WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

DATA BUOY CO-OPERATION PANEL
FIFTEENTH SESSION

Wellington, New Zealand, 26-29 October 1999

FINAL REPORT

1. ORGANIZATION OF THE SESSION

1.1. OPENING OF THE SCIENTIFIC AND TECHNICAL WORKSHOP

1.1.1 The Scientific and Technical Workshop associated with the fifteenth session of the Data Buoy Cooperation Panel (DBCP) was opened by the chairman of the panel, Mr Graeme Brough, at 08.50 hours on Tuesday, 26 October 1999, in the conference room of the Copthorne Plimmer Towers Hotel in Wellington, New Zealand. He welcomed all participants to the session and to the workshop, noting with satisfaction that participation in the panel session and workshop had increased once more, testimony to the value of the workshop and to the strength and importance of the panel, as well as to the undoubted attraction of New Zealand as a venue. Mr Brough expressed his sincere thanks, on behalf of all participants as well as of the sponsoring organizations, WMO and IOC, to MetService New Zealand Ltd., and particular to Ms Julie Fletcher and her co-workers, for hosting the meetings and for providing such excellent facilities and support. He then passed the floor to Ms Fletcher, who introduced the Chief Executive of MetService New Zealand and Permanent Representative of New Zealand with WMO, Mr John Lumsden.

1.1.2 Mr Lumsden welcomed all participants to the meeting, noting that the DBCP represented a great exercise in international cooperation, in a field which was of considerable importance to New Zealand and in which the MetService was very pleased to be able to participate. He expressed the pleasure and privilege of his service in being able to host the meeting, and then invited the Secretary for Transport of New Zealand, Mr Alastair Bisley, to open the meeting.

1.1.3 Mr Bisley also welcomed all participants to the meeting and to New Zealand, and expressed his delight at being able to host both the DBCP session and also the meeting on the Argos Joint Tariff Agreement which was to follow. In doing so, he noted that many participants had traveled great distances to get to New Zealand for the meeting, distances which were to a large extent over oceans. These oceans were of great interest and importance to New Zealand in many and varied ways. In particular, MetService New Zealand had international responsibilities for providing meteorological forecasts and warnings for vast ocean areas, which were very dependent on the availability of meteorological and oceanographic data from these areas. The information provided by drifting buoy programmes, those operated by New Zealand and also by other countries, was essential to fulfilling these responsibilities. In this context, he noted that MetService New Zealand had developed considerable expertise in operating and recycling buoys, and was making a substantial contribution to the work of the DBCP. Mr Bisley concluded by wishing all participants a very successful meeting and an enjoyable stay in New Zealand.

1.1.4 On behalf of the Secretary-General of WMO, Professor G.O.P. Obasi, and the Executive Secretary of IOC, Dr P. Bernal, the WMO Secretariat representative also welcomed participants to the meeting. In doing so, he offered the very sincere appreciation of both Organizations to the Government of New Zealand, and especially MetService New Zealand, for hosting the meeting and for providing such excellent facilities, support and hospitality. He offered particular thanks and appreciation to Ms Fletcher, for her support to the meeting and to the work of the DBCP in general, and also for the example of professionalism and excellence which she set for the whole of the international buoy community in her management of buoy operations. He recognized the ever increasing importance of the panel and its work, in particular now in the context of integrated ocean observing systems to be coordinated under the new Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). The WMO representative concluded by assuring the panel of the ongoing full support of both Secretariats in its work.

1.1.5 The list of participants in the workshop is included in the workshop proceedings, which are published as a separate DBCP Technical Document.

1.2. OPENING OF THE SESSION

1.2.1 The fifteenth session of the DBCP was opened by the chairman of the panel, Mr Graeme Brough, at 14.15 hours on Wednesday, 27 October, at the same location as the technical workshop. He thanked once again all those involved in the organization of the session, in particular Ms Julie Fletcher of MetService NZ Ltd.

1.2.2 The list of participants in the session is given in *Annex I*, and a list of acronyms is in *Annex X*.

1.3. ADOPTION OF THE AGENDA

1.3.1 The agenda for the session adopted by the panel is in *Annex II*.

1.4. WORKING ARRANGEMENTS

1.4.1 Under this agenda item, the panel decided on its working hours and other arrangements for the conduct of the session. The Secretariats introduced the documentation for the session.

B. IMPLEMENTATION COMPONENT

2. IMPLEMENTATION REPORTS

2.1 TECHNICAL COORDINATOR

2.1.1 The Technical Coordinator, Mr. Etienne Charpentier, presented his activities in support of the DBCP during the intersessional period. As for the previous years, he was based in Toulouse and employed by the Intergovernmental Oceanographic Commission. As agreed by the panel at its previous session, the technical coordinator worked part time (35%) as coordinator of the Ship-of-Opportunity Programme. Since CLS/Service Argos also offered equivalent staff support for working on routine DBCP tasks, this did not significantly impact the work for the panel.

2.1.2 In November 1998, the TC/DBCP represented the panel at the GOOS Interim Advisory Group meeting in Paris. He attended the EGOS and IABP Action Group (AG) meetings, while the panel was represented by Pierre Blouch and Eric Meindl at the IBPIO and ISABP AG meetings respectively. In January 1999, he visited the National Institute of Biology in Piran, Slovenia, and other institutes in Italy to assist with the implementation of a cooperative project to deploy moored buoys in the Gulf of Trieste. In June, he presented the panel and its activities at an Argos UK Users' conference in Oban, Scotland. In July, he represented the panel at the first transition planning meeting for a JCOMM in St Petersburg.

2.1.3 With support from Service Argos, the technical coordinator made contacts with Argos buoy operators and tried to convince them to authorise GTS distribution of their buoy data. It now appears that authorisation for GTS distribution of the data is granted for approximately 70% of the buoys transmitting through the Argos System. However, for practical reasons (quality, tests, delay to implement adequate information in the system), only 50% of the buoys actually report on the GTS. Only 8% of the buoys are now identified as "confidential". Status is not known for about 10% of the buoys. General information regarding the GTS, how to practically distribute buoy data on GTS, plus arguments to convince buoy operators to do so is available on the DBCP web site (http://dbcp.nos.noaa.gov/dbcp/1gtsinfo.html).

2.1.4 The technical coordinator worked on specific technical issues such as implementation of new facilities within the Argos GTS sub-system, coordination with major meteorological centres for the production of consistent buoy monitoring statistics (South African Weather Bureau started to produce such statistics during the intersessional period), metadata, code matters (e.g. including metadata in BUOY code), Argos message formats (as discussed last year, a few Argos message formats are now recommended and detailed on the DBCP web site), GTS distribution of sub-surface float data, quality control of buoy data (QC guidelines). As decided at the previous DBCP session, GTS bulletin headers used for GTS distribution of buoy data were changed on 13 October 1999, and a new pair of GTS bulletin headers is now dedicated to the Global Drifter Programme (GDP). A substantial amount of time was required for the coordination of this issue.

2.1.5 Upon request, or when problems arose, technical assistance was provided to buoy operators, national programmes, and DBCP Action Groups. This is mainly related to the Argos system and GTS distribution of buoy data.

2.1.6 An SVPBW/Minimet evaluation group was created to deploy and test SVPBW drifters in various sea conditions, evaluate the data, suggest hardware/software design changes, share experience, etc. The sub-group is chaired by Elizabeth Horton, primarily works via email, and meets at DBCP workshops.

2.1.7 Regarding information exchange, the DBCP web site was regularly updated (http://dbcp.nos.noaa.gov/dbcp/) and new information added (e.g. recommended Argos messages, new list of GTS bulletin headers), a new DBCP Internet technical forum was established (http://www-dbcp.cls.fr) as a means of debating on technical issues, answering technical questions, and exchanging information among buoy operators or actors. Also, new DBCP documents have been published within the DBCP series (i.e. DBCP 1998 report, Marathon workshop report, and DBCP implementation strategy), and the DBCP brochure finally published and distributed to various actors including National Focal Points and DBCP Action Groups.

2.1.8 More details regarding these issues was provided to the panel during the session while discussing relevant agenda items. The full report of the technical coordinator is given in the 1999 DBCP Annual Report, which also includes the list of routine tasks undertaken by him during the period and not summarised above. The panel expressed its appreciation to the technical coordinator for the work accomplished on its behalf during the past year, as well as in previous years. Discussion on issues raised is recorded under appropriate agenda items.

2.2 ACTION GROUPS AND RELATED PROGRAMMES

2.2.1 Under this agenda item, the panel was presented with reports by its action groups, viz the European Group on Ocean Stations (EGOS), the International Arctic Buoy Programme (IABP), the International Programme for Antarctic Buoys (IPAB), the International South Atlantic Buoy Programme (ISABP), the International Buoy Programme for the Indian Ocean (IBPIO), the Global Drifter Programme (GDP) and the Tropical Atmosphere Ocean (TAO) array Implementation Panel (TIP). As usual, the full reports of the action groups will be reproduced in the panel’s annual report.

The European Group on Ocean Stations (EGOS)

2.2.2 Mr D W Jones, chairman of the EGOS management committee, gave an oral presentation on EGOS activities, and on the status of moored and drifting buoys in the North Atlantic. In introducing the EGOS intersessional report (EGOS technical document number 201) covering the 12 month period August 1998 to August 1999 he was particularly pleased to report that the increased number of drifting buoys operational in the area reported the previous year had been maintained, varying between 31 and 49 at the end of each month; there were 43 operational drifting buoys at the end of the period. 73 buoys had been deployed in the year, and 68 had ceased to function. The operational lifetime of buoys in the EGOS programme that had failed was 221 days, however if the buoys that suffered very early failure are excluded the average operational lifetime is increased to 263 compared to 278 days in 1998 and 252 days in 1997. Although this figure is comparable to the average for the previous 3 years, the group remained concerned about the continued higher early failure rate of the SVPB drifters compared to TOGA style buoys.

2.2.3 Mr Jones was particularly pleased to inform the panel that the excellent collaboration that had been established with the US Naval Oceanographic Office, NAVOCEANO, had continued, 22 buoys being air deployed on 2 missions. During the first mission there was a high early failure rate of SVPB buoys. Following this there was considerable discussion between the chairman, the buoy manufacturer and the deployment team. As a result of this a deployment trial was held in April in the Gulf of Mexico under 'controlled conditions' where the buoys could be recovered after deployment, however all 6 buoys deployed on this mission worked satisfactorily. 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. He was also pleased to report that NAVOCEANO had deployed a number of CMOD style drifters in the EGOS area; this significantly improved the spatial observation coverage following the early failure of the SVPBs.

2.2.4 Maintaining a high data availability rate with minimum time delay between time of observation and insertion onto the GTS remains a high priority for the Group, and in this respect he was pleased to report the continued operation of the LUTs in Oslo operated by Norway and in Sondre Stromfjord operated by Denmark. On average the data are received in the NMCs about 20 to 30 minutes after the observations are made.

2.2.5 In addition to the drifting buoys, the group also operates 10 moored buoys, this number having increased in July with the deployment of the K7 buoy by UKMO west of Shetland, and the deployment of a moored buoy by Meteo France in the Mediterranean Sea south of Nice.

2.2.6 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.

2.2.7 A new ship-borne automatic weather station is being tested by the Norwegian Meteorological Institute. The station is based upon Inmarsat C communication, uses GPS for positioning, and has a “silent area” function that automatically switches the station off in over-observed areas, or areas of no interest. The station has been on test at the Norwegian Weather Ship ”Polarfront” at station ”M” in the Norwegian Sea since August 98.

2.2.8 EGOS met twice in the period, in December in Geneva, hosted by WMO, at which Mr Jones was re-elected to chairman, and Mr W. van Dijk was re-elected to vice-chairman. Mr P. Blouch remained chairman of the technical sub-group and Mr Torleif Lothe of Christian Michelson Institute Bergen was appointed technical secretary. Meteo France hosted the second meeting in May at Centre de Meteorologie Marine (CMM) in Brest. At this meeting, the Management Committee decided to merge the EGOS Technical Subgroup with the Management Committee. It was, however, noted that the technical work would still require a focal point, but that this could be achieved through the appointment of a technical coordinator. The Management Committee appointed Mr. Pierre Blouch as technical co-ordinator of EGOS, with responsibility for deployment co-ordination and GTS matters. Mr Pierre Blouch would continue to act as Chairman of the EGOS Technical Subgroup until the December 99 meeting. As a formalisation of its recent deployment strategies the Management Committee agreed to extend the EGOS primary area of interest 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. In the latter context he was pleased to report that two of the members had contributed barometers to SVPs operated by the Icelandic Marine Research Institute.

The International Arctic Buoy Programme (IABP)

2.2.9 Ms Elisabeth Horton reported that the 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.

The International Programme for Antarctic Buoys (IPAB)

2.2.10 Etienne Charpentier reported on IPAB on behalf of Ian Allison, IPAB Coordinator. 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).

2.2.11 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.

2.2.12 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.

2.2.13 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.

2.2.14 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).

The International South Atlantic Buoy Programme (ISABP)

2.2.15 Mr Louis Vermaak reported that the International South Atlantic Buoy Programme (ISABP) experienced another successful intersessional period. 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.

2.2.16 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.

The International Buoy Programme for the Indian Ocean (IBPIO)

2.2.17 Mr Graham Jones, chairman of the IBPIO Programme Committee, reported on the success of the fourth Programme Committee meeting at Cape Town, South Africa, which was held jointly with ISABP and was preceded by a two-day technical workshop. He reported *inter alia* on the deployment status of buoys in the Indian Ocean area, drawing particular attention to the need to reverse a decline in barometer numbers, even though the overall number of buoys remains fairly constant. He mentioned the serious losses through vandalism reported by the NIOT (India) to their moored buoys in the Arabian Sea and Bay of Bengal, but that efforts are continuing to rebuild the network. He also reported on the publishing of a new promotional leaflet for the IBPIO.

2.2.18 Mr K. Premkumar (India) reported on the progress made by the National Data Buoy Programme (moored) of India in providing regular data for weather and cyclone forecasting, ocean satellite data validation, climate research programme, etc. Regarding the acts of vandalism that seriously damaged deep water buoys, he sought panel members' input on (i) tamper proof designs for buoy systems; (ii) warning system in the event any are intentionally damaged; (iii) creation of awareness among mariners on the importance of moored buoys.

2.2.19 Representatives of other panel action groups also reported on the problem of vandalism. The panel requested that WMO write to the International Hydrographic Organization (IHO) with a view that IHO promulgate 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.

The Tropical Atmosphere Ocean (TAO) array Implementation Panel (TIP)

2.2.20 Mr Paul Freitag reported that 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.

2.2.21 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.

2.2.22 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.

2.2.23 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.

2.2.24 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.

The Global Drifter Programme (GDP)

2.2.25 Mr Steve Cook reported that since the last year session of the panel, the GDP has been busier than usual with the merging of the Global Drifter Centre (GDC) into NOAA's Global Ocean Observing System (GOOS) Centre within the Physical Oceanography Division located at the Atlantic Oceanographic and Meteorological Laboratory (AOML) and the departure of some senior personnel. However the GDP has continued to cooperate with many national and international programmes and institutions duting this period of time and has continued see the global drifter network increase from about 650 last October to 820 at the end of September 1999.

2.2.26 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.

2.2.27 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.

2.2.28 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.

2.2.29 Plans are to continue to work closely with international colleagues, to increase communication, thereby improving the efficiency and effectiveness of all buoy deployments as well as their tracking and data insertion onto the GTS. 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.

2.2.30 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.

2.2.31 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.

2.2.32 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.

2.3 NATIONAL REPORTS

2.3.1 The panel had received written reports on current and planned buoy programmes from Australia, Brazil, Canada, France, Iceland, India, Indonesia, Japan, Netherlands, New Zealand, South Africa, Thailand, U.K., USA. As usual, these reports, as well as others submitted to the Secretariats before 30 November 1999, will be published in the panel's annual report.

2.4 EVALUATION SUBGROUP REPORT

2.4.1 Ms Elisabeth Horton, chair of the Evaluation Sub-group, reported that, during the intersessional period, problems identified with SVPB drifters and their variants led to the establishment of a sub-group to examine technical issues. The technical co-ordinator set up a forum associated with the DBCP web page. Users and manufacturers were encouraged to participate in the forum. Representatives from both sectors registered on the forum, and have been providing information exchange. Météo France has been analysing the data from SVPB and variants and providing comments. Météo France and the South African Weather Bureau have recently purchased SVPB drifters fitted with AIR and Vaïsala barometer sensors. These drifters will be deployed shortly and results compared. One of the SVPB manufacturers, Marlin-Yug, provided information on improvements they had implemented recently in the construction of their drifters. Although considerable progress has been made, much work remains to be done in the future. The panel therefore agreed that the sub-group should continue as an important ongoing component of the DBCP. Participants were thanked for their input and all panel members were encouraged to provide input.

2.4.2 The panel thanked the sub-group and its chairperson for the work accomplished so far. It requested that the sub-group report be published in the panel's annual report, under the chapter "Technical developments".

3. REQUIREMENTS

3.1 The panel briefly reviewed global requirements for buoy data in support, in particular, of operational meteorology and oceanography, major research programmes including the World Climate Research Programme (WCRP), the Global Ocean Observing System (GOOS), and the Global Climate bserving System (GCOS), on the basis of reports provided by these programmes.

3.2 The panel noted that no new requirements had been expressed recently within the fields of operational meteorology and oceanography, nor of research programmes

3.3 The panel recalled that the Workshop on the Implementation of Global Ocean Observations for GOOS/GCOS (Sydney, Australia, 4-7 March 1998) decided to develop an action plan for implementing the global ocean observations required by GOOS and GCOS. A small interim Implementation Advisory Group (IAG) was tasked with coordinating and providing oversight to the development and implementation of the action plan. The IAG *inter alia* adopted for the action plan the title: "*Global Physical Ocean Observations for GOOS/GCOS: an Action Plan for Existing Bodies and Mechanisms*".

3.4 The second meeting to develop an Implementation Action Plan for Global Ocean Observations for GOOS/GCOS (Paris, 30 November 1998) decided *inter alia* that the Action Plan would be published by the GOOS Project Office (GPO) as a GOOS and GCOS Numbered Report in the GOOS Series. The Action Plan was finalized by end August 1999 and is being published by IOC as GOOS Report No. 66, GCOS Report No. 51 and IOC/INF-1127.

3.5 The requirements are detailed in section 2.1.4 of the Action Plan and summarized in the table reproduced as *Annex III*. In addition, section 3.2 of the Action Plan presents a description of the panel's status, responsibilities, publications, structure, operational observing network, and data collection, exchange and management. It concludes with an analysis of the strengths and weaknesses of the panel as follows:

- ***Strengths****: Responsibilities for guidance; long history and experience in management of an operational marine observing system and the collection, exchange and management of the data; global networks of experts (meteorological and oceanographic) directly involved in buoy operations; co-ordination involving all major buoy deployers; active in improving buoy technology and performance; established and proven data management system.*

- ***Weaknesses:*** *Experience and existing expertise limited primarily to the management and applications of buoy programmes; financial involvement of only a small number of countries; does not initiate requirements, only services others; lack of co-ordination with other network components.*

3.6 The panel recognized that the Action Plan was a "dynamic" document, which would be updated as requirements and implementation status developed. The Conference OCEANOBS99 – The Ocean Observing System for Climate (Saint-Raphaël, France, 18-22 October 1999) would certainly lead to some re-definition of the *requirements* section of the document. In addition, the gradual development and implementation of JCOMM will eventually also require some further changes. Nevertheless, the basic function of the plan was to provide a blueprint for implementation actions and mechanisms in support of global physical ocean observations for climate, and as such it also provided a blueprint for the work of the panel itself in support of the same goal. Eventually, implementation of the plan as a whole will be undertaken through JCOMM, which would thus be the mechanism for integrating the panel's work into an overall ocean observing system. In the meantime, however, the panel agreed that it should ensure that the requirements for buoy data, and the role of the panel as specified in the plan, were fully taken into account in its own implementation strategy.

4. SCIENTIFIC AND TECHNICAL WORKSHOP

4.1 Under this agenda item, the panel reviewed briefly the results of the preceding workshop. The panel expressed its appreciation to Mr Ron McLaren for his excellent work in organizing and chairing the workshop. It agreed that both the theme and structure should be retained for the workshop associated with DBCP-XVI, and accepted the kind offer of Mr Wynn Jones to undertake the organization of this workshop.

5. DATA AND INFORMATION EXCHANGE

5.1 REPORTS BY BUOY DATA MANAGEMENT CENTRES

5.1.1 The panel reviewed the reports by the Responsible National Oceanographic Data Centre (RNODC) for drifting buoys, operated by the Canadian Marine Environmental Data Service (MEDS); and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Specialized Oceanographic Centre (SOC) for drifting buoys, operated by Météo France. Their full reports are published, as usual, in the panel's annual report.

5.1.2 Mr Jean Rolland presented the report of the SOC for Drifting Buoys, which performs a daily collection and archiving of buoy reports from the world ocean. As usual, the SOC produced monthly graphic products for drifting buoys, moored buoys and ships. Data are delivered on request or on a regular basis.

5.1.3 Mr André Bolduc presented the report of the RNODC for drifting buoys. At the end of 1998, the drifting buoy database contained 14,151,318 messages, an increase of 13.3% over last year's total. MEDS has developed a web site page on the RNODC activities. Regional and global monthly maps are available for the different action groups. A database of buoy QC messages has been built and can be searched on the web by the users.

5.1.4 The panel expressed its appreciation for the work of both centres. The panel requested the RNODC to develop regional maps for EGOS and for the Tasman Sea.

5.2 INFORMATION EXCHANGE

The DBCP Web Server

5.2.1 The technical coordinator reported on improvements and updates realised with the DBCP web site during the intersessional period. For example, following discussion at the last DBCP session, a list of recommended Argos message formats is now proposed (http://dbcp.nos.noaa.gov/dbcp/1ramf.html). A map permits to directly access a DBCP Action Group web site by directly clicking on its area of interest (http://dbcp.nos.noaa.gov/dbcp/dbcp_ag.html). 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).

5.2.2 The panel reminded 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 technical forum

5.2.3 At its 14th session, the panel discussed the possibility to develop a DBCP Internet forum as a means of debating on technical issues, answer technical questions, and exchange information among buoy operators or actors. A forum is a good complement to the DBCP web site and is directly linked to it. Documents, questions and answers can be accessible to anybody in the buoy community. Météo France and CLS offered to study feasibility and estimate costs involved in order to provide the DBCP with an answer hopefully in early 1999.

5.2.4 In May 1999, with assistance from the technical coordinator, CLS opened a forum on a trial basis *(http://www-dbcp.cls.fr)*. The forum presently includes themes such as Argos (technical questions, JTA information, etc.) DBCP (QC, buoy technology, etc.), GTS (formats, QC, technical questions, problems, etc.). It also includes "sub-forums" or "teams" reserved for a smaller community: SVPBW/Minimet evaluation (reserved to SVPBW evaluation group), DBCP (reserved to DBCP members), and EGOS (reserved to EGOS members). If desired, new teams dedicated to other DBCP Action Groups (AG) could be created on the forum with privileged access for AG Participants. For example, the AG team can be administered by the AG Coordinator as is the case for EGOS.

5.2.5 To use the forum, one must register first. To date, 28 people registered on the forum. This is an excellent figure for a start.

5.2.6 The panel thanked CLS/Service Argos for providing the facilities for the forum and decided that it was worthwhile to pursue the idea. It encouraged DBCP members, when appropriate, to make use of the forum for exchanging information and debating on technical issues.

5.2.7 The panel requested the technical coordinator to make reference on the web site to case studies regarding the impact of buoy data on meteorological analyses and forecasts. It further requested the technical coordinator to draft a short statement regarding vandalism of buoys, and to make this available also on the web server, for use by members as required.

Annual Report

5.2.8 The panel reviewed and agreed on the table of contents for its 1999 Annual Report, which is similar to that for the 1998 report. This report will be compiled by the IOC Secretariat, and as usual material to be included in the report should be submitted to IOC by 30 November 1999.

DBCP Publications

5.2.9 The panel noted that three publications in the Technical Document series had been issued in the past year:

(i) No. 13 – *Annual Report for 1998*
(ii) No. 14 – *Proceedings of the Technical Workshop with DBCP-XIV*
(iii) No. 15 – *DBCP Implementation Strategy*

This latter document was also available on the DBCP web server. The revised version of Technical Document No. 4 (SVPB Drifter Construction Manual) should be available for publication shortly, both on the web and in paper form, while other publications foreshadowed for the coming year included the 1999 Annual Report and the Proceedings of the current technical workshop.

DBCP Brochure

5.2.10 The panel noted with satisfaction that the English version of the DBCP brochure had been printed and distributed in early 1999, and that the French, Portuguese and Spanish versions had also now recently been printed and would be distributed before the end of 1999. It expressed its particular appreciation to Mr André Bolduc, and to MEDS, Canada, for organizing and funding this printing, which was recorded as an additional financial contribution by Canada to the work of the panel in the financial statement given in Annex VII. It also thanked Brazil for the Portuguese translation and WMO for arranging the French and Spanish translations. The panel considered that the brochure should be updated approximately every two years, and in this regard it requested members to provide the technical coordinator with comments and proposals for such an updating before June 2000, so that a revised version could be made available for consideration by DBCP-XVI.

Implementation Strategy

5.2.11 The panel recalled that its Implementation Strategy agreed at the previous session had been published as Technical Document No. 15, and was also available on the web server. It recognized that the strategy should be a dynamic document, updated in the light of developments in requirements and technology. In this context, it agreed that the strategy should be revised during the coming intersessional period, for consideration by DBCP-XVI, and accepted the kind offer of Mr David Meldrum to coordinate this revision.

6. TECHNICAL ISSUES

6.1. QUALITY CONTROL

6.1.1 The technical coordinator reported regarding quality control (QC) of buoy data and how the DBCP QC guidelines had been operated during the intersessional period.

6.1.2 Overall activity of QC guidelines had decreased a little in the last few years. The cause of this decrease is not clear. One possibility could be that Meteorological Centres are now more confident in the quality of the buoy data since the quality of the models had increased to a level where first guess fields were now very close to observed data. However, the magnitude of the QC guidelines activity is similar and the guidelines worked very efficiently during the period. 62 buoys had their status changed (132 last year (Aug 97 to July 98) versus 171 in 1997 and 210 in 1996).

6.1.3 For a total of 1551 buoys that reported onto the GTS during the period 1 July 1998 to 30 June 1999, following 225 status change proposals from PMOCs related to 155 buoys, 62 buoys had their status changed (i.e. 4.0% versus 9.6% last year, and 11% the year before). All 62 buoys were removed from GTS, or data from one of their sensors removed, and no buoy was recalibrated.

6.1.4 The panel encouraged the following centres to resume their activities under the QC guidelines as PMOC:

- The National Data Buoy Center (for global data)
- The Pacific Marine Environmental Laboratory (for TAO array data)
- The South African Weather Bureau (for the South Atlantic area)
- The European Center for Medium Range Weather Forecasts (for global data: they provide buoy monitoring statistics but do not make status change proposals for suspicious buoy data

anymore)

6.1.5 The MEDS, which is operating the RNODC/DB, informed the panel that they were archiving status change proposal messages from the QC guidelines and making those available through the web. The panel thanked MEDS for their efforts in this regard.

6.1.6 The technical coordinator showed evidence (buoy monitoring statistics) that the quality of buoy data was excellent, especially for air pressure (1.2 hPa RMS), SST (0.5C RMS), and wind (2 m/s RMS), including air pressure from SVPB drifters (1.3 hPa). When comparing observed data with first guess fields, higher RMS values were observed for wind speed data during the winter (2.6 m/s versus 2m/s) because of stronger winds and therefore larger errors (in absolute) in the model wind field. Although buoy technology did not evolve dramatically in the last ten year, improvements in NWP techniques during the same period permitted an eventual demonstration of the excellent quality of buoy data.

6.1.7 The South African Weather Bureau began to produce buoy monitoring statistics for the South Atlantic area from December 1998. Details regarding buoy monitoring statistics produced by ECMWF, UKMO, NCEP, Météo France, and SAWB can be found on the DBCP web site at http://dbcp.nos.noaa.gov/dbcp/monstats.html.

6.1.8 Finally, the panel agreed to update the quality control guidelines to reflect the fact that the TC is responsible for updating the list of Principal GTS Coordinators.

6.2. CODES

BUOY code

6.2.1 The technical coordinator presented a proposal for a modification of the BUOY code to include a limited number of metadata in BUOY reports. Buoy and drogue type is for example useful to sort out Lagrangian drifters from other types of buoys in the GTS data flow (GDP requirement). Anemometer height is useful for the models to correct wind speed data to the standard 10m height (it is difficult to provide the models regularly with an accurate and up to date list of wind buoys). When the WOTAN technique is used to measure wind, the anemometer type could be indicated in BUOY reports. Apart from metadata, for buoys equipped with thermistor strings, the hydrostatic pressure at one or more depths near the lower end of the cable is useful to compute estimates of the depths of the temperature probes using a simple model. This information could be included in BUOY reports as well.

6.2.2 The panel agreed in principle with this 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 would then finalize the proposal and pass it to the WMO Secretariat for consideration and approval by CBS in late 2000.

6.2.3 The CMM (now JCOMM) Working Group on Marine Observing Systems had proposed that the DBCP should develop changes to the BUOY code to enable all moored buoys to report on the GTS in this code rather than SHIP. The DBCP noted this proposal, which it agreed with in principle. It recommended to its members to provide the technical coordinator with a list of variables actually measured by buoys and which can be encoded in SHIP reports but cannot be presently encoded in BUOY reports. The panel asked the technical coordinator to compile the list and prepare a draft proposal for a code modification - for example a new section 5 could be added for such variables.

6.2.4 The DBCP urged its members to provide the technical coordinator with feedback before 1 March 2000. The draft would then be reviewed and finalized by an **ad hoc** subgroup, chaired by Eric Meindl and including representatives from Australia, Canada, Netherlands, U.K, and USA, in close consultation with an appropriate expert from CBS. The panel agreed that, ideally, these proposed modifications should also be finalized in time for consideration and approval by CBS in late 2000.

BUFR code

6.2.5 The technical coordinator informed the panel that a small number of new BUFR table entries had been proposed, to include certain variables in BUFR reports (e.g. anemometer height, hydrostatic pressure, height above station with higher accuracy). These modifications had been proposed for discussion at the October 1999 "fast-track" CBS meeting, for implementation in May 2000. With regard to the eventual implementation of distribution of buoy data in BUFR, the panel agreed that this should only be envisaged once a strong requirement for such distribution had been expressed by users. It therefore requested the technical coordinator and the Secretariats to keep it informed of the status of such a requirement.

6.3. ARGOS SYSTEM

6.3.1 The technical coordinator reported that a few improvements were realised with regard to the GTS sub-system. For example, data from buoys drifting in the vicinity of La Réunion Island and collected from the Local User Terminal operated at Météo France on the island are distributed in real time to the French Argos Global Processing Centre (FRGPC) in Toulouse for data processing and GTS distribution. Those data are also directly distributed in BUOY format to La Réunion. Other improvements realised included specific algorithms for eliminating quasi duplicate data when required, for processing TRITON moorings data, and for processing data from new Argos XBT devices.

6.3.2 At the 14th DBCP session, the panel recommended that developments for implementing a TAO mooring-specific algorithm to correct probe depths should be included by the JTA within the Argos development programme, provided that TIP decides to go forward with this. No decision had been taken by TIP so far.

6.3.3 The panel was reminded that members should pass requests to implement new requirements regarding the Argos GTS Sub-system to the technical coordinator.

6.3.4 At its 18th session, the JTA asked CLS to make an evaluation of developments required for GTS distribution of sub-surface float data. The technical coordinator had worked in conjunction with CLS on this matter and wrote technical specifications for inclusion of sub-surface float data processing within the GTS sub-system. The specifications have been sent by CLS to a French company for evaluation. Based upon requirements and request for GTS distribution of sub-surface float data as expressed by operators (e.g. France, Japan), plus JTA request to evaluate work, and based upon results from the evaluation, CLS decided to go ahead with the developments. Work should be finalised in January 2000.

6.3.5 Specifications have been written based upon existing formats of floats deployed by JMA (PALACE), Woods Hole (PALACE), and IFREMER (PROVOR). With this type of instrumentation, it would be unrealistic to aim for a universal data processing system, so standards based upon existing formats have been proposed. There is, however, substantial room for flexibility within proposed specifications (e.g. up to 120 points, delayed mode distribution, dynamic Argos messages, room to further develop specific QC tests).

6.3.6 The panel noted with interest and appreciation a presentation by CLS/Service Argos of planned developments and improvements in the Argos system in general over the next few years. Details of these developments will also be presented to the JTA meeting and would appear in an annex to the JTA report. The panel appreciated the information provided by CLS that it expected CLS and the Argos processing system to be fully Y2K compliant.

6.4. NEW COMMUNICATION TECHNIQUES AND FACILITIES

6.4.1 The panel recalled that, at its last session, it had requested its vice-chairman, Mr D Meldrum, to continue to review and report on new developments in the communications field of relevance to data buoy operations. A paper outlining these developments is in *Annex IV* and is published on the DBCP web site. The topic was also discussed in the Scientific and Technical Workshop immediately preceding the session. 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.

6.4.2 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.

6.4.3 The panel agreed that it should continue to monitor progress and that the information on the DBCP web server should be kept up to date. 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.

6.5 GTS BULLETIN HEADERS

6.5.1 The panel recalled that, at its 14th session, it had decided to change the list of GTS bulletin headers used for GTS distribution of buoy data from the Argos Global Processing Centers. This followed a request from the Global Drifter Programme (GDP) and the US GOOS Center to have dedicated GTS bulletin headers for GDP drifters in order to monitor them more easily. The panel established a working group, which included Bill Woodward and the technical coordinator, to work on the issue and make a proposal.

6.5.2 Such a proposal had been circulated among key players and a new list had finally been agreed upon. Details regarding the proposal can be found at the DBCP web site at http://dbcp.nos.noaa.gov/dbcp/newgtsbul.html The backup procedure (even and odd numbers) in case one of the two Argos global processing centres fails had not changed: 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.

6.5.3 The new list given in *Annex V* was advertised through DBCP and WWW channels, including the WWW Operational Newsletter of July/August 1999. The change was implemented on 13 October 1999 at 1500 UTC.

6.5.4 While considering specific GDP requirements, the panel recommended that for GDP buoys deployed in an area of interest of another DBCP Action Group, the GDP bulletin header should be used rather than the one for the other Action Group. For example, SSVX13 LFPW (GDP) should be used instead of SSVX03 LFPW (Southern Hemisphere) for a GDP buoy deployed in the South Atlantic and reporting on GTS via the FRGPC in Toulouse.

6.5.5 The panel thanked the technical coordinator and the working group for their efforts in proposing and implementing the new list.

6.6 METADATA

6.6.1 The panel discussed the issues of (i) compiling a catalogue of metadata regarding data buoys, and (i) including metadata in BUOY reports. It recognized that It is crucial for both scientific and operational purposes to have easy access to metadata concerning buoys which are reporting onto the GTS and also for archived data. When using the data, users must have certain information in hand in order to conduct their work as efficiently as possible (e.g. buoy type, drogue type, drogue depth, instruments and calibration procedures, anemometer height, etc.). For example, using FGGE type buoy for computing surface velocities is much less accurate than using Lagrangian drifters with Holey Sock drogue attached.

Metadata catalogue

6.6.2 The panel was informed that the JCOMM Sub-group on Marine Climatology was in the process of compiling a catalogue of metadata for all types of ODAS, both drifting and non-drifting. A draft format had been proposed by the sub-group, and this was discussed by the panel.

6.6.3 It was decided that DBCP members should provide the technical coordinator with their comments regarding the proposed format 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. The sub-group will meet in early 2000 and take the DBCP recommendations into account.

6.6.4 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.

6.6.5 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.

Including metadata in BUOY reports

6.6.6 The panel recognised that there was also a need to include certain types of metadata in BUOY reports. These included:

- Buoy type, drogue type, and drogue depth, if any;
- Anemometer height or indication that WOTAN is being used

Inclusion of such information requires small changes in the BUOY code, typically adding several fields in Section 4 plus related code tables. In addition, such changes would not require substantial developments at the Argos centres and LUTs, and information would be optional due to the difficulty sometimes to obtain relevant information from the buoy operators.

6.6.7 The panel decided that it was worthwhile to suggest related changes to the BUOY code. See discussion under code matters for details.

6.7. OTHER TECHNICAL ISSUES

SVPB drifters in the Southern Ocean

6.7.1 The Atlantic Oceanographic and Meteorological Laboratory (AOML) informed the panel that, because of priorities within the USA buoy community (NOAA and Scripps principally), which were basically to make surface velocity and SST **in situ** measurements in the world oceans, it was no longer in a position to purchase and deploy SVP Barometer drifters, in particular in the Southern Ocean. However, it would continue to deploy standard SVP drifters in large quantities (SST only). It also informed the DBCP that under certain conditions, interested meteorological agencies could use the GDP potential of deploying standard SVP drifters to upgrade such buoys with a barometer by paying only for the equivalent cost of the barometer. Costs of deployment, as well as the Argos communications costs (for full-on operation) would continue to be met by AOML.

6.7.2 The panel noted the likely loss of important atmospheric pressure data from the Southern Oceans which would result from this decision with considerable concern, and agreed that urgent actions needed to be considered to redress the situation if at all possible. As a first step, it requested WMO, and the national Meteorological Services most directly affected by the decision, to make direct representations on its behalf with NOAA, both to underline the negative impact of the decision and also to investigate the possibilities for it to be reversed, even partially.

6.7.3 With regard to the offer from AOML for contributions by meteorological services to the upgrade and deployment of SVPB drifters, the panel expressed its appreciation to AOML for this offer, while at the same time noting a number of reservations and concerns. These included in particular:

(i) Likely procurement and competitivity problems for meteorological services if only AOML were involved in the upgrading of buoys partly funded by meteorological services;
(ii) Since any barometer purchase would have to be made from fixed budgets, this implied a reduction in existing deployment programmes by meteorological services, with consequent implications also for the JTA;
(iii) The large failure rates of SVPBs, particularly on deployment, coupled with concerns regarding the quality of the SVPB barometers;
(iv) The need for direct involvement in decisions on deployment locations.

6.7.4 In view of these considerations, the panel recommended to meteorological services concerned to consult together and with other interested agencies, perhaps by way of the DBCP Forum, with a view to developing a common position regarding the offer from AOML. They should then undertake direct discussions with NOAA on a resolution of the problems and the possible eventual implementation of the offer.

Support for new programmes

6.7.5 The panel noted that the technical coordinator was becoming increasingly involved in assisting in the development of buoy programmes, in particular with regard to coastal buoys, in a number of countries. It agreed that this was an important activity, which fitted well within the spirit of its terms of reference, and should therefore be continued. At the same time, it recognized the potential importance of the technical coordinator being able to call on the expertise available in panel Member Countries when assisting in these development activities. It therefore decided to establish an ad hoc Programme Initiation Support Group for this purpose. Initial offers to participate in this group were made by Australia, Canada, France, India, South Africa, U.K. and the USA (AOML, NDBC, NAVOCEANO, PMEL). The technical coordinator was invited to contact appropriate people in these countries as necessary when developing new programme assistance plans. Finally under this item, the panel requested the IOC Secretariat to arrange for the existing Non-Drifting ODAS Catalogue, previously developed under IGOSS, to be made available in electronic form, and provided to the technical coordinator and MEDS to be placed on the appropriate web servers. The Secretariats and the technical coordinator should then ensure that the catalogue was regularly and frequently updated.

7. COORDINATION AND REPORTING PROCEDURES

7.1 The new Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) was established by WMO Congress and the IOC Assembly as the reporting and coordination mechanism for all operational marine bodies and activities of the two organizations. It is also now the primary implementation mechanism for GOOS and the ocean component of GCOS. The panel noted with interest a report on the status of implementation of JCOMM, as well as on the future relationship between the DBCP and the Commission. It expressed its appreciation for the fact that the technical coordinator had participated in the first transition planning meeting for JCOMM (St Petersburg, July 1999) on behalf of the panel. It agreed that both he and the chairman and vice chairs should continue to be closely involved in the development and implementation of JCOMM, including its structure and work programme.

7.2 The panel agreed that JCOMM represented a very significant and potentially far reaching step on the road to truly operational oceanography, in the same sense as operational meteorology. The integrating role of JCOMM was particularly important, and in this context the panel recognized the excellent example and model which it represented itself, in providing a forum and mechanism for coordination and integration in a specific field among meteorologists and oceanographers, research and operations. In addition, the technical coordinator, particularly in his dual role as DBCP/SOOP coordinator, now offered an example and perhaps a basis for the future technical coordination of all operational ocean observing systems under JCOMM. The panel therefore offered its full support for both the concept and practical implementation of JCOMM.

7.3 The panel recognized that the new reporting procedures agreed for JCOMM would necessitate some minor changes to its terms of reference. The draft new terms of reference are given in *Annex VI*, and the Secretariats were requested to present these to the forthcoming sessions of the Executive Councils of WMO and IOC for formal approval.

8. NEW ACTION GROUPS

8.1 No proposals for the formation of new regional or programmatic action groups of the panel were noted.

C. ADMINISTRATIVE COMPONENT

9. REPORTS

9.1 CHAIRMAN AND VICE-CHAIRMEN

9.1.1 The panel was presented with reports by its Chairman and Vice-chairmen on their respective activities during the intersessional period, and plans and proposals for on-going or future activities. The chairman reported that his fourth year of chairmanship of the DBCP has continued to be most interesting and challenging - the main activities during the year are summarized in the following paragraphs.

9.1.2. The chairman noted that progress has been made on most items in the intersessional work plan and action is in hand on all the remaining matters. The chairman wished to record his appreciation for the work of panel members and especially the efforts of the two vice chairmen, the technical coordinator, and the Secretariats of WMO and IOC in advancing the work plan.

9.1.3. During the intersessional period the chairman reported that his activities had somewhat reduced in the recent period compared to previous years, although there have been a range of very important issues involving the DBCP and its Action Groups over the year. The chairman was ably assisted by the vice-chairmen and technical coordinator in handling a number of these issues. He noted that the Interim Implementation Advisory Group (IIAG) that was set up at the Workshop on the Implementation of Global Ocean Observations for GOOS/GCOS that was held in Sydney in March 1998, had its first meeting in Paris last December. Panel members will recall that the IIAG was set up to progress an implementation plan of networks to obtain observations required to support the common GOOS/GCOS module. The panel was represented at the meeting by the technical coordinator, Mr Etienne Charpentier. As is reported under another item, Mr Meldrum updated the DBCP's Implementation Plan to provide the necessary support for GOOS/GCOS prior to the Paris meeting.

9.1.4. The chairman also noted that the closer cooperation with the DBCP and the Ship of Opportunity Programme Implementation Panel (SOOPIP), foreshadowed at last year's meeting, has advanced to the extent that the technical coordinator is now being shared between the two organizations. Details of the arrangements will be presented under another agenda item. Initial indications are that the sharing of Mr Charpentier's time has been most successful, especially for the SOOPIP community, but without any serious impact on the DBCP's programmes. This type of cooperation is going to become increasingly important in the future with the realigning and overlapping of the oceanographic and marine meteorology communities.

9.1.5. The chairman brought members attention to the IOC's agreement to proceed with the establishment of the Joint Technical Commission for Oceanography and Marine Meteorology

(JCOMM). Subsequently the First Transition Planning Meeting was held in St Petersburg in July this year to move towards the formal establishment of JCOMM. This new commission will amalgamate WMO's Commission for Marine Meteorology (CMM) and the joint WMO/IOC Integrated Global Ocean Services System (IGOSS). The DBCP was represented by the technical coordinator, Mr Etienne Charpentier - amongst others, Dr Peter Dexter, from the WMO Secretariat, was also present.

9.1.6. The chairman noted that the DBCP's Action Groups had another successful and productive year. He was particularly pleased to report the success of the joint meeting of the South Atlantic and Indian Ocean groups (ISABP/IBPIO) in Capetown held in July. The North Atlantic group (EGOS) has continued to prosper under the new chairmanship of Wynn Jones. The other groups have also continued to contribute to the on-going success of the panel in their respective advancement of buoy matters. The chairman also noted that the forthcoming closer cooperation of various oceanographic operational panels will provide further opportunities for the panel and its members.

9.1.7. The chairman highlighted the continuing production of technical documents in the DBCP series - covering the Annual Report for 1998, the Technical Presentations made at the Fourteenth Session and the Implementation Strategy.

9.1.8. The chairman expressed his appreciation for the assistance of the two vice-chairmen during the intersessional period, particularly with respect to representing the panel at various international meetings. He also expressed his thanks to the technical coordinator and the two Secretariats.

9.1.9. During the intersessional period, the main DBCP-related activities in which Mr D. Meldrum, vice-chairman, was involved were as follows:

(i) **Mobile satellite systems.** A close watch was kept on developments in this area, and an updated information paper produced for DBCP XV. Operational experience has been gained with both the Orbcomm and Iridium systems in the course of research projects at Dunstaffnage Marine Laboratory, and the results of these trials is included in the above paper.

(ii) **UK Argos Users' Meeting.** This meeting was hosted at Dunstaffnage, and the opportunity was taken to inform attendees of the work of the DBCP and its technical coordinator, and to encourage buoy operators to become involved in its activities.

9.1.10 During the past 12 months, Mr E. Meindl, vice-chairman, participated in the following activities on behalf of the DBCP:

(i) From July 26 to July 30, 1999, he participated in the joint technical workshop and annual meeting of the International South Atlantic Buoy Programme and the International Buoy Programme for the Indian Ocean. He provided two presentations at the technical workshop. In the first presentation, he summarized and presented highlights of the DBCP Technical Workshop conducted prior to the 14th session of the DBCP in Marathon, FL, USA. In the second presentation, he summarized the activities at the previous DBCP using information from Etienne Charpentier. This briefing emphasized issues appropriate to the ISABP/IBPIO.

(ii) During the year, he communicated on a few occasions with Mr. Ron McLaren, chairman of the 15th DBCP Technical Workshop, regarding how to prepare for the workshop.

9.1.11 The panel expressed its sincere appreciation to the chairman and both vice-chairmen for their efforts on behalf of the panel over the past year.

9.2 SECRETARIATS

9.2.1 The WMO Secretariat representative reported to the session on the various activities undertaken by WMO in support of the panel during the past 12 months. Panel members were urged in particular to check carefully the lists made available by WMO of national focal points for the DBCP and for logistic support, as well as the WMO buoy assignments. These latter now include assignments made under the new scheme for profiling floats agreed at DBCP-XIV, which seemed to be working satisfactorily.

9.2.2 The representative of the IOC Secretariat reported that the IOC Assembly, at its twentieth session (29 June - 9 July 1999), noted the achievements of the Panel and commended it for its contribution to the development of the Implementation Action Plan for Global Ocean Observation to meet the requirements of GOOS and GCOS. The Assembly further highlighted the close relationship between the panel's undertakings, the activities under the Ship-of-Opportunity Programme and the Argo project, in that those three bodies/programmes are presently the core of operational oceanography with regard to *in situ* measurements. The Assembly concluded in urging Member States to consider contributing to funding the post of the panel's technical coordinator, which is now combined with that of technical coordinator for the Ship-of-Opportunity Programme.

9.2.3 Other Assembly decisions did not directly address the panel's activities, but were of relevance to its work:

(i) as expected, the Assembly agreed to establish JCOMM (see item 8);

(ii) the Assembly instructed "*the Executive Secretary IOC to establish an* ad hoc *Working Group on Oceanographic Data Exchange Policy, including the two co-chairpersons of JCOMM and the chairperson of IODE, and other experts, to review existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products, with a view to proposing to the next session of the Assembly:*
   (a) a restatement of the general IOC principles and policy with regard to oceanographic data exchange, and
   (b) *a statement of recommended practices and the required institutional arrangements for the operational exchange of oceanographic data*."

9.2.4 The panel noted this last piece of information with interest. It recommended that its members give some thoughts to the question of data policy and communicate their conclusions to the chairman, who will then address the interim co-chairmen of JCOMM and communicate to them the views of the panel in this regard.

10. FINANCIAL AND ADMINISTRATIVE MATTERS

10.1. FINANCIAL SITUATION

10.1.1 The panel considered the financial statements provided by IOC and WMO as follows:

(i) Finalized IOC account 1 June 1998 - 31 May 1999;
(ii) Interim WMO account 1 January 1998 - 30 September 1999;
(iii) Provisional WMO statement of estimated income and expenditure to 31 May 2000.

These statements are reproduced in *Annex VII*. The panel approved and accepted these various statements as appropriate.

10.2. CONTRACTS

10.2.1 The contracts established by IOC/UNESCO for the employment and logistic support for the position of the technical coordinator were considered and approved by the panel.

10.3. FUTURE COMMITMENTS

10.3.1 The panel recalled the agreement made with Mr Charpentier at the end of 1998, that he would be willing to remain as technical coordinator, located in Toulouse and employed by IOC/UNESCO, until at least May 2001. It therefore decided to continue the existing arrangements for the next financial period, 1 June 2000 – 31 May 2001, subject to the availability of funds. With regard to future years, the panel noted the agreement of Mr Charpentier to inform the chairman and the Secretariats, by 1 December 1999, of his desire to continue as technical coordinator beyond 31 May 2001. In the event of a decision to continue on the part of Mr Charpentier, it was agreed by the panel that it would retain him as technical coordinator, subject to the availability of funds.

10.3.2 The panel recognized that all panel Member States were continuing to experience severe financial constraints, and that this situation was likely to continue for some time. At the same time, it agreed that the technical coordinator position was essential to the ongoing success of the panel, and that a budget for other activities (publications, travel, special studies, etc.) was also essential if the panel was to play its full role in facilitating buoy programmes worldwide and in contributing to the development of operational oceanography. It therefore agreed on the necessity of maintaining a budget appropriate for these purposes.

10.3.3 The panel then reviewed likely expenditure requirements for 2000-2001 in the light of anticipated income. In this context, it noted with appreciation the anticipated contributions from SOOPIP participants, which reflected the work being undertaken by Mr Charpentier in support of SOOP, but which also provided a valuable addition to the overall support budget for both programmes. In the light of requirements for expenditure in support of both DBCP and SOOP, the 2000/2001 expenditure estimates are shown in *Annex VIII*. On the basis of provisional commitments made at the meeting oir otherwise, as well as anticipated contributions from SOOP participants, the panel therefore drew up a table of provisional contributions for 2000-2001, which is also given in *Annex VIII*. The panel expressed its appreciation to all contributing Member States for their continuing support for the work of the panel. It requested the Secretariats, as in past years, to ensure that the invoices for these contributions were issued as soon as possible, and in any case before the end of 1999. At the same time, it reiterated the need for a budget fully appropriate to its role and requirements, and therefore urged the Secretariats and all members to make additional efforts to recruit additional contributors to the trust fund, no matter how small their contributions might be.

10.4. REVIEW OF THE TASKS OF THE TECHNICAL COORDINATOR

10.4.1 The panel recalled its decision at DBCP-XIV, that the technical coordinator could also serve as technical coordinator for the SOOPIP, provided that appropriate budgetary contributions were received from SOOPIP Member States, that the support provided by the technical coordinator to DBCP members was not severely compromised, and that the situation would be reviewed at future panel sessions. In this context, it noted with appreciation the budgetary contributions in 1999 from SOOPIP Member States of USD 25k, with anticipated contributions in 2000 of at least USD 20k. At the same time it agreed that the ongoing support from the technical coordinator for the panel and its members was exemplary, while at the same time the synergy being developed by the joint coordinator role was an excellent example for the future coordination of operational ocean observing systems under JCOMM. It therefore agreed to continue the present dual coordinator arrangements, subject to continuing financial support from SOOPIP Member States, and to review the arrangements at each panel session.

D. CONCLUDING COMPONENT

11. RECOMMENDATIONS TO THE ARGOS JTA

11.1 The panel noted that additional LUTs had become available to support the ISABP but that connections to the ARGOS processing centres were not yet implemented. The panel therefore requested its chairman to recommend to the JTA that these connections should be implemented as soon as possible as part of the ARGOS development programme.

11.2 The panel was informed that a programme of the Brazlian Space Agency (INPE) would provide a three-satellite system with a payload fully compatible with the ARGOS system but without store and forward capability. Brazil had developed the system for its own needs with data collection instruments based on the Argos system technology working on bent-pipe mode only - neither onboard processing nor data storage. Transmission frequency used is within Argos-2 bandwidth thus Argos transmitters using it will be received both by NOAA flying Argos-2 generation and Brazilian satellites.

11.3 Brazilian « Argos-type » equipment will fly on:

1. Brazilian SCD satellites, flying on low-orbit equatorial planes: SCD1 was launched in early 1993, SCD2 was launched in early 1999. Both satellites are operating. SCD3 is schedule for 2001-2002.
2. On CBERS (China Brazil cooperation) polar orbiting satellites, dedicated to Earth observation. First satellite, CBERS1, was successfully launched in October 1999.
3. On SACI 2, equatorial micro satellite, whose launch is planned for 1999.

There had been some discussions between CNES and INPE to fly Argos-3 equipment onboard SCD-3.

11.4 The panel noted that this system had great potential for DBCP programmes and it requested the chairman to recommend to the JTA that it should be integrated into the ARGOS system if possible through agreement between the ARGOS Operations Committee and INPE.

11.5 Finally, the DBCP recognized the success of the JTA in the past two years in stabilizing costs while encouraging growth of ocean observing networks. In view of the likelihood that there will be few new sources of funding for such programs in the foreseeable future, the DBCP urged the JTA's continued emphasis on cost control, increased system efficiency, and greater usage of data collection and distribution systems.

12. WORKPLAN

12.1 As in previous years, the panel reviewed and updated its operating procedures, as well as the overall workplan for itself and the technical coordinator for the coming intersessional period. These work plans are given in *Annex IX*.

13. ELECTION OF THE CHAIRMAN AND THE VICE-CHAIRMEN OF THE PANEL

13.1 The panel re-elected Mr Graeme Brough as its chairman, to serve until the end of the next panel session. It also re-elected Mr Eric Meindl and Mr David Meldrum as its vice-chairmen for the same period.

14. DATE AND PLACE OF THE NEXT SESSION

14.1 The panel recalled its agreement at DBCP-XIIII that, in principle, the session in 2000 would take place in Canada. It was therefore pleased to accept the confirmation from Environment Canada to host DBCP-XVI in Victoria, British Columbia, subject as always to a similar agreement by JTA-XIX. Tentative dates for the session were agreed as 16-20 October 2000. The panel also noted with appreciation the tentative offer from Australia to host the 2001 session in Perth, as usual towards the end of October.

15. CLOSURE OF THE SESSION

15.1 In closing the session, the chairman Mr Graeme Brough once again paid a special tribute to MetService New Zealand and to Ms Julie Fletcher for the excellent facilities, support and hospitality that they had provided for the meeting, which had contributed substantially to its success. He also thanked participants for their active and positive contributions to the meeting and to the work of the panel in general.

15.2 The fifteenth session of the Data Buoy Cooperation Panel closed at 19.30 hours on Friday, 29 October 1999.

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AGENDA

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1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SCIENTIFIC AND TECHNICAL WORKSHOP
1.2 OPENING OF THE SESSION
1.3 ADOPTION OF THE AGENDA
1.4 WORKING ARRANGEMENTS

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2.2 ACTION GROUPS AND RELATED PROGRAMMES
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3.3 GLOBAL OCEAN OBSERVING SYSTEM (GOOS) AND GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)

4. SCIENTIFIC AND TECHNICAL WORKSHOP

5. DATA AND INFORMATION EXCHANGE

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9.2 SECRETARIATS

10. FINANCIAL AND ADMINISTRATIVE MATTERS

10.1 FINANCIAL SITUATION
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10.3 FUTURE COMMITMENTS
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11. RECOMMENDATIONS TO THE ARGOS JTA

12. WORKPLAN

13. ELECTION OF THE CHAIRMAN AND THE VICE-CHAIRMEN OF THE PANEL

14. DATE AND PLACE OF THE NEXT SESSION

15. CLOSURE OF THE SESSION

TABULATED OBSERVATIONAL DATA REQUIREMENTS FOR GOOS/GCOS

Table A

A summary of the sampling requirements for the global ocean, based largely on OOSDP (1995), but with revisions as appropriate. These are a statement of the required *measurement network* characteristics, not the characteristics of the derived field. The field estimates must factor in geophysical noise and unsampled signal. Some projections (largely unverified) have been included for GODAE.

SAMPLING REQUIREMENTS FOR THE GLOBAL OCEAN

Code	Application	Variable	Hor. Res.	Vert. Res.	Time Res.	No. of samples	Accuracy
A	NWP, climate, mesoscale ocean	Remote SST	10 km	-	6 hours	1	0.1-0.3°C
B	Bias correction, trends	*In situ* SST	500 km	-	1 week	25	0.2-0.5°C
C	Climate variability	Sea surface salinity	200 km	-	10 day	1	0.1
D	Climate prediction and variability	Surface wind	2°	-	1-2 day	1-4	0.5-1.0 m/s in the components
E	Mesoscale, coastal	Surface wind	50 km	-	1 day	1	1-2 m/s
F	Climate	Heat flux	2° x 5°	-	month	50	Net: 10 W/m^2
G	Climate	Precip.	2° x 5°	-	daily	Several	5 cm/month
H	Climate change trends	Sea level	30-50 gauges + GPS with altimetry, or several 100 gauges +GPS	-	monthly means		1 cm, giving 0.1 mm/yr accuracy trends over 1-2 decades
I	Climate variability	Sea level anomalies	100-200 km	-	10-30 days	~ 10	2 cm
J	Mesoscale variability	Sea level anomalies	25-50 km	-	2 days	1	2-4 cm
K	Climate, short-range prediction	sea ice extent, concentration	~ 30 km	-	1 day	1	10-30 km 2-5%
L	Climate, short-range prediction	sea ice velocity	~ 200 km	-	Daily	1	~ cm/s
M	Climate	sea ice volume, thickness	500 km	-	monthly	1	~ 30 cm
N	Climate	surface pCO_2	25-100 km	-	daily	1	0.2-0.3 µatm
O	ENSO prediction	T(z)	1.5° x 15°	15 m over 500 m	5 days	4	0.2°C
P	Climate variability	T(z)	1.5° x 5°	~ 5 vertical modes	1 month	1	0.2°C
Q	Mesoscale ocean	T(z)	50 km	~ 5 modes	10 days	1	0.2°C
R	Climate	S(z)	large-scale	~ 30 m	monthly	1	0.01
S	Climate, short-range prediction	U(surface)	600 km	-	month	1	2 cm/s
T	Climate model validation	U(z)	a few places	30 m	monthly means	30	2 cm/s

Table B

Ocean Remote Sensing Requirements

OBSERVATIONS				OPTIMIZED REQUIREMENTS				THRESHOLD REQUIREMENTS			
Code	**Application**	**Variable**	**Type**	**Horizontal scal e (km)**	**Cycle**	**Time**	**Accuracy**	**Horizontal scale (km)**	**Cycle**	**Time**	**Accuracy**
ALTIMETRY											
A	Mesoscale Variability	Sea Surface Topography	input	25	7 days	2 days	2 cm	100	30 days	15 days	10 cm
B	Large- scale Variability (seasonal, tides, gyres)	Sea Surface Topography	input	100	10 days	2 days	1 cm	300	10 days	10 days	2 cm
C	Mean Sea Level Variations	Sea Surface Topography	input	200	decades	10 days	1 mm/year	1000	decades	10 days	5 mm/year
D	Absolute Circulation Heat transport	Sea Surface Topography	input	100	N/A	N/A	1 cm	500	N/A	N/A	5 - 10 cm
E	Geoid Estimation	Geoid	Base	100	N/A	N/A	2 cm	500	N/A	N/A	~ 1 cm
SURFACE WIND VECTORS											
F	Wind-forced Circulation	Wind Field	input	25	1 day	1 day	1-2 m/second 20°	100	7 days	7 days	2 m/second 30°

Footnotes:

A requires wave height + wind (EM bias correction) measured from altimeter, water vapor content measured from on board radiometer, and ionospheric content / measured from 2 frequencies altimeter.
B requires, in addition, precise positioning system: accuracy 1-2 cm for a spatial resolution of 100 km.; need to address aliasing from solar tides with non-sun- synchronous orbits.
C requires, in addition precise monitoring of transit time in the radar altimeter.
A, B, C require repeat track at ± 1 km to filter out unknowns on geoid.
A requires adequate sampling: at least 2, and better 3, satellites simultaneously.
A, B, C require long lifetime, continuity, cross calibration.
D requires absolute calibration.
E requires *one-off* missions with both high- and broad-resolution determination.
F Wind field requirements for sea state determination normally exceed sampling requirements for wind forcing.

Table B of Ocean Remote Sensing Requirements

(continued)

OBSERVATIONS				OPTIMIZED REQUIREMENTS				THRESHOLD REQUIREMENTS			
Code	**Application**	**Variable**	**Type input**	**Horizontal (km)**	**Cycle**	**Time**	**Accuracy**	**horizontal (km)**	**Cycle**	**Time**	**Accuracy**
SEA SURFACE RADIATIVE											
G	Ocean/ Atmosphere coupling	Sea Surface Temperature (Radiometer)	input	10	6 hours	6 hours	0.1 K (relative)	300	30 days	30 days	1 K
H	Ocean Forcing	Short wave irradiance	input	200	1 day	1 day	15 W/m^2	500	7 days	7 days	20-30 W/m^2
REMOTE SALINITY											
I	Circulation and Water Transport	Salinity	input	200	10 days	10 days	0.1 PSU	500	10 days	10 days	1 PSU
SEA ICE											
J	Ice-Ocean Coupling	Sea Ice Cover	input	10	1 day	3 hours	2 %	100	7 days	1 day	10 %
OCEAN COLOR											
K	Upwelling to Recirculation	Ocean Color Signal	input	25	1 day	1 day	2 %	100	1 day	1 day	10 %
SURFACE WAVES											
L	Sea State Prediction	Significant wave height	input	100	3 hours	3 hours	0.5 meters	250	7 days	12 hours	1 meter
M	Sea State Prediction	Period and Direction	input	10	1 hour	2 hours	2 second 10°	30	6 hours	4 hours	1 second 20°

Footnotes: G requires high resolution sea surface temperature: new geostationary satellite + combination with low satellite.

The requirements include consideration of climate applications as determined by the OOPC and ocean forecasting/estimation as determined by GODAE.

The requirements beyond the climate module have not been detailed here.

DEVELOPMENTS IN SATELLITE COMMUNICATION SYSTEMS Update - October 1999

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1. INTRODUCTION

Mobile satellite systems (MSS) may be classified according to orbit altitude as follows:

- GEO - geostationary earth orbit, approx altitude: 35 000 km
- MEO - mid-altitude earth orbit, approx altitude: 10 000 km
- LEO - low earth orbit, approx altitude: <1 000 km

LEOs can be further sub-divided into Big LEO and Little LEO categories. Big LEOs will offer voice, fax, telex, paging and data capability, whereas little LEOs will offer data capability only, either on a real-time direct readout ('bent pipe') basis, or as a store-and-forward service.

Since the satellite footprint decreases in size as the orbit gets lower, LEO and MEO systems require larger constellations than GEO satellites in order to achieve global coverage and avoid data delays. Less energy is, however, generally required for LEO and MEO satellite communication because of the shorter average distance between transmitter and satellite. Some systems implement several high-gain antennas to generate ‘spot beams’ and so reduce the requirement of the mobile to have a complex antenna and/or high output power. A key feature of several MSS currently under development will be their inter-operability with existing public switched telephone and cellular networks, using a dual-mode handset, for example.

Because of the commercial forces which are driving the implementation of the new systems, many will primarily focus on land masses and centres of population, and will not offer truly global or polar coverage. These systems will not in general be acceptable for global ocean monitoring. Furthermore, while the technical capabilities for the new MSS do currently exist, delays are inevitable due to problems with spectrum allocation, licensing (in each country where the service will be offered), company financing, and availability of launch vehicles and ground stations. It is unlikely that all of the planned systems will overcome all of these hurdles. Indeed, major financial difficulties have hit a number of systems, with Starsys having been cancelled, and both Iridium and ICO having filed for Chapter 11 bankruptcy protection in the US.

Some systems do offer significantly enhanced capabilities compared with existing methods. Potential advantages include two-way communication, more timely observations, and greater data rates and volumes. Some systems may also prove to be considerably less expensive than existing channels, although this is as yet unclear. However, dangers will exist for data buoy users of most MSS, in that they will generally be small minority users of the system, with consequent lack of influence in regard to pricing. The arrangements for data distribution are also unlikely to be tailored towards data buoy applications, in particular those that require data insertion on the GTS.

2. LITTLE LEOS

2.1 ARGOS

Enhancements to the Argos on board equipment (‘Argos-2') include increased bandwidth and sensitivity, with two-way communication (‘downlink messaging’) to follow. Future Argos equipment will fly on the Japanese ADEOS-II and European METOPS satellites in addition to a continuing programme of launches on board NOAA satellites. The system is one of the few that offers true global coverage, and currently has no commercial requirement to recover the cost of the launch or space segment equipment. Proposed changes to the rules within the US regarding fair competition by fully commercial MSS may impact the service that CLS/Service Argos will ultimately be able to offer, and CLS/Service Argos have altered their admissions procedure in response to these moves.

The first of the Argos-2 satellites, NOAA-K (NOAA-15) was launched in May 1998 and is now operational, replacing NOAA-D (NOAA-12) as the morning satellite. Several new direct readout stations have been commissioned recently, including Halifax, Edmonton, Monterey, Réunion, Cape Town, Lima, Tokyo and Largo. This continues the programme of improving data timeliness by exploiting use of Argos in 'bent-pipe' mode. Further enhancements to the on board equipment (Argos-3) and to the ground processing centres are at the planning stage.

2.2 ORBCOMM

This company was awarded the first FCC Little-LEO licence in late 1994. Satellites consist of discs about one metre in diameter prior to deployment of solar panels and antenna. Two satellites were launched into polar orbit during 1995, using a Pegasus rocket piggy-backed on to a Lockheed L-1011 aircraft. After a prolonged period of launcher problems, 28 satellites (more or less the complete constellation) are now in orbit. Of those, 24 have been declared operational. The A, B and C planes are at 45° inclination and therefore have poor coverage at high latitudes: only three satellites, in the F and G planes (70°), offer a near-polar service. A launch of 7 or 8 more satellites in an equatorial plane is planned for late 1999, at a higher altitude to improve the satellite coverage near the tropics. A further 8-satellite launch, possibly to a high inclination orbit, is scheduled for 2000.

The system offers both bent-pipe and store-and-forward two-way messaging capabilities, operating in the VHF (138-148 MHz) band. User terminals are known as ‘Subscriber Communicators’ (SCs). Although there have been significant problems with interference close to urban areas, this is not expected to impact offshore operations, and some early trials of the system have been encouraging. Many more trials have now taken place and operational confidence in the system is starting to grow, although detailed and accurate technical information is very difficult to obtain.

The message structure currently consists of packets transmitted at 2400 bps (scheduled to rise to 4800 bps), and coverage will be global and near-continuous when the full constellation is in place. Messages are acknowledged by the system when correctly received and delivered to a user-nominated mailbox. The platform position is determined, if required, using propagation delay data and doppler shift, or by an on-board GPS receiver. Position accuracy without GPS is expected to be similar to that offered by Argos.

The limitations on the store and forward mode messages (known as globalgrams) are beginning to become apparent, with SC originated messages limited to 229 bytes and SC terminated messages limited to 182 bytes. Each SC can send a maximum of 16 globalgrams to a satellite in one pass. It is not possible to send or receive globalgrams when the satellite is in view of a gateway station.

Authorised transceiver manufacturers include Panasonic, Elisra (Stellar), Torrey Science, Magellan and Scientific Atlanta. Elisra were the first to offer a transceiver with a fully integrated GPS engine, although Panasonic now also have one available. Scientific Atlanta have made a chip-set available to third-party integrators. Prices of most units are around $1000.

The ground segment has started to expand, and there are now active stations in Italy, Argentina, Brazil, Japan and Korea in addition to the four in the US. However the Japanese and Korean stations are not available for international registrations. Further stations are under construction in Malaysia, Morocco, and Brazil, and potential sites have been identified in Russia, Ukraine, Philippines, Botswana, Australia and Oman. 16 international service distribution partners have been licensed. Non-US customers have faced considerable difficulties because of the absence of ground stations, lack of spectrum licensing and the presence of other in-band users. However the situation is improving rapidly. Many operational details, and the costs of using the system, which will mainly be available to users through service providers ('resellers'), are only now starting to become known.

2.3 STARSYS

This system was to have been broadly similar to ORBCOMM, except that it offered bent pipe mode only, thus limiting its usefulness to coastal areas. Further work on the system, in which CLS/Service Argos was closely involved, has been suspended because of difficulties in securing financial backing. The FCC licence was returned in late 1997.

2.4 IRIS/LLMS

This European-led system appears to be similar to Argos, using two polar-orbiting satellites with store-and-forward capability. However, terminals are alerted by the satellite downlink signal, and two-way communications and message acknowledgement are supported. Location is by doppler and ranging, and message lengths of up to a few kilobytes are permitted. Some provision is planned for terminal-terminal communication within the satellite footprint. No launches have yet been reported, although an 'attached payload' test system was to have been deployed in early 1998.

2.5 VITASAT/GEMNET

This was a 36 + 2 satellite constellation proposed by CTA Commercial systems. Their experimental satellite was the failed VITASAT launch in 1995. CTA is reported to have been taken over by Orbital Science Corporation, the parent organisation of ORBCOMM. Currently there are two satellites in orbit, with two more planned. The 36-satellite GEMNET component has been cancelled.

2.6 FAISAT

This planned 38 satellite constellation will provide data messaging services, principally aimed at small messages (~ 100 bytes), but with support for larger messages as well. It will operate in both bent-pipe and store and forward modes. The first satellite launch, on the Russian Cosmos vehicle, is scheduled for late 1999 or early 2000. Further launches are expected to occur roughly twice a year. The system received FCC authorisation in April 1998.

2.7 LEO ONE

This consists of a planned 48 satellite constellation offering store-and-forward two-way messaging at 9600 bps and above. An FCC license was granted in February 1998, and a spectrum sharing agreement has apparently been signed. Commercial operation is expected to start in 2002, although no details are known regarding the launch schedule.

2.8 GONETS

Two GONETS LEO messaging systems have been proposed by the former Soviet Union, using both UHF and L/S-band communications channels. Both will offer true global coverage from high inclination 1400 km orbits. One system, GONETS-D already has 8 satellites in orbit with a further 36 planned. No operational experience has been reported to date.

2.9 OTHER SYSTEMS

Six E-Sat satellites are planned, three to be launched in mid 1999. The system is aimed principally at the US utility industry for remote metering. Other planned systems include Temisat and Courier, both of which are intended to offer global coverage. Little further has been heard of the SAFIR store-and-forward messaging system, which has two satellites in orbit.

3. BIG LEOS

3.1 IRIDIUM

Iridium filed for Chapter 11 bankruptcy protection in August 1999, and are currently undergoing financial restructuring. Despite the continued financial difficulties the system is operational, service having started in late 1998. Iridium now has 72 satellites in orbit and the constellation, offering true global coverage, is complete. Of particular interest to data buoy operators is the Motorola L-band transceiver module, which may be integrated with sensor electronics in the same way as an Argos PTT. A data service using this module, which is now becoming available in small quantities, is supposed to commence soon, but no launch date has yet been announced.

The costs of using the system are expected to be broadly similar to Argos, but with the potential for much higher data volumes. There is currently a one way short message service allowing emails of up to 119 bytes to be sent to any Iridium phone. This service is free. Voice calls from international waters are currently $3/min, and there are no monthly service charges until January 2000 at the earliest. The system may prove to be relatively costly for users sending only short data messages, but operational experience is needed before a true assessment can be made. Iridium has a second generation system planned, called MacroCell. This will have 96 LEO satellites, and will provide data transfer at up to 384 kbps (compared with 4.8 kbps in the current system). Given the current situation the implementation of this system is questionable.

3.2 TELEDESIC

This ‘Internet in the Sky’ system plans a 288 (originally 840) LEO constellation to carry global broadband services such as video conferencing, the Internet, etc. It recently merged with Celestri, another proposed broadband LEO system. Since then there has been some doubt over the actual makeup of the combined constellation. Teledesic has suffered from the financial difficulties of Iridium, as Motorola, one of Teledesic’s primary investors and head of the industrial partnership developing the system, has transferred engineering effort and funding to prop up Iridium. Teledesic has received FCC licensing for operations in the USA.

3.3 GLOBALSTAR

Globalstar is Iridium’s main competitor in the mobile satellite telephony market. After a bad start in September 1998 when 12 satellites were lost in a single launch failure, Globalstar now has 40 satellites in space, and is commencing a limited commercial service (October 1999). It is planned to have the complete constellation (48 + 4 spares) in service by the end of 1999. Globalstar differs significantly from Iridium in that for a call to be made the user must be in the same satellite footprint as a gateway station. There is no inter-satellite relay capability as in Iridium. This means that coverage will not be truly global, especially in the short term as far fewer gateways have been built than originally planned. However Globalstar is currently in a much stronger financial position than any of its competitors (principally Iridium and ICO), and voice quality has been reported to be superior to the Iridium system.

Data services at 9600 bps are planned to be commercially available sometime in 2000. As with Iridium this is likely to be very dependent on the initial success of the basic voice service. Globalstar also has a second generation system planned, said to involve 64 LEO satellites and 4 GEO satellites. Little else is known about the planned enhancements of this system.

3.4 OTHER SYSTEMS

Other planned big LEOs include Ecco (by the owners of Orbcomm), Ellipso, Signal and SkyBridge.

4. MEOS

4.1 ICO

ICO is the third of the three main players in the global satellite telephony market. However it also has suffered severe financial difficulties and filed for Chapter 11 bankruptcy protection in August 1999, just 2 weeks after Iridium. The system, formerly known as Inmarsat-P but now fully autonomous, will use a constellation of 12 MEO satellites backed by a 12-station ground segment to provide a truly global voice, fax, data and messaging service. The aim is to complement and be inter-operable with existing digital cellular telephone networks. Prior to filing for bankruptcy protection, the first launch was planned for late 1999 with commercial service roll out scheduled for the third quarter of 2000.

When the complete constellation is in service two satellites will always be visible from any point on the earth's surface. The space segment is being built by the Hughes Corporation. Data rate will be 9600 bps. Many large manufacturers are engaged in developing dual mode ICO/cellphone handsets. An ICO 'engine, is to be defined for the benefit of third-party equipment manufacturers.

4.2 WEST

9 satellites are planned, with service scheduled to begin in Europe in 2003.

5. GEOS

5.1 INMARSAT D+.

This is an extension of the Inmarsat D service using the new (spot-beam) Inmarsat Phase 3 satellites and small, low-power user terminals. The system was initially designed as a global pager or data broadcast service, with the return path from the mobile used only as an acknowledgement. D+ permits greater flexibility, with uplink packets of up to 128 bits. The first ground station has been implemented in the Netherlands by the existing Inmarsat service provider (Station 12), but useful technical information has been difficult to obtain.

D+ transceiver manufacturers include JRC, Calian, STK-Atlas and Skywave. The JRC unit features an integral GPS receiver and combined GPS/Inmarsat antenna, and is the first to receive type approval. The Skywave unit includes an integral antenna and is specifically designed for low power applications.

The service may prove particularly attractive to national meteorological services as protocols already exist with Inmarsat service providers for the free transmission of observational data to meteorological centres for quality control and insertion on to the GTS. Inmarsat, given its assured multinational backing and established infrastructure, is also extremely unlikely to disappear.

6. REFERENCES

Hanlon, J (1996). Emerging LEOs telemetry options for use in scientific data buoys - a marine instrument manufacturer's perspective. In: *Proceedings of the DBCP Technical Workshop, Henley on Thames, October 1996*. DBCP Technical Document No 10, WMO, Geneva.

Hoang, N (in press). Data relay systems for drifting buoys utilizing low-earth orbit satellites. In: *Proceedings of the DBCP Technical Workshop, Hawk's Cay, October 1998*. DBCP Technical Document No 14, WMO, Geneva.

Many interesting articles and status reports may be found in: *International Space Industry Report*, Launchspace Publications, Washington (see below).

7. USEFUL WEB SITES

7.1 General information

http://www.ee.surrey.ac.uk/Personal/L.Wood/constellations/	comprehensive site on LEOs
http://www.ee.surrey.ac.uk/CSER/UOSAT/SSHP/const_list.html	little LEO status, launch dates
http://www.launchspace.com	International Space Industry Report newspaper
http://www.spacedaily.com/constellations.html	News articles on constellation status
http://www.tbs-satellite.com/tse/online/	On-line satellite encyclopedia
http://www.msua.org/	Mobile Satellite Users Association (good links page)
http://www.space.com/business/communications/index.html	Business news on MSS

7.2 Specific operators

http://www.argosinc.com/
http://www.orbcomm.com/
http://www.inmarsat.org/
http://www.vita.org/
http://www.finalanalysis.com/comserv.htm
http://www.leoone.com/overview.html
http://www.ellipso.com/overview/index.html
http://www.globalstar.com/
http://www.iridium.com/
http://www.ico.com/
http://www.dbsindustries.com/ (E-sat)
http://www.skybridgesatellite.com/

Overview of mobile satellite systems with possible data buoy applications

System	Implementation	Orbit type	Buoy position	Message type	Terminal size	Power (watts)	Comments
ARGOS	Operational	Little LEO	Doppler shift	data: 32 bytes	handheld	1	various enhancements, incl 2-way messaging, are scheduled
Courier/Konvert	Planned	Little LEO		data		TBD	up to 12 satellites planned
ECCO	Planned	Big LEO	GPS required	voice/data	handheld	TBD	46 satellites planned by 2003
ELLIPSO	Planned 2002+	Big LEO	GPS required	voice/data	Handheld	TBD	17 satellites in highly elliptical orbits, serving major land masses in 2000
EYESAT	Operational (not commercial)	Little LEO	GPS required	data: 60 bytes	Handheld	5	1 satellite 1995, principally for radio amateurs
E-SAT	Planned 2001+	Little LEO	GPS Required	data: TBD	TBD	TBD	6 satellites for utility metering
FAISAT	Planned 2000+	Little LEO	GPS Required	data: 10 / 128 / 1k bytes	Handheld	10	38 satellites 2000+. Bent-pipe and Store and forward
GEMNET	Cancelled	Little LEO	GPS Required	data: no maximum	'laptop'	10	1st satellite 1995 - launch failure 36 satellites by ???
Globalstar	Pre-operational	Big LEO	GPS required	voice/data: no maximum	handheld	1	40 satellites in orbit. 52 planned. Full service by end 1999. Data / fax 2000.
GOES, Meteosat, GMS	Operational	GEO	GPS required	data: various options	'laptop'	10	4 satellites; directional antenna desirable
GONETS-D	Planned	Little LEO	GPS/ Glonass	data	handheld	TBD	8 satellites in orbit, 36 more planned
GONETS-R	Planned	Little LEO	GPS/ Glonass	data	handheld	TBD	48 satellites planned
INMARSAT-C	Operational	GEO	GPS	data: no	5.5 kg	15	steered antenna not required

			required	maximum			
INMARSAT-D+	Operational	GEO	GPS required	data: up to few kbytes	handheld	1	global pager using existing Inmarsat-3 satellites

ICO	Planned 2000+	MEO	GPS required	voice/data: no maximum	handheld	1	12 satellites: global cell-phone, inter-operable with terrestrial cellular networks
Iridium	Operational (no data)	Big LEO	GPS required	voice/data: no maximum	handheld	1	72 satellites in orbit - constellation complete. Service operational (no data)
IRIS/LLMS	Planned	Little LEO	Doppler + ranging	data: up to few kbytes	handheld	1	2 satellites 1999+
LEO One	Planned 2002	Little LEO	GPS required	TBD			48 satellite constellation, store and forward
OCEAN-NET	Planned	GEO	Moored	no maximum	large		uses moored buoys + Intelsat
Odyssey	Cancelled	MEO	GPS required	voice/data: no maximum	handheld	1	12 satellites were planned
Orbcomm	Operational	Little LEO	Doppler or GPS	data: no maximum	handheld	5	28 satellites in orbit. Further 7 or 8 satellites planned late 99.
SAFIR	Pre-operational	Little LEO	Doppler or GPS	data: no maximum	'laptop'	5	2 satellites in orbit. 6 total planned, including 3 piggy-back.
Signal	Planned	Big LEO		voice/data			48 satellites planned
SkyBridge	Planned	Big LEO	GPS required	broadband			80 satellites planned by 2002
Starsys	Cancelled	Little LEO	Doppler + ranging	data: 27 bytes multiple msgs	Handheld	2	12 satellites 1998+ 24 satellites 2000+
Teledesic	Planned	Big LEO	GPS required	broadband			288 satellites planned by 2003 FCC licence granted

Temisat	Planned	Little LEO		data			7 satellites planned
Vitasat	Planned	Little LEO	GPS required	data			2 satellites in orbit, 2 more planned (all piggy-back)
WEST	Planned	MEO	GPS required	broadband			9 satellites planned by 2003

ANNEX V

NEW GTS BULLETIN HEADERS

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

Bulletin header	Deployment area
SSVX02 KARS	NOAA/NDBC, Southern Hemisphere
SSVX04 KARS	North Atlantic
SSVX06 KARS	Northern Hemisphere
SSVX08 KARS	NOAA/NDBC, Northern Hemisphere
SSVX10 KARS	Southern Hemisphere
SSVX12 KARS	Arctic
SSVX14 KARS	Antarctic
SSVX16 KARS	Navoceano
SSVX18 KARS	NE Pacific Ocean
SSVX20 KARS	Navoceano
SSVX40 KARS	TAO
SSVX96 KARS	NDBC

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

Bulletin header	Deployment area
SSVX01 LFPW	North Atlantic
SSVX03 LFPW	Southern Hemisphere
SSVX05 LFPW	Northern Hemisphere
SSVX07 LFPW	Arctic
SSVX09 LFPW	Antarctic
SSVX19 LFPW	French West Indies
SSVX51 LFPW	CMM
SSVX55 LFPW	CMM

REVISED TERMS OF REFERENCE

DATA BUOY CO-OPERATION PANEL

PART A

Terms of reference for the Data Buoy Co-operation Panel

The Data Buoy Co-operation Panel shall:

1. Consider the expressed needs of the international meteorological and oceanographic communities for real-time or archival data from ocean-data buoys on the high seas and request action from its members, the Technical Co-ordinator or action groups to meet these needs;
2. Co-ordinate activity on existing programmes so as to optimize the provision and timely receipt of good quality data from them;
3. Propose, organize and implement, through the co-ordination of national contributions, the expansion of existing programmes or the creation of new ones to supply such data;
4. Support and organize as appropriate such action groups as may be necessary to implement the deployment of data gathering buoys to meet the expressed needs of oceanographic and meteorological programmes such as WWW, WCRP, GOOS and GCOS;
5. Encourage the initiation of national contributions to data buoy programmes from countries which do not make them;
6. Promote the insertion of all available and appropriate buoy data into the Global Telecommunication System;
7. Promote the exchange of information on data buoy activities and encourage the development and transfer of appropriate technology;
8. Ensure that other bodies actively involved in buoy use are informed of the workings of the panel and encourage, as appropriate, their participation in the panel deliberations;
9. Make and regularly review arrangements to secure the services of a Technical Co-ordinator with the terms of reference given in Part B;
10. Report formally to the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), and participate in and contribute to an integrated global operational ocean observing system, implemented and co-ordinated through JCOMM;
11. Submit annually to the Executive Councils of the WMO and the IOC, to JCOMM and to other appropriate bodies of WMO and IOC, a report which shall include summaries of the existing and planned buoy deployments and data flow.

PART B

Terms of Reference for the Technical Co-ordinator of the Data Buoy Co-operation Panel

The Technical Co-ordinator of the Data Buoy Co-operation Panel shall:

1. Under the direction of the Data Buoy Co-operation Panel take all possible steps within the competence of the panel to assist in the successful achievement of its aims;
2. Assist in the development, implementation and management of quality control procedures for data buoy systems;
3. Assist in setting up suitable arrangements for notifying the appropriate user communities of changes in the functional status of operational buoys;
4. Assist in the standardization of buoy data formats, sensor accuracy, etc.;
5. Assist when requested with the development of co-operative arrangements for buoy deployment;
6. Assist in the clarification and resolution of issues between Service Argos and buoy operators;
7. Assist in promoting the insertion of all available and appropriate buoy data into the Global Telecommunication System;
8. Supply information about buoy developments and applications to the WMO and IOC Secretariats and assist the Data Buoy Co-operation Panel to promote an international dialogue between oceanographers and meteorologists;
9. Co-ordinate and monitor

ANNEX VII

Financial Statement by IOC
for the year 1 June 1998 to 31 May 1999
(all amounts in US $ unless otherwise specified)

BALANCE (from previous year)			**$ 30 587**
FUNDS TRANSFERRED FROM WMO (relevant to the period)			
90 000	(18.05.1998)		
15 000	(02.07.1998)		**$ 105 000**
FF 80 000	(02.07.1998)		**FF 80 000**
TOTAL RECEIPTS			**$ 135 587**
			FF 80 000
EXPENDITURES			
Technical Co-ordinator's employment:			
- Salary:		66 524	
- Allowances:		20 710	
- Relocation (yearly provision):		4 008	**$ 91 242**
Technical Co-ordinator's missions:			
- La Jolla (22-26 June 1998)		2 778	
- Seattle (29 July - 4 August 1998)		3 007	
- Geneva (5-6 October 1998)		1 112	
- Marathon/Nouméa (12-30 October 1998)		9 187	
- Paris (30 November 1998)		590	
- Geneva (8-9 December 1998)		1 167	
- Piran/Trieste (10-14 January 1999)		1 660	
- Brest (26-28 May 1999)		2 915	**$ 22 416**
Contract with CLS/Service Argos:			**FF 80 000**
TOTAL EXPENDITURES			**$ 113 658**
			FF 80 000
BALANCE (at 1 June 1999)			**$ 21 929**

PROVISIONAL ESTIMATE OF INCOME AND EXPENDITURE
UNTIL 31 MAY 2000

Income		**USD**
Balance of fund from interim account		9,245
Expenditure		
Publications	*Existing obligations*	Nil
	New publications	3,000
Travel of chairman/vice-chairmen/JTA chairman		4,000
Experts		
Total		
Anticipated balance to transfer to 1999/2000 account		2,245

EXPENDITURES AND INCOME FOR 1996-2001

	Actual 1996 and 1997 (2 years)	Estimated 1998 - 99 (2 years)	Estimated 2000/01 (1 year)
		USD	
Expenditures			
Technical Coordinator (Salary, Travel and Logistics)	240,936	262,575	130,000
Travel (chair, vice-chairs and JTA chair)	11,005	18,619	10,000
Experts	6,420	5,000	3,500
JTA chairman		5,000	6,000
Prep meetings	2,073		
Publications	11,429	8,751	5,000
WMO	1,185	149	500
Contingencies			1,995
TOTAL	273,048	300,094	156,995
Income			
Contributions	285,344	268,029	148,750
JTA chair			6,000
Carry over	21,349	33,645	2,245
TOTAL	306,693	301,673	156,995

DRAFT TABLE OF PROVISIONAL CONTRIBUTIONS

DBCP

	1998-1999	1999-2000	2000-2001
AUSTRALIA	12,500	12,500	12,500
CANADA (including brochure in 1999)	10,000	10,000 C$ 9,687.5	10,000
FRANCE	11,400 (FRF 75,000)	11,400 (FRF 70,000)	11,400 (FRF 70,000)
GREECE	2,200	2,200	2,200
ICELAND	1,500	1,500	1,500
IRELAND	1,377 (IR£ 1,000)	1,459 (IR£ 1,000)	1,500 (IR£ 1,000)
NETHERLANDS	1,575	1,575	1,575
NEW ZEALAND	500	500	500
NORWAY	1,575	1,575	1,575
SOUTH AFRICA	3,000	3,000	3,000
UNITED KINGDOM (JTA chair support in 1999)	15,000	17,000	15,000
USA	68,000	68,000	68,000
TOTAL	**128,627**	**130,709**	**128,750**

SOOPIP

	1998-1999		1999-2000		2000-2001
Germany			5,000		5,000
Japan			5,000		5,000
USA			15,000		10,000
TOTAL			**25,000**		**20,000**

DBCP IMPLEMENTATION AND TECHNICAL WORKPLAN FOR THE 15th YEAR

PART A - Summary of tasks

1. Analyse programme information and other data as appropriate and in particular in accordance with DBCP global programme implementation strategy.

2. Assist in the planning and implementation, as appropriate, of the ocean data buoy component of GOOS, GCOS and CLIVAR.

3. Implement data base of buoy programme information on DBCP WWW server.

4. Update and amend, as necessary, the DBCP World Wide Web server, including up to date information on existing and planned data telecommunication systems.

5. Continue investigation regarding developments in communication technologies and facilities, relevant to the collection of sensor and/or location data from buoys.

6. Finalise latest version of SVP-B construction manual and make it available on DBCP server.

7. Develop and implement co-operative buoy deployment strategies, in particular with the GDP, to provide buoy networks which serve both research and operational applications.

8. Organize scientific & technical workshop at DBCP-XVI.

9. Make reference on DBCP web site of case studies regarding impact of buoy data.

10. Investigate possibility to produce additional GTS data availability index maps according to GOOS and GCOS requirements, taking into account basic variables and different types of platforms.

11. Monitor and evaluate quality of pressure and wind data from SVPB and SVPBW drifters.

12. Assist in implementing new buoy programmes as required.

13. Produce leaflet to provide information on buoy programmes in order to limit vandalism.

14. Submit modification of BUOY code to CBS (meta-data)

15. Make proposal for modification of BUOY code so that moored buoys presently reporting in SHIP code can switch to BUOY code.

16. Implement regional projects (by Action Groups) to monitor and document the availability and use of buoy observations.

17. Undertake action to make sure that Southern Ocean will continue to be adequately seeded with barometer drifters.

18. Provide the Technical Coordinator with deployment opportunities (maps and point of contact) for inclusion in the DBCP web server.

19. Update QC guidelines to reflect that the Technical Coordinator is responsible for maintaining the list of Principal GTS Coordinators (PGC).

20. Provide the Technical Coordinator with comments regarding meta-data catalogue for buoy data.

21. Develop regional maps for EGOS and Tasman Sea.

DBCP IMPLEMENTATION AND TECHNICAL WORKPLAN FOR THE 15th YEAR

PART B

TASK	CARRIED OUT BY*	SUPPORTED/ASSISTED BY	REPORTED TO/ACTION BY	RELEVANT TOR OF THE PANEL
1	Technical co-ordinator (1,8)	Vice-chairmen	Chairman for presentation to the panel	1, 2
2	DBCP	Panel members	Panel	7, 8
3	Technical co-ordinator (1,2,3)		Panel	2, 3, 6
4	NOAA/AOML and technical co-ordinator (1,2,3,4,6,7,8)	Vice Chairman (Meldrum)	Panel	7, 8
5	Vice-chairman (Meldrum) and technical co-ordinator (1, 7, 8)	Chairman and Panel members	Panel	1, 2, 6, 7
6	Technical Co-ordinator (4,8)	Scripps Institution of Oceanography	Panel	7
7	Regional action groups, GDC	Panel members, Technical co-ordinator (5,8)	Panel, GDP	1, 2, 3
8	Mr Wynn Jones	Secretariats	Panel	7
9	Technical co-ordinator (1)	Panel members	Panel	7
10	Météo France		Panel	2, 6
11	SVPB/SVPBW evaluation group		Panel	2, 6
12	Support team (USA, UK, Brazil, Canada)	Technical Coordinator (1,4,6,7,9), Secretariats	Panel	1,3,5,6,7
13	Technical Coordinator (1)	Panel members	Panel	1, 2, 4
14	Technical Coordinator (1,3)		Panel	1,2,6
15	BUOY code sub-group (USA (chair), Canada, Netherlands, UK, Australia, TC (1,3))	Technical Coordinator (1,3)	Panel	1,2,6
16	Regional Action Groups	Panel members	Panel	1, 2, 4, 7
17	Panel	Secretariats	Panel	1,2,3,5
18	Members		Panel	1, 2, 4
19	Technical Coordinator (2)		Panel	2,6
20	Panel Members	Technical Coordinator (1,2,3)	Panel	1,7
21	MEDS		Panel	1,7

* When the technical co-ordinator is involved in carrying out a task, the figures in parenthesis relate to the terms of reference for the technical co-ordinator

DBCP ADMINISTRATIVE WORKPLAN FOR THE 15TH YEAR

PART A - Summary of tasks

1. Maintain summary of requirements for buoy data to meet expressed needs of the international meteorological and oceanographic communities.

2. Maintain a catalogue of existing ongoing ocean data buoy programmes

3. Maintain a list of national contact points for the DBCP and within other relevant bodies with potential for involvement in DBCP activities.

4. Identify sources of buoy data not currently reported on the GTS and determine the reason for their non-availability.

5. If deemed necessary, make proposals for co-ordination activity as a result of the above actions to address items 2 to 6 in the terms of reference of the DBCP.

6. Arrange for the circulation of information on the Panel's activities, current and planned buoy programmes and related technical development/evaluations, including via distribution of existing DBCP publications to potential Argos GTS users.

7. Monitor the operation of the Argos GTS processing sub-system and arrange for modifications as necessary.

8. Continue the arrangements (including finance) to secure the services of a technical co-ordinator.

9. Review programme and establish working priorities of the technical co-ordinator.

10. Prepare annual report of the DBCP.

11. Support, as required, existing DBCP action groups (EGOS, IABP,IPAB, ISABP, IBPIO, GDP, TIP) and, on request provide assistance to other internationally co-ordinated buoy programme developments.

12. Investigate requirements for initiating new co-ordinated buoy deployments in other ocean areas.

13. Make every effort to recruit new contributors to the trust fund.

14. Keep up-to-date with the latest buoy technical developments.

15. Co-ordinate operation of DBCP QC guidelines.

16. Follow up and possibly assist in implementing requirements expressed by the buoy users within the Argos system.

17. Provide technical workshop papers to WMO Secretariat (end November) and publish proceedings (mid 2000).

18. Submit national reports in electronic form to the technical coordinator for inclusion in the DBCP server.

19. Prepare and distribute revised budget estimates for 2000-2001

20. Provide TC with suggested small changes to DBCP brochure prior to next Panel session.

21. Propose changes to DBCP implementation strategy

22. Investigate updating JCOMM list of non-drifting ODAS more frequently and making it available via an appropriate web site.

DBCP ADMINISTRATIVE WORKPLAN FOR THE 15TH YEAR

PART B

TASK	CARRIED OUT BY*	SUPPORTED/ASSISTED BY	REPORTED TO/ACTION BY	RELEVANT TOR OF THE PANEL
1	Technical co-ordinator (1, 8)	Panel members and Secretariats	Chairman for presentation to the panel	1, 2
2	Technical co-ordinator (1,2,3,8)	Panel members and Secretariats	Chairman and panel for information	1, 2
3	Secretariats	Panel members	Chairman and panel for information	1, 2, 8
4	Technical co-ordinator (1, 7), CLS/Service Argos	Panel members and Secretariats	Chairman and panel for information	6
5	Chairman and technical co-ordinator (1,2,4,5,6,7,8,9)	Secretariats and others as appropriate	To Panel for consideration and appropriate action or for direct action by chairman	1, 2, 3, 5
6	Technical co-ordinator (3,4,8)	Chairman, Secretariats and CLS/Service Argos	Wide circulation by Secretariats and CLS/Service Argos	7, 8
7	Technical co-ordinator (1,2,7) and chairman	Secretariats	Panel and users	1, 2, 6
8	Chairman and sub-committee	Secretariats	Secretariats	9
9	Panel/chairman		Panel (at next session)	9
10	Chairman and Secretariats	Technical co-ordinator (1,8)	Executive Councils of WMO and IOC	10
11	Chairman and Secretariats	Technical co-ordinator (1, 5, 8)	Panel	1
12	Chairman and Secretariats	Panel members	Panel	4
13	Chairman	Panel members	Panel	7, 8
14	Operational services, chairman, vice-chairmen and technical co-ordinator (1,4)	Panel members	Panel	1, 2, 3, 7. 8
15	Technical co-ordinator (1, 2)	Panel members and operational services	Panel	2, 3, 6
16	CLS/Service Argos	Technical co-ordinator (1, 6)	Panel, meeting on JTA	6, 7
17	Panel members, WMO Secretariat		Panel	7
18	Panel members, technical coordinator (5,8)		Panel	7, 8
19	Secretariats		Panel	8
20	Panel members		TC	7, 8
21	Panel members		Vice-chairman (Meldrum)	7, 8
22	IOC Secretariat	Technical Coordinator (3)	Panel	1,7

* When the technical co-ordinator is involved in carrying out a task, the figures in parenthesis relate to the terms of reference for the technical co-ordinator

ANNEX X

LIST OF ACCRONYMS AND OTHER ABBREVIATIONS

AARI	Arctic and Antarctic Research Institute
AG	Action Group (of the DBCP)
ALACE	Autonomous Lagrangian Circulation Explorer
AOPC/OOPC	Atmospheric Observation Panel for Climate/Ocean Observations Panel for Climate
AOML	Atlantic Oceanographic and Meteorological Laboratory (NOAA)
ATLAS	Autonomous Temperature Line Acquisition System
AWI	Alfred Wegner Institute (Germany)
BUFR	Binary Universal Form for Representation of meteorological data (WMO)
BUOY	Report of a Buoy Observation (WMO code form)
CBERS	China Brazil Cooperation
CBS	Commission for Basic Systems (WMO)
CLS	Collecte – Localisation - Satellite
CMM	Commission for Marine Meteorology (WMO)
CMM	Centre de météorologie maritime (Meteo-France)
CNES	Centre national d`études spatiales (France)
DAC	Data Assembly Center
DBCP	Data Buoy Cooperation Panel (WMO-IOC)
DBCP/TC	Technical Coordinator of the DBCP
DOE/ARM	Department of the Environment/Atmospheric Radiation Measurement
EC	Executive Council
ECMWF	European Centre for Medium-Range Weather Forecasts
EGOS	European Group on Ocean Stations
EPIC	Eastern Pacific Investigation of Climate Processes in the Coupled Ocean-Atmosphere System
FGGE	First GARP Global Experiment
FRGPC	French Argos Global Processing Centre
GEOS	Geodynamics Experimental Ocean Satellite
GCOS	Global Climate Observing System
GDC	Global Drifter Center
GDP	Global Drifter Programme
GLOSS	Global Sea-Level Observing System
GMS	Geostationary Meteorological Satellite (Japan)
GOES	Geostationary Operational Environmental Satellite (NOAA)
GOOS	Global Ocean Observing System
GPO	GOOS Project Office
GPS	Global Positioning System
GSC	GOOS Steering Committee
GTS	Global Telecommunication System (WMO)
IABP	International Arctic Buoy Programme
IAG	Implementation Advisory Group
IBPIO	International Buoy Programme for the Indian Ocean
ICEX	Ice and Climate Experiment (NASA)
IGOSS	Integrated Global Ocean Services System (IOC/WMO)
IFREMER	Institut Francais de Recherche pour L`èxploitation de la Mer
IHO	International Hydrographic Organization
IIAG	Interim Implementation Advisory Group
IMO	International Maritime Organization
INPE	Instituto Nacional de Pesquisasa Espaciais (Brazil)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Data and Information Exchange (IOC)
IPAB	International Programme for Antarctic Buoys

ISABP	International South Atlantic Buoy Programme
JAMSTEC	Japanese Marine Science and Technology Centre
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JTA	Joint Tariff Agreement (Argos)
LUT	Local User Terminal
MEDS	Marine Environmental Data Service (Canada)
NASA	National Aeronautics and Space Administration (USA)
NAVOCEANO	US Naval Oceanographic Office
NCEP	National Center for Environmental Prediction (NOAA)
NDBC	National Data Buoy Center
NIOT	National Institute of Oceanography and Technology
NMC	National Meteorological Centre
NOAA	National Oceanographic and Atmospheric Administration (USA)
NOPP	National Ocean Partnership Programme
NSIDC	National Snow and Ice Center (USA)
NWP	Numerical Weather Prediction
NWS	National Weather Service (USA)
PALACE	Profiling ALACE
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
PMEL	Pacific Marine Environmental Laboratory
PMOC	Participating Meteorological and Oceanographic Centres
PNBOIA	Programa Nacional de Boias (Brasil)
QC	Quality Control
RMS	Root Mean Square
RNODS	Responsible National Oceanographic Data Centre
SAWB	South African Weather Bureau
SHIP	Report of surface observation from a sea station (WMO code form)
SOC	Specialized Oceanographic Data Centre
SOOP	Ship-of-Opportunity Programme
SOOPIP	SOOP Implementation Panel
SST	Sea Surface Temperature
SVP	Surface Velocity Programme (of TOGA and WOCE) drifter
SVPB	SVP “barometer” drifter
SVPBW	SVP “barometer and Wind” drifter
TAO	Tropical Atmosphere Ocean
TESAC	Temperature, salinity and current report from a sea station(WMO code form)
TIP	TAO Implementation Panel
TOGA	Tropical Ocean and Global Atmosphere
TRITON	Triangle Trans-Ocean buoy Network
TRMM	Tropical Rainfall Measurement Mission (NASA)
UKMO	United Kingdom Meteorological Office
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTC	Universal Time Coordinated
VOS	Voluntary observing ship
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WWW	World Weather Watch (WMO)
XBT	Expendable Bathythermograph
YOTO	Year of the Ocean
Y2K	Year 2000