMEL GPS Buoy
Sep 97	26696	48576	1053	SSVX12-KARS	79.688	-163.788	32	Y	Y	CES/Zeno Ice Buoy