JCOMM EXPERT TEAM ON SEA ICE (ETSI)
Third Session
STEERING GROUP FOR THE GLOBAL DIGITAL SEA ICE DATA BANK (GDSIDB)
Eleventh Session

Geneva, Switzerland, 28-31 March 2007

FINAL REPORT

JCOMM Meeting Report No. 51

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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N O T E

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C O N T E N T S

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION

1.1 Opening

1.1.1 The third session of the JCOMM Expert Team on Sea Ice (ETSI) and the eleventh session of the Steering Group for the Global Digital Sea Ice Data Bank (GDSIDB) was opened by the Chairperson of the Expert Team on Sea Ice (ETSI), Dr Vasily Smolyanitsky (Russian Federation), at 0930 hrs on Wednesday, 28 March 2007, in salle C2 at the WMO Headquarters, Geneva, Switzerland.

1.1.2 Dr Smolyanitsky welcomed participants to these sessions and expressed his considerable appreciation to WMO for hosting the meeting. Dr Smolyanitsky recalled that three years had passed since the previous sessions of the ETSI and GDSIDB and stressed that great progress had been made during this period. He pointed out the Expert Team's contribution to the International Polar Year and informed the Team on the new vision for the Services Program Area (SPA) by focusing cross-linkages between ETs, especially with the Expert Team on Maritime Safety Services (ETMSS) and its task teams on Met-Ocean graphical products and on the provision of Marine Safety Information (MSI) for Polar Regions. Dr Smolyanitsky also highlighted the new WMO technical documents to be discussed during the sessions and the relationships with the Expert Team on Marine Climatology (ETMC) and GCOS SST&SI Working Group that would be presented by their Chairpersons. He then introduced Dr Georgi Kortchev, the Director of the Applications Programme Department of the WMO, to address these sessions.

1.1.3 On behalf of the Secretary-General of the WMO, Mr Michel Jarraud, and and the Executive Secretary of Intergovernmental Oceanographic Commission (IOC), Dr Patricio Bernal, Dr Georgi Kortchev welcomed the participants to these sessions, to Geneva in general and to the WMO in particular. Dr Kortchev recalled that in 2005, on the occasion of its Fifth-seventh Session, the WMO Executive Council (EC-LVII) decided that the theme for the World Meteorological Day of the year 2007 would be "Polar Meteorology: Understanding Global Impacts", in recognition of the importance of, and as a contribution to the International Polar Year 2007-2008, which is being co-sponsored by the WMO and the International Council for Science (ICSU). The fundamental concept of the IPY is an intensive burst of internationally coordinated, interdisciplinary scientific research and observations focused on the Earth's Polar Regions and their far-reaching global effects. Dr Kortchev pointed out that the JCOMM ETSI (before 2001 called the Sub-group and Working Group on Sea Ice of the WMO Commission for Marine Meteorology (CMM)) has been the lead focal point for promoting and coordinating international cooperation in the acquisition, exchange, archival and dissemination of sea-ice information since the foundation of the WMO in 1950. He also noted that following Resolution 34 of the Fourteenth Session of the WMO Congress (Cg-XIV) and the Recommendations of the Second Session of the JCOMM (JCOMM-II, Halifax, Canada, September 2005), the ETSI agreed to support the International Polar Year 2007-2008 by:

(i) Providing tailored information, including web pages dedicated to the Global Digital Sea Ice Data Bank (GDSIDB), normals, ice records and national ice data, on a timely basis;
(ii) Encouraging national ice services to supply updates and historical documents and ice data from coastal stations to the Global Digital Sea Ice Data Bank (GDSIDB) centres;
(iii) Encouraging the Expert Team on Sea Ice Members to enhance sea ice observations and data archiving at the designated centres;
(iv) Developing an Ice Information Portal, hosted by the PolarView project (and supported by the ESA and European Commission with participation by the Canadian Space Agency (CSA) - http://ipy-ice-portal.com/);
(v) Reviewing and updating the mandatory WMO publication *Sea-Ice Information Services in the World* (WMO-No. 574). Regarding this publication, it was with great pleasure that Dr Kortchev informed the Team that the printed revised version of this publication has become available especially for the opening of these sessions.

1.1.4 Dr Kortchev also highlighted that the ETSI has been working on code and map standards for sea ice, including management of an ice objects for the Electronic Navigation Chart Systems and that he looked forward to seeing the results from the Expert Team's discussion during these sessions on this issue, in particular the adoption of the new WMO publication *Ice Objects Catalogue*.

1.1.5 Dr Kortchev informed the Team that a major data management activity of the WMO is the development of the WMO Information System (WIS). The WIS is an overreaching approach based on widely accepted standards, such as those promoted by the ISO to meet information exchange requirements of all WMO Programmes. In this regard, he invited the Team to consider and discuss how its activities would fit in with the WMO Information System.

1.1.6 Dr Kortchev recalled that at its Fifth Session, the JCOMM Management Committee (MAN-V, Geneva, Switzerland, October 2006), agreed that there was a clear need to define cross-JCOMM Programme Area issues, and urged the Programme Area Coordinators to define a strategic implementation plan for Programme Area cross-cutting activities and interactions, addressing WMO cross-cutting programmes and activities, such as the WMO Natural Disaster Prevention and Mitigation Programme (DPM), Least Developed Countries Programme (LDCs), and WIS, as well as the IOC Programmes. In this regard, and noting the substantially increased oil and gas activities in the Arctic Ocean, the Services Programme Area Coordination Group, at its Third Session agreed in developing a cross-Services Programme Area Expert Teams Pilot Project for Polar Regions focused on maritime services, support and disaster risk management (including sea ice and icebergs, oil spills, rogue waves, etc.). In particular, special attention should be provided to storm surge and wave – sea ice interactions, and the modelling and forecasting of oil spills on ice covered areas. In addition, noting that the Expert Team on Sea Ice had been working on climatological sea ice datasets and standards for sea ice charts, Dr Kortchev finally invited the Team to establish appropriate links with the Data Management Programmme Area Expert Team on Marine Climatology, in particular on the Global Digital Sea Ice Data Bank Project in order to develop a proposal for a joint work plan. Dr Kortchev assured participants of the full support of his staff and concluded by wishing everyone a successful meeting and an enjoyable stay in Geneva.

1.1.7 Mr Edgard Cabrera, Chief of the Ocean Affairs Division of the Applications Programme Department of the WMO, welcomed the participants to these sessions, to the WMO Headquarters and to Geneva. He informed the Team that the Scientific Officer in charge of these sessions is Ms Alice Soares, and assured themof their full support during the meeting and throughout the implementation of the work programme of the Team and he concluded by wishing all participants a very successful meeting and an enjoyable stay in Geneva.

1.1.8 Dr Eduard Sarukanian, Special Adviser to the WMO Secretary-General on the International Polar Year (IPY), welcomed the participants to these sessions on behalf of the Joint Committee for IPY, of which he is a Member. He invited the Team to assist on the implementation of IPY and wished them a successful meeting and good luck for IPY.

1.1.9 The list of participants in the session is given in Annex I.

1.2 Adoption of the agenda

1.2.1 The Team adopted its agenda for the session based on the provisional agenda. This agenda is given in Annex II.

1.3 Working arrangements

1.3.1 The Team agreed its hours of work and other practical arrangements for the session. The documentation was introduced by the Secretariat, and the participants introduced themselves, to facilitate future interactions.

2. Reports

2.1 Report of the Services Programme Area Coordinator

2.1.1 The Team noted with interest and appreciation the report of the Services Programme Area (SPA) Coordinator, Dr Craig Donlon. This report covered the structure of the SPA, a brief description of the new Expert Team on Marine Accident Emergency Support (ETMAES), the terms of reference for the newly appointed Rapporteur for Operational Ocean Forecasting Systems (OFS), the work plan developed by the Coordinator for the current intersessional period and

concluded with a series of key issues for the Expert Team on Sea Ice (ETSI) to consider during the remainder of the meeting.

2.1.2 At the SCG-III (Exeter, United Kingdom, November 2006), the SPA coordinator proposed a new structure for the SPA which focuses all current ETs on a common theme of Met-Ocean Services in support of Maritime Safety Systems. In addition, noting the importance of pulling through the successes of the Ocean Forecasting systems (such as those within the Global Ocean Data Assimilation Experiment (GODAE) Project) into JCOMM as GODAE transitions from pilot project to operations and, the increasing role of integrating ocean forecast systems. To facilitate this transition, a new Rapporteur, Dr Adrian Hines (Met Office, United Kingdom) has been appointed for the Operational Ocean Forecasting Systems (in particular the ocean meso-scale forecasting). Dr Hines will work closely with the ETSI Chairperson on the subject.

2.1.3 Dr Donlon introduced the agreed Top Level Objectives (TLOs) for the SPA work plan, which are applicable to all activities of ETSI, and other ETs within the SPA as specified in Annex III. An electronic version of the SPA work plan is available at http://www.jcomm-services.org. Dr. Donlon discussed the role of the SPA within JCOMM and noted that a key challenge for the programme is the integration of science and standards into operational services supporting maritime safety, emergency response, disaster risk reduction, and maritime hazards with full user support and interaction. The main deliverables from the work plan are a series of standards specification documents and services including the following:

- A New JCOMM SPA web site for general discussion, promotion and information on the activities of the SPA at http://www.jcopmm-services.org;
- A JCOMM Services User Requirement Document (URD);
- Observation Requirements for JCOMM Services including in situ and satellite observations;
- A JCOMM Catalogue of Operational Ocean Products and Services;
- Standard Data and Metadata Formats for Ocean Products (including satellite, climatology, model, combined);
- A Guide to Ocean Product Presentation, Symbology, and Nomenclature.

The SPA Coordinator and ET Chairpersons will develop these documents with inputs from ETs themselves rather than by a dedicated Task Team for Ocean Products Development. A Guide to Ocean Product Presentation, Symbology, and Nomenclature will be presented to the Commission during JCOMM-III for approval.

2.1.4 The Team noted with appreciation that the SPA is planning an International Maritime Met-Ocean Services Conference (IMMSC) 2008 (Exeter, United Kingdom, October 2008), with the aim of establishing and agreeing on International Met-Ocean Services requirements, identifying shortcomings of the present systems and reviewing long and short-term solutions. The Conference will bring together private and public maritime application industries, system and service providers, marine scientists, and engineers to improve communication and mutual understanding. A Scientific Coordination Group will be established to develop the format and content of the Conference in the next six months. Dr. Donlon requested that the ETSI nominate delegates to represent the Team on the IMMSC Scientific Steering Team **(Action: ETSI Members and Secretariat)**.

2.1.5 The SPA Coordinator, Dr Craig Donlon presented the SPA website (www.jcomm-services.org), including a revised JCOMM Electronic Product Bulletin (J-EPB) for ocean services. Dr Donlon demonstrated the functionality of the website, which has been developed so that the ET Chairpersons and Team Members can directly access and edit web pages from anywhere in the world by simply using a web browser. Dr Donlon explained that basic template pages had been prepared for each of the ETs within the SPA, and that the SPA Coordinator would maintain all web management services and tools. Dr Donlon acknowledged the support of the UK Met Office (USD10K) for the JCOMM web system. Dr Donlon reminded the ETSI that the task to populate the JCOMM SPA web space with useful content was now the responsibility of the ETs themselves, using the web-tool provided by the coordinator. The system is easy to use, providing an interface similar to Microsoft Word, so that no knowledge of HTML is required to develop and edit pages.

2.1.6 The Team agreed that the web was now an important and necessary communication tool and should therefore contain useful information to its potential audiences. It agreed that content should be added as a matter of urgency by the Team. Dr Donlon therefore encouraged the ET Members to take action and provided them with a username and password to act as editors of the SPA website content at the ETSI sections **(Action: ETSI Chairperson and ETSI Members)**. At the top level of the SPA website, Members of the Team were invited to submit their contributions to the ETSI Chairperson, SPA Coordinator, or WMO Secretariat.

2.1.7 The SPA Coordinator noted the following as key areas for ETSI to consider during the discussions:

a) Provide support to the IPY in an appropriate manner including tailored information, the Ice Information Portal (see: http://ipy-ice-portal.com/);
b) Develop a cross-ETs Pilot Project for the Arctic region, focused on maritime services, support and disaster risk management (to include sea ice and icebergs, oil spills, rogue waves, etc.) including modelling of ice cover and pollution;
c) Continue to develop the *Ice Objects Catalogue* extending this to S-57 format consistent with the IHO and ISO standards, and where appropriate, explore how this approach could be used for developing standards for other Met-Ocean products within the ECDIS;
d) Continue to work on improving broadcast coverage and the list of the sea ice products routinely available to the mariners in the high Arctic and Antarctic (e.g., by facsimile transmissions) in collaboration with the ETMSS Chairperson to advocate the extension of the products ;
e) To investigate the possible use of the Iridium satellite system for the delivery of sea ice information products to the polar regions;
f) Respond, as appropriate, to a requirement of the ETMSS for the provision of sea ice information (in particular icebergs);
g) Develop and implement an operational Ice Chart Inter-comparison Workshop;
h) Participate in the development of the Cross-JCOMM Pilot Project on Extreme Water Level (JEWL);
i) Contribute to the JCOMM user requirements document;
j) Provide advice on *in situ* observations working with the International Ice Charting Working Group (IICWG) on the requirements for sea ice observations, and within the IGOS cryosphere theme on the requirements for space-based remote-sensing of sea ice and icebergs parameters;
k) Develop one or more capacity building modules for OceanTeacher and/or Bilko lessons on sea ice data sets and their application;
l) Contribute and participate in the IMMSC Conference, in October 2008;
m) Add, review, and maintain the content on the JCOMM Services website (see: http://www.jcomm-services.org).

2.1.8 The Team noted that the CBS Expert Team on the Evolution of the Global Observing System (ET-EGOS) was collecting and maintaining sets of user requirements for a large spectrum of applications and comparing them with both satellite and in situ instrument performances in its Rolling Review of Requirements Process. The Team agreed that it should provide input to the Services Programme Area Coordinator for consideration of ETSI requirements in the JCOMM Statement of Guidance **(Action: ETSI Chairperson)**. The Team noted that the issue is further discussed under agenda item 2.9.

2.2 Report of the Chairperson

2.2.1 The Team noted with interest and appreciation a report (Annex IV) by the Chairperson of the Expert Team on Sea Ice (ETSI), Dr Vasily Smolyanitsky, regarding the present status and effectiveness of its activities during the intersessional period since the last session (Hamburg, Germany, April 2004), and plans for the future. This report summarizes main activities related to JCOMM on the level of national ice services, as well as the direct contributions of the Team since its second session.

2.2.2 The Team noted that substantial progress had been made in the implementation of the previous work plan, which includes, in particular, the revision of the current version of the WMO *Sea Ice Nomenclature* (WMO-No. 259), and provision of the stated publication an electronic form, development of the future vision and strategy for new standards for sea ice charts, Ice Objects Catalogue and to this effect establishment of a liaison between ETSI and the IHO TSMAD, third edition of the WMO publication *Sea Ice Information Services in the World* (WMO-No.574), requirements for sea ice observations and products, cooperation with ETMSS on definition of the sea ice products related to marine safety and effective collaboration with the International Ice Charting Working Group (IICWG) and the Baltic Sea Ice Meeting (BSIM). To the effect of further successful revision of the WMO technical publications the Team noted and stressed the need of availability in electronic form of the main WMO publications providing guidance to Met-Ocean observations and services, in particular 558 and 471 **(Action: WMO Secretariat)**. The Team also noted that detailed discussion on the working items is envisaged further under specific agenda items.

2.3 Report of the Secretariat

2.3.1 The Team recalled that the second session of the JCOMM took place in Halifax, Canada, in September 2005. Bearing in mind that the best way to activate and motivate the main JCOMM subsidiary bodies is to have them meet early in the intersessional period to prepare work strategies, address priority issues identified by JCOMM-II and allocate specific tasks. To address this issue a work programme was prepared which allowed for the Management Committee and SPA Coordination Group to meet in 2006 and develop a specific work plan.

2.3.2 The Team noted with appreciation the summary reports on: (i) the results of JCOMM-II; (ii) the fifth session of the Management Committee; (iii) the third session of the SPA Coordination Group; (iv) the second session of the Expert Team on Maritime Safety Services; and (v) the first session of the Expert Team on Marine Accident Emergency Support. The meeting was briefed on these meetings. Details of actions proposed to the ETSI by Coordination Groups and other Teams were discussed under appropriate agenda items. During the discussion, the Team also noted and stressed the need of availability in electronic form of the main WMO publications No. 558 and 471.

2.4 Reports by the Members of the ETSI

2.4.1 The Team reviewed ETSI Member's reports from Argentina, Canada, Denmark, Finland, Germany, Iceland, Japan, Norway, Russian Federation, Sweden, United Kingdom and the USA. These reports will be published separately in electronic form as a JCOMM Technical Report.

Report by the Glaciological Division of the Argentina Navy Meteorological Service

2.4.2 The Team was informed that sea ice activities through the Glaciological Division of the Argentine Navy Meteorological Service (SMARA, Spanish abbreviation by initials), a technical Department of the Naval Hydrographic Service (SHN, abbreviation by initials), are mainly focused on operational purposes and planning information for tactical and strategic sea ice and icebergs support in the: (i.) NAVAREA VI (essentially encompassed west of LON 67° 16W, east of LON 020°W, and south of LAT 35° 50'S to the Antarctic coasts), (ii.) SAR maritime area (bordered between LONs 67° 16'W and 010°W and south of LAT 35° 30S to the Antarctic coasts), and (iii.) Naval Combined Antarctic Patrol (PANC, Spanish abbreviation by initials) zone south of LAT 60°S and between LONs 00° and 131°W. The sea ice observations (visual from coasts and ships and satellite image interpretation), manual analysis, special brief outlook and training are routinely performed throughout the year.

2.4.3 The Team noted that tactical sea ice support is also provided under request by the Meteorological Office on board the Icebreaker A.R.A. "ALMIRANTE IRIZAR" (AI), but only when this vessel is at sea in Antarctic waters.

2.4.4 The Team noted that information of sea ice edge and icebergs outlook is included in the Notices to Mariners and in NAVAREA VI Nautical Warnings through SafetyNET, ruled by the International Maritime Organization (IMO). No information is sent via NAVTEX messages due to

the particular environment of South American coasts. These data will be next sent to the National Meteorological Service (SMN, Spanish abbreviation by initials) of Argentina to be included in the METAREA 6, after coordination with the SMN.

2.4.5 The Team also noted that the Glaciological Division of the SMARA continued sending sea ice observations (under code messages IILL and IISS) to the NSIDC and AARI. Messages IILL of five Argentinean coastal stations were sent (Orcadas, Jubany, Esperanza, Marambio and San Martín), and IISS of Icebreaker A.R.A. "ALMIRANTE IRIZAR", Oceanographic Ship A.R.A. "PUERTO DESEADO" and Auxiliary Ship A.R.A. "SUBOFICIAL CASTILLO".

Report by the Canadian Ice Service

2.4.6 The Team noted that Canadian Ice Service (CIS) continued to provide ice information as described in WMO Publication No. 574. In response to user demands from ships staying in the Canadian Arctic later in the season because of reducing ice conditions, the CIS increased the frequency of production of Arctic charts from monthly during the winter to bi-weekly. Contrary to the report at the last ETSI meeting, aircraft ice reconnaissance in Canada has been re-vitalized by developing partnerships with marine pollution patrols and maritime security. There are currently three aircrafts being equipped for this multi-mission role.

2.4.7 In addition to the Ice Chart Climate Archive that is available on the CIS website (http://www.ice.ec.gc.ca), CIS has developed climate products "Departure from Normal" charts and a new tool to allow users to create their own Ice Cover Graphs based on the digital chart archive. Since January 2006, all current CIS charts are available in Sigrid-3 format and the regional products are provided to NSIDC in real time.

2.4.8 The Team was informed that the CIS is preparing for an active role in the International Polar Year. In addition to its participation in the ETSI-Polar View Ice Information Portal, the CIS is planning a significant increase in ice information to assure the safety of IPY researchers in Canadian waters. Additional staff has been hired and a special IPY section on the CIS web page established. For IPY scientific use, the CIS is digitizing the "Historical Chart" collection produced during 1959-74 to be added to our climate database.

2.4.9 Under the general direction of ETSI, the CIS has revised the Ice Objects Catalogue for Electronic Navigation Chart Systems and met with the IHO sub-group on Marine Information Objects to further the development of standards for ice information in ENC systems.

Report by the Danish Meteorological Institute

2.4.10 The Danish Meteorological Institute (DMI), Greenland Ice Service, is responsible for operational monitoring and charting of sea ice conditions in the waters around Greenland and distributes this information to ships primarily as ice charts and reports. The service production of navigational ice charts is mainly based on the two SAR satellite platforms (e.g., RADARSAT and ENVISAT). A robust and fully automatic ingest and processing system has been implemented to make SAR images available from the RADARSAT and ENVISAT in near real time for the ice analysts. All products are freely available at the following web address: http://dmi.dk. More than 400 navigation ice charts, 52 weekly ice charts, and numerous inshore ice reports are issued each year. In the ice season, more than 20000 ice charts are downloaded from the DMI website on a monthly basis. Weekly ice products are also available as a GMES contribution at: http://ocean.dmi.dk/polarview.

2.4.11 In February 2006, the DMI's new ice charting system, called SIKU, was launched for operational ice analysis and chart production. The SIKU is a new state of the art development based on ESRI ArcGIS. The SIKU follows all international ice charting standards including export of ice analyses in SIGRID-3.

2.4.12 The DMI has a major role in several sea ice related research programmes financed by the European framework programs (e.g., DAMOCLES) and in Satellite Application Facilities financed through EUMETSAT (Ocean and Sea Ice). In the spring of 2006, the DMI and CIS jointly

provided ice and meteorological information to the Arctic Ocean field program LORITA-1. Since February 2005, the DMI has been contracted to provide near-real-time ice information for the North Caspian Sea to operating oil companies and local Kazakh authorities.

Report by the Finnish Ice Service

2.4.13 When the operational ice service operations began in Finland in 1915 the marine transportation was the main driving force, and it still is in the Baltic Sea. Some 731 million marine tonnes were transported in 2003, of which about 40% occurred during the winter months and by 2020, the total transportation is expected to grow up to 1.2 billion tonnes.

2.4.14 The Finnish Ice Service routinely monitored area has been expanded to cover the area covering the Baltic Sea, Kattegat, Skagerrek, and Swedish lakes of Vanern and Malaren The service is financed by the Finnish and Swedish Maritime Administrations. Since 2006, the Finnish Ice Service has also provided ice services to Swedish Icebreaking Services. Also by 2007 services: ice charts, ice reports in English, Modis images, and by Polar View project high-resolution ice thickness charts (in 500 resolution) and ice forecasts (in 1 nautical miles resolution in 3h steps and for +45h) have been available to the Baltic Icebreaking Management at http://www.baltice.org. All available SAR data (numbering 250 in 2006) has been provided to Finnish and Swedish icebreakers in reduced resolution.

Report by the German Federal Maritime and Hydrographic Agency (BSH)

2.4.15 The Team was informed that after being vacant for a long time, the position of leader of the ice service was filled in the beginning of 2006. In 2006, the ice service was unified with the German Baltic sea water level service and is now based in its totality at the BSH in Rostock. The operational service has not changed in the last few years and is mentioned in the ice services Documentation (WMO No 574). A recent change was the incorporation of ice information into the German NAVTEX. Work on BSIS WWW-pages was delayed but the new look is expected to be operational in summer 2007.

2.4.16 For 2006 it was planned to make the Baltic ice database (ice station data and gridded chart data) publicly available vie WWW. This was postponed to 2007 to be incorporated into the planned BSH GIS-Portal. Available German charts have been digitized from 1958 onward and in future, the gappy older charts will be digitized. The available German Ice Station data starting in the 1890ies have been digitized almost completely

Report by the Iceland Meteorological Office

2.4.17 The Team was informed that main sea ice activities at the Icelandic Meteorological Office (IMO) concentrate on providing service to the fishing fleet operating in waters around Iceland, transport shipping along the coasts of Iceland, various kinds of sport and tourist vessels as well as harbour authorities as requested. Reports on sea ice are received from trawlers close to the sea ice edge, weather observers at coastal stations and other sources. Close collaboration is maintained with the Icelandic Coast Guard, which provides fairly detailed ice charts resulting from sea ice reconnaissance flights along the ice edge area in the Denmark Strait and the Iceland Sea north of Iceland and flights closer to land during times of extensive sea ice with some ice reaching into bays and fiords. On a larger scale, use is made of ice charts provided by ice centres abroad. Further, some limited use can be made of satellite imagery received by the APT antenna technique at the IMO. The reception facilities at the IMO will be upgraded in the very near future.

2.4.18 The Team noted that IMO information output provided to users at sea travel along various means of communications, such as radio, NAVTEX, the IMO website, etc.

2.4.19 Annual reports on sea ice at the Icelandic coasts continue to be worked upon and produced accordingly. Gaps in the publication series have almost been filled.

2.4.20 The IMO participated in a pilot study of the occurrence of frazil ice in Icelandic fjords, and the risk posed to fish farming. Funding has been requested for a complete study. The IMO

also participated in a study of an area 300 km south of Jan Mayen (roughly from 67- 69N and 6-11W). This study was part of an environmental assessment in regards to possible licensing of exploratory oil drilling. The ERA-40 sea-ice data (1957-2006) was utilized to analyse temporal and spatial sea-ice distribution in the area. In addition, a cursory comparison was made between the ERA-40 ice data and the ACSYS data.

Report by the Japan Meteorological Agency

2.4.21 The Team noted that the Japan Meteorological Agency (JMA) has been operationally monitoring sea ice conditions and providing sea ice information in the Sea of Okhotsk since 15th December 1970, in support of fishing, shipping and coastal and harbour activities. The JMA operationally analyzes sea ice conditions in the Sea of Okhotsk, the northern and western parts of the Sea of Japan, Bohai Sea, and the seas east of the Kamchatka Peninsula daily from November to July each year. The JMA produces sea ice analysis charts and numerical sea ice prognosis charts broadcasted on radio facsimile and available on JMA website twice a week from December to May. Daily sea ice analysis charts are available on the NEARGOOS Regional Real-Time Data Base website. The JMA started the global sea ice analysis in March 2006.

2.4.22 The sea ice analysis in the Sea of Okhotsk are provided based on satellite data, visible observation data from aircrafts, ships, and five coastal meteorological stations. The DMSP/SSM/I data are used for the global analysis. The JMA's model system has provided 7-day forecasts of sea ice distributions in the southern part of the Sea of Okhotsk and the neighbouring waters since 1991.

2.4.24 The JMA is currently developing algorithms to calculate the sea ice motion vector in the Sea of Okhotsk. It plans to make the results publicly available as nowcast information on sea ice and use them as initial conditions for JMA's numerical sea ice model.

Report by the Norwegian Meteorological Institute

2.4.25 The Norwegian Meteorological Institute (met.no), Sea Ice Service, is responsible for operational monitoring and charting of sea ice conditions in the waters around Svalbard and the Atlantic part of the Arctic (from eastern Greenland to Novaya Zemlya, Russia) and distributes this information to ships primarily as ice charts. The products delivered are based on several data sources. Increased use of SAR images from both Radarsat and Envisat has improved the quality and resolution of the ice charts. The availability of SAR images is though dependent on project funds, and hence the regularity is per day not consistent. However, since 2004, high-resolution ice charts over Svalbard has been delivered once a week. Other data sources for ice chart production are Envisat Global Mode mosaics, NOAA images, Modis, AMSR and Ocean and Sea Ice SAF (EUMETSAT). All products produced are available, free of charge, at met.no's web page: http://www.met.no/kyst_og_hav/iskart/.

2.4.26 The ice service in Norway is running on a system developed on an ESRI ArcView 3.x platform. However, development in being done towards a new updated system. In cooperation with the Canadian Ice Service (CIS), the sea ice service in Norway will adopt the ESRI ArcInfo system from CIS.

2.4.27 A thermodynamic sea ice model is developed by the research department of met.no. The model is running on an operational basis, but work is being done with data assimilation and tuning. Validation of the model remains and hence the model products are still not available for users.

Report by the Russian Federation Arctic and Antarctic Research Institute

2.4.28 The Team was informed that the sea ice information services in the Russian Federation are provided by the Arctic and Antarctic Research Institute in St. Petersburg (AARI), the Hydrometeorological Centre in Moscow (HMC), Far-East Hydrometeorological Research Institute (FEHRI) and local hydrometeorological offices in the Arctic, Far-Eastern Russia, Baltic, Black and Caspian seas, all above-mentioned centres belonging to the Russian Federal Hydrometeorological

Service (Roshydromet). The AARI provides centralized services mainly for shipping and coastal and harbour activities within the Northern Sea Route (NSR), for the Central Arctic Basin and Arctic seas (Greenland, Kara, Laptevs, Eastern-Siberian and Chukha), as well as for the seas with the seasonal ice cover (Baltic, White, Bering, Okhotsk, Caspian and also Antarctic seas). The AARI also operates the "Akademik Fedorov" research and expeditionary ice-breaking vessel used to support Russian Antarctic Expedition (RAE) and conduct research cruises in both Polar Regions. The FEHRI provides operational ice mapping services for the Russian Far-East seas (Japan Sea, Sea of Okhotsk) and NEARGOOS Project. The HMC provides an operational set of short-range prognostic meteorological information on global scale, as well as operating the Moscow Radio Meteorological Centre, providing in particular radiofax services for the Arctic Region.

2.4.29 The main data source for sea ice diagnosis is visible and infrared satellite imagery. For the cases of tailored support (the latest one – routine support for navigation in the Sakhalin waters), Radarsat imagery is requested with 1-3 days periodicity. Supplementary information is provided routinely by the coastal weather polar stations of Roshydromet and by icebreakers and ice-breaking research vessels when in operation within the Northern Sea Route or in Antarctic waters and by aircraft ice reconnaissance flights conducted occasionally during tailored support of applied and scientific activities. The main output products include a) general and detailed 1-7 days sea-ice conditions charts of the Arctic, Eurasian shelf seas and Antarctic waters, b) annotated imagery, c) prognostic charts of ice drift and currents, level elevation, winds and wave height in the Arctic Ocean as the output of two thermo-dynamic sea-ice and one waves and surface currents models run operatively at the AARI and d) medium and long-term prognostic information based on empirical and statistical models. Informational products are relayed to the users both in textual and graphic formats and in binary formats (SIGRID (1 & 3), e00, shapefile or S-57). Many of the sea ice informational products are available via the AARI website (http://www.aari.ru) and within the Russian Unified System of Information on World Ocean Conditions – ECIMO (http://data.oceaninfo.ru).

2.4.30 The AARI website hosts GDSIDB pages, Russian Antarctic Expedition, since 2006 Eurasian Arctic sub-office for IPY 2007-2008. Since 2000, the AARI hosts the Joint German – Russian Otto Schmidt Laboratory (OSL) for Polar Research and from 2003 – Joint Norwegian – Russian Fram Laboratory, both established to facilitate education and training of post-graduates students in Polar Geography and Oceanography.

Report by the Swedish Ice Service

2.4.31 During 2006 the whole Ice Service was reorganized and are now located at the SMHI's Department for Operational Oceanography. The group working with the Ice Service is also responsible for icing, sea water level service, oceanographic models, and NAVTEX forecasts in the Baltic region. During the last winter season, most of the recourses were used for operational training of the new staff. During this spring and the upcoming summer and autumn, the ice service will start testing and use GIS systems for ice charting. SMHI hope to be operational with the new charting system before the end of October 2007. Through the PolarView project a 10-day deterministic and an 8-day ensemble ice forecast is visually presented at www.smhi.se/polarview.

2.4.32 The main data source is remote sensing, both from the DSMP/NOAA satellites and from RADARSAT. Some 100 RADARSAT scenes are available during period January-April, downloaded and re-transmitted in near-real time by KSAT in Tromsö Norway, as cooperation between the Maritime Administrations and the Ice Service in Finland. Additional information on parameters such as ice concentration/thickness and floe size is received in real-time from icebreakers, other vessels and from pilot stations and ice observers along the coast.

Report by the United Kingdom British Antarctic Survey

2.4.33 The Team was informed that the UK ships that operate in polar waters and the UK Antarctic coastal stations make ice observations using WMO codes. The British Antarctic Survey research ships operating in Antarctica also compile charts of sea-ice encountered on their voyages, and report icebergs to the Norwegian monitoring programme. Some research is being carried out using instrumented aircraft. Sea-ice information is provided through the PolarView

portal and via email using data provided by other ice services. There is a thriving UK research community, which studies many areas including climatology, dynamic processes, and chemistry.

Report by the U.S. National Ice Centre

2.4.34 The Team noted that the U.S. National Ice Centre (NIC) has routinely produced maps of sea ice conditions since 1952. Bi-weekly charts are produced of all ice-covered regions of the Arctic and Antarctic. As well, the NIC produces at least weekly ice charts for all ice-covered seas continuous to the United States, the Arctic Basin and much of the North Atlantic Ocean along with the Ross Sea during the navigation season. Twice weekly charts are prepared of the Alaskan and Great Lakes regions. The NIC also produces and posts to the web site a daily ice edge in ASCII latitude/longitude for the Northern and Southern Hemisphere. The NIC uses multiple sources of information and remotely sensed imagery to build the daily ice edge. There is also a Marginal Ice Zone (MIZ) product for the Northern Hemisphere only. There is also a database on the web site of currently tracked and historical Southern Hemisphere icebergs longer that 15 km on the longest axis. The NIC has is now issuing all ice charts in SIGRID 3 format and the WMO Colour Code format. The NIC is currently collaborating with the Canadian Ice Service and the International Ice Patrol to develop a single analysis and production system for use by the three partners in the North American Ice Service.

2.4.35 The Polar Ice Prediction System (PIPS) 3.0 model based on the NCOM global ocean model, the CICE sea ice model developed at Los Alamos National Laboratory and the NOGAPS meteorological model will become operational this year. An international team will begin testing and validation of PIPS 3.0 in 2007. The NIC completed work on the project to provide the GDSIDB a complete set of sea ice data for the years of 1972/1973 through the present. The NSIDC produced a 33-year concentration climatology publication (NIC Sea Ice Charts and Climatologies Dataset) from the dataset. The climatology publication is available to the public at http://nsidc.org/.

2.4.36 The Team also noted that the National Ice Centre (NIC) and the University of Washington (UW) Polar Science Centre (PSC) collaborate in the management of US contributions to the International Arctic Buoy Programme (IABP) through the U.S. Interagency Arctic Buoy Program (USIABP). The USIABP purchased 18 buoys this year: 3 Ice Mass Balance (IMB) buoys, 5 ICEXAIR air droppable meteorological buoys, and 10 Ice Beacon meteorological buoys in 2006. These were deployed using a combination of logistics coordinated with collaborators of the IABP. The USIABP also coordinated the Hercules C-130 deployment of 12 ICEXAIR buoys by the US Naval Oceanographic office (NAVO) via the White Trident Mission in August 2006.

2.4.37 Under the auspices of the IICWG and the ETSI, the NIC prepared the initial report on the harmonization of the IHO Ice Objects Catalogue and the WMO standards documents and worked with the CIS and the contractor on the preparation of Version 4 of the Ice Objects Catalogue.

2.5 BSIM and IICWG reports

Baltic Sea Ice Meeting (BSIM) Report

2.5.1 The Team noted the Baltic Sea Ice Meeting (BSIM) report presented by its Chairperson, Mr Ari Seina (Finland). The Team was informed that after the retirement of Dr Klaus Strubing on 30 April 2004, Mr Seina took the Chairpersonship, as agreed at the Twenty-first BSIM. Mr Seina highlighted that a Memorandum of Understanding for Baltic Sea Ice Services was signed by Denmark, Finland, Germany, Latvia and Sweden. During the Twenty-second BSIM, Poland and Estonia informed that the MoU would be signed soon, and representatives of Lithuania and Netherlands informed that the MoU is currently under evaluation. Russian Federation has not signed this Memorandum.

2.5.2 The Team noted that the Twenty-second BSIM discussed the status and future of the Baltic Sea Ice Services website, in particular the provision of sea ice products free-of-charge through this website. The Team also noted that governmental roles do not allow countries to provide this information free-of-charge.

2.5.3 Mr Seina informed the Team that BSIM agreed to shorten these meetings from 5 to 3 days in the future, with the following structure: (i) Day 1 - meeting with users and key players, (ii) Day 2 - meeting with icebreaking, and (iii) Day 3 - internal meeting. The Team was informed that the forthcoming meeting was planned for the later part of 2007 in Norway or the Russian Federation.

2.5.4 The Chairperson of the ETSI, Dr Vasily Smolyanitsky, pointed out that some of the BSIM countries are not represented on the ETSI, however sea-ice information provided by these countries is included in the WMO-No. 574.

International Ice Charting Working Group (IICWG) Report

2.5.5 Mr Paul Seymour (USA), representative of IICWG in the ETSI presented the Team with the International Ice-Charting Working Group report. He informed them that the Arctic nations and related organizations formed the International Ice Charting Working Group in Copenhagen, Denmark on 7 October 1999, to address common needs, including: 1.) data and product exchange, 2.) terminology, 3.) data and mapping standards, 4.) operations and customer support, 5.) training, and 6.) applied science, research and development. The Members recognized that there is value in "cooperative activities in operational ice services supporting maritime navigation". The Team noted that this Group meets every year and the eighth upcoming meeting would be hosted by ESA, in Frascati, Italy, October 2007. Mr Seymour explained that one of the main roles of this Group has been as the advisory group for ETSI, also contributing for WMO publications.

2.5.6 The Team noted that the main information from previous meetings of the Group and scientific material is available on-line on the following web page: http://nsidc.org/noaa/iicwg/. Mr Seymour briefed the Team with the results from the seventh session of the IICWG (IICWG-7, Helsinki, Finland, September 2006). IICWG-7 decided to integrate a 1-day IICWG science workshop into the general meeting to put together operational services and researchers together.

2.5.7 The Team noted that IICWG had developed a set of important technical documents of interest for JCOMM, in particular a socio-economic document submitted to the Group on Earth Observation (GEO) and Global Monitoring for Environment and Security (GMES) and containing Observational Requirements for Key Ice Features/Optimum Future Value. A new version is now being prepared for future submission. The Team recognized that this document among the other IICWG documents contains an important input to the SPA User Requirement Document and to this effect agreed in collaboration with the IICWG to develop a selection of IICWG publications to be made available via the JCOMM-services web-site (**Action: ETSI Members and IICWG representatives to ETSI**). This issue is discussed under agenda item 2.11.2.

2.5.8 The Team was informed that IICWG-7 had specific session on IPY operations work for the development of the Ice Information Portal.

2.5.9 The Team noted the need for engaging other national ice services to participate actively in IICWG, in particular countries from Southern Hemisphere and Asia. Mr Seymour informed the Team that this corresponds to the first action item from the IICWG-7 for the IICWG co-Chairpersons, who sent a letter to those countries encouraging them to participate in the IICWG. The Team also noted that there is a lack of representation from South Hemisphere in the ETSI Membership and urged the Secretariat and the ETSI Chairperson to encourage the participation of those countries in ETSI activities **(Action: ETSI Chairperson and Secretariat)**.

2.6 Provision of Marine Safety Information (MSI) related to sea ice

2.6.1 IHO Report

2.6.1.1 The Team was informed that the Second Session of the Expert Team on Maritime Safety Services (ETMSS-II, Angra dos Reis, Brazil, January 2007) noted the information provided in the IHO S-53 Appendix 1, also published as the IMO/IHO/WMO *Manual on MSI*, with references to 'Sea Ice'. The ETMSS-II recognized that the MSI, in particular meteorological warnings, should

be more clearly defined and included in said publication. The ETMSS recalled at the Seventh Session, the CPRNW Correspondence Group (CPRNW-7 CG) established to review all World-Wide Navigational Warning Service (WWNWS) documentation, had decided to take a top-down approach and focus initially on IMO Assembly Resolutions A.705 (17) and A.706 (17). The Eighth Session of the CPRNW (CPRNW-8) further completed additional work on reviewing these resolutions. At the time of this meeting, the CG is continuing its work with the intention of completing it in time for approval by the Ninth Session of the CPRNW (CPRNW-9), the IHO and WMO and submission to COMSAR-12. Subsequently, the information in these revised resolutions would be cascaded down into the IMO Publication on Maritime Safety Information, the NAVTEX Manual and International SafetyNET Manual and IHO Publications S-53 and S-53, Appendix 1. The ETMSS urged the WMO Secretariat to consider proposing a Resolution to the IMO on Met-Ocean services similar to A.706(17) for navigational warnings.

2.6.1.2 The Team expressed some concerns regarding the provision of ice information by SafetyNET, in particular for the NAVAREAs/METAREAs in the Southern Hemisphere, in order not to duplicate the provision of such information for mariners. In this context, the Team urged the Secretariat to assess these issues and make the necessary arrangements, jointly with the ETMSS, to avoid such problems. Noting that the ETMSS established a Task Team on the provision of MSI for Polar Regions (ToR for TT PMSI and Membership provided in the Annex V), the Team in addition to Capt. Manuel Picasso and Dr Vasily Smolyanitsky who were nominated to TT PMSI during the ETMSS to represent correspondingly Argentina on national level and ETSI nominated Ms Nora Adamson (Denmark), Dr Jürgen Holfort (Germany) and Mr Amund Lindberg (Sweden – leader) to review above-mentioned publication IMO/IHO/WMO *Manual on MSI* and to provide input to the proposed Resolution to the IMO on Met-Ocean services (similar to A.706(17) for navigational warnings), assuring that sea ice information would be included **(Action: ETSI Members to TT PMSI)**.

2.6.2 Proposals for the new potential Arctic NAV/METAREAS

2.6.2.1 The Team noted the information provided by the Secretariat on the status of the process of definition of boundaries and responsibilities for new potential Arctic NAV/METAREAs XVII-XXI. The report of the IMO/IHO/WMO Correspondence Group on Arctic MSI Services presented at the Eleventh Session of the IMO/COMSAR (London, United Kingdom, from 19 to 23 February 2007), is provided in the Annex VI.

2.6.2.2 The Team noted that the Norwegian Meteorological Institute had sent an official offer to assume the role as Issuing Service for the proposed METAREA XIX. Denmark also indicated and informed the Secretariat of its potential interest. The ETMSS, at its second session, urged the Secretariat to discuss with Norway and Denmark in order to define who will take the responsibility as Issuing Service and Preparatory Service for this METAREA. Canada has formally expressed at the ETMSS-II the intention to be the Issuing Service with responsibility for the proposed GMDSS METAREAs XVII and XVIII and that Environmental Canada is currently seeking proper approvals in Canada to that effect. The Representative of USA informed the ETMSS of the potential interest of USA to be Preparatory Service for the proposed METAREAs XVII, and possibly METAREA XVIII. The ETMSS-II noted that the Russian Federation is routinely providing meteorological and ice MSI for SafetyNET within the seventeen forecast regions of the Northern Sea Route area of the current Arctic Ocean METAREA, and is ready to become the Issuing Service for METAREA XX and XXI.

2.6.2.3 The Team again expressed some concerns regarding the provision of ice information by SafetyNET, in particular for the NAVAREAs/METAREAs in the Southern Hemisphere. In this context, the Team was informed about the GMDSS website (http://weather.gmdss.org) and was recommended to check the content of the NAVAREAS/METAREAS descriptions and include references to potential occurrence of sea ice and links to ice services, where appropriate, based on the information provided in the WMO-No. 574. A suitable form of words could be “This area may contain sea-ice or icebergs. Please see the NIC charts at http://www.natice.noaa.gov or other web pages for ice details.” **(Action: ETSI and ETMSS Chairpersons and Secretariat)**.

2.6.3 Ice Information for Electronic Navigation Systems (ECS)

2.6.3.1 Mr John Falkingham (Canada), formal representative of the IHO in the session, presented the results of recent work with the IHO-IEC Harmonization Group on Marine Information Objects with respect to the Ice Objects Catalogue, as well as a path forward to obtaining formal sanction of the Catalogue.

2.6.3.2 The Team noted that the Marine Information Objects (MIO) consist of supplementary information to be used with an Electronic Navigational Chart (ENC). Supplementary means additional, non-mandatory information not already covered by existing International Maritime Organization (IMO), International Hydrographic Organization (IHO), and the International Electrotechnical Commission (IEC) standards or specifications. Examples of MIOs include ice coverage, tide/water level, current flow, and meteorological, oceanographic, and marine habitats. Depending on the navigation situation or task-at-hand, the provision and use of the MIOs (e.g., ice coverage, weather conditions, etc.) can be crucial in terms of improving both the safety and efficiency of maritime navigation, as well as ensuring the protection of the marine environment.

2.6.3.3 The Team was informed that, in order to facilitate the development and implementation of MIOs, the IHO and IEC agreed to establish a Harmonization Group on Marine Information Objects (HGMIO) in May 2002. The HGMIO is a subsidiary to both the IHO Committee on Hydrographic Requirements for Information Systems (CHRIS) and the IEC Technical Committee No. 80 - Maritime Navigation and Radiocommunications Equipment and Systems (TC80). Dr. Lee Alexander of the University of New Hampshire currently chairs the HGMIO.

2.6.3.4 At a recent meeting between the Canadian Ice Service, Canadian Hydrographic Service, Canadian Coast Guard and Dr. Alexander, it was determined that the Ice Objects Catalogue Version 4.0 should be published as an MIO in the IHO Registry of Registers. In this context, the Team reviewed its Terms of Reference (ToR). The revised ToR were also considered under further agenda item '3.7 – Working plan for the next intersessional period' and are provided in the Annex VII. Mr Falkingham also informed the Team of the recommended procedures for the development of the MIOs (provided in Annex VIII).

2.6.3.5 In order to establish the appropriate link with IHO, the Team agreed that the Ice Objects Register Manager should be the WMO Secretariat; and approved the creation of an Electronic Navigational Chart Ice Objects Task Group (TG ENCIO) operating under Terms of Reference proposed in Annex IX). The Team nominated Canada, Germany, Russian Federation and USA to be Members of this TG (with a leader be elected by the TG itself during the next weeks) and work in consultation with other ETSI Members as appropriate. The Ice Objects Catalogue should be submitted to the IHO Registry of Marine Information Objects by the Register Manager **(Action: WMO Secretariat)** and the TG ENCIO and the Register Manager should develop the appropriate documents to effectively implement and maintain the Ice Objects Catalogue as an IHO Register as well as develop a testing scheme **(Action: Register Manager and TG ENCIO)**. This TG should also contribute to the work of the JCOMM Expert on binary products and the cross-SPA TT that would develop Met-Ocean graphic products, in accordance with the ToR provided in Annex X **(Action: TG ENCIO)**.

2.6.3.6 The Team was informed that Mr. John Falkingham (Canada) was invited to present the result of the current ETSI session to the forthcoming HGMIO meeting to be held in May 2007 at the University of New Hampshire **(Action: Mr Falkingham (Canada))**.

2.6.4 Ice Objects Catalogue

2.6.4.1 The Team noted that the Ice Objects Catalogue Version 3.0, was adopted several years ago, but was not used for practical implementation until 2005. In the course of implementing the Catalogue in the International Hydrographic Organization (IHO) registry system for Marine Information Objects, several inconsistencies were discovered. At the International Ice Charting Working Group (IICWG) meeting, in October 2005, in which ETSI Members attended, an action was taken to review the Ice Object Catalogue for consistencies and to harmonize the WMO *Sea Ice Nomenclature* and SIGRID-3 format. This harmonization has involved an extensive review process of all relevant existing documentation, as well as a consultative cycle with key international

stakeholders. In addition to the International Ice Community Standards, all previous versions of the Ice Objects Catalogue were reviewed accordingly. As well, the S57, Edition 3.1 documentation set was regularly consulted to ensure compatibility with the International Hydrographic Organization (IHO) Object Catalogue standards. The harmonization of the Ice Objects Catalogue with WMO and SIGRID-3 standards used the following approach:

- For the most part, WMO Symbology was used as a basis to develop S-57 Ice Feature Objects. This will enable Internationally-accepted symbology to be used for any ECDIS/ENC-displayed ice products.

- Because of internal inconsistencies within WMO ice symbol tables, and in order to support "Strips and Patches", SIGRID-3 attribute codes are used as a basis for those Attributes related to the standard "Egg Code".

- Since SIGRID-3 attribute codes do not, support them, this version of the Ice Objects Catalogue does not support the "Double-Egg" sub-attributes, which would be, required with the Attribute "Strips and Patches" within the SEAICE and LACICE "area" Objects.

- For simplicity, Ice Feature Objects are defined as "area", "point", or "line" only. For those point symbols in WMO Symbology that relate to either a "Specific Location", or a "Presence in the Area", a new "Ice Location" Attribute is defined.

- Neither WMO nor SIGRID-3 support line-type Objects. Additionally, there is no support for Iceberg information products produced by IIP or CIS, or for "Stage of Development" Attributes for Lake Ice (LACICE). These particular Ice Feature Objects have thus been harmonized with *"MANICE – Manual of Standards Procedures for Observing and Reporting Ice Conditions", 8th Edition, 1984, Canadian Ice Centre, Ottawa, Canada.*

- Ice Feature Objects and Attributes that have no symbology support within the WMO, SIGRID-3 or MANICE documents referenced, have been dropped from this version of the Ice Objects Catalogue. This is because new symbols would have to be created, accepted by the International ice community, and incorporated into the referenced documents – before S-57, products could be defined for these Objects. This is deemed "out of scope" for the development of this version.

- During this harmonization process, some of the Attributes have been moved up to become Ice Feature Objects, so that the associated WMO attributes can be better accommodated without having to define "sub-attributes". These include Ice Fracture, Ice Compacting, Snow Cover, Stage of Melt, etc.

- Many of the Attributes associated with "point" Ice Feature Objects have also been added as Attributes to the SEAICE and LACICE "area" Feature Objects. This is done to provide S-57 support to future map-type/polygon-based ice information products, such as an ice lead product, ice drift products, etc.

- The following "regional" item has been included: "ICELVL (Level ice)" as an attribute to the SEAICE and LACICE objects. WMO Symbology supports this for use in the Baltic, for hatching or colouring of ice charts.

- Through discussion with Dr. Paul Birkel of The MITRE Corporation, and with Paul Seymour of NIC, Dr. Birkel's comments from his analysis of October 2003 have been included into this version of the Ice Objects Catalogue.

2.6.4.2 The Team was informed that three key ETSI Members were involved in the reviews and edits of Version 4.0. These Members were Mr John Falkingham (Canada), Mr Paul Seymour (USA) and Dr Vasily Smolyanitsky (Russian Federation). Dr Paul Birkel (MITRE Corporation, USA), Mr Holger Bothien (7C's, Germany) along with several other international experts, provided technical

advice during this process. Mr Bruce Ramsay (retired from CIS), lead the review under contract with CIS. These iterative reviews and revisions resulted in four early versions of the document. In February 2007, Dr Smolyanitsky to all respective Members of the ETSI disseminated a draft. Comments and suggestions were compiled, reviewed, and included in the present version, dated March 2007.

2.6.4.3 Throughout this process, the approach to harmonization, as outlined in section 4 of the document, was followed as closely as possible. The intent has been to develop a set of Ice Objects and Attributes, based upon accepted international standards, which will lay the initial foundation for an ice information layer with an operational ECDIS/ECS. It is recognized that the Ice Object Catalogue may be expanded in the future if further information and products are needed, as the use of an ice layer in the ECDIS and ECS Systems evolves.

2.6.4.4 The revised Sea Ice Nomenclature proposed by Dr A. Busheyev was reviewed to see if the Catalogue could be made more consistent as well. However, it was determined that necessary changes are significant in scope, and will require substantial discussion by the ETSI Members. The Team adopted Version 4.0 of the Ice Objects Catalogue for subsequent submission to the IHO Registry of Marine Information Objects, based on its consistency with the presently approved Sea Ice Nomenclature; and urged the WMO Secretariat to provide a Number and publish it as a WMO/TD Publication **(Action: WMO Secretariat)**.

2.6.4.5 The Team noted a proposal from UK and agreed that accepted philosophy/paradigm would be that the *Ice Objects catalogue represents the subset of the WMO Sea Ice Nomenclature being at the same time a driving force for amending sea ice Nomenclature with an intention of including the navigators' feedback in the future*.

2.7 WMO sea ice documents and publications

2.7.1 Sea ice nomenclature

2.7.1.1 Dr Vasily Smonyanitsky, Chairperson of the ETSI, presented the status information regarding the WMO Publication Number 259, *Sea Ice Nomenclature*, the draft of the new updated version of the Nomenclature and suggestions for its further development, based on user requirements and sea ice practices, including a presentation of the publication(s) in electronic and Extensible Mark-up Language (XML) formats.

2.7.1.2 The Team noted that the currently effective the *WMO Sea-Ice Nomenclature* was developed by a WMO CMM Sea Ice Working Group in 1968, and published in 1970 (without scales and symbols). In 1989, it was re-published in the form of Supplement (Supplement No. 4), where Volume 3 "International System of Sea-Ice Symbols" is presented, and Supplement No. 5, presenting several supplements and edited main sections of the Nomenclature (ice terms arranged in the subject and alphabetical orders). The ETSI-I session in October 2002 amended definitions of the three terms and presentation scheme of the three ice objects, while the ETSI-II session in April 2004 introduced one new term. The ETSI-II session also discussed and approved full revisions of the Spanish and French linguistic equivalents of the sea ice terms by ice experts from Argentina and Canada and based on corresponding national practices. Formal textual versions of the stated amendments and revisions are included into ETSI-I/GDSIDB-IX and ETSI-II/GDSIDB-X reports. The Second Session of JCOMM (JCOMM-II, Halifax, Nova Scotia, Canada, September 2005) formally approved amendments to the terms and linguistic equivalents of the nomenclature introduced by the ETSI-I and ETSI-II Sessions. In total, the currently effective sea ice nomenclature now has 193 terms and definitions arranged in 13 sections.

2.7.1.3 The Team noted that the JCOMM-II also formally approved the development of an electronic version of the Nomenclature. To further facilitate inter-lingual comparisons and exchange of sea ice terms with other databases of hydro-meteorological terms (such as the WMO Marine Glossary), during 2002-2006, a tetra-lingual English/French/Russian/Spanish electronic version of sea ice terms and definitions (Supplement No. 5) in UTF-8 coding (preserving national characters) was developed in the AARI as a local version as a MS Access XP database, alongside with a internet MySQL 5.0 based version with a corresponding active server page (ASP) interface

in JavaScript. The local MS Access XP version of the database provides easy and simple search, listing and editing of the terms and definitions of Supplement No. 5 and its export to a set of database formats (supported by MS Access XP or higher). Internet MySQL-based version provides extensive capabilities for the output of formats, search, and the terms and definitions (of Supplement No. 5) are produced in .html, and .xml formats.

2.7.1.4 The Team agreed that the AARI with the support of WMO Secretariat would be responsible for the management of the electronic version of this publication and its database (**Action: ETSI Chairperson**). It was recommended that the creation of a mirror of this database in the SPA website along with the textual static version of this publication be available on the SPA website **(Action: ETSI Chairperson)**.

2.7.1.5 Within this agenda item the Team agreed to discuss the introduction of the term "frost flowers" during the intersessional period and urged the Electronic Navigational Chart Ice Objects Task Group to make the necessary harmonization between this publication and the Ice Objects Catalogue **(Action: TG ENCIO)**.

2.7.1.6 The Team noted that following recommendations and endorsement by the former CMM-XI, JCOMM-I and JCOMM-II Sessions, the experts from the AARI developed the draft of a new Nomenclature in a form of a two documents with the following preliminary titles: a.) shorter "Sea Ice Nomenclature for Ice Charting" (author: Dr Andrey Bushuev), and b.) a wider, more scientific one "WMO Glossary on Sea Ice Cover" (authors: Dr Stanislav Losev and Dr Vladimir Spichkin). The ETSI-II Session in April 2004 discussed the drafts and agreed that it would concentrate its further work on the update of the Sea Ice Nomenclature using the document prepared by Dr Andrey Bushuev as a draft version 1.0. During May 2004, Dr Jonathan Shanklin (United Kingdom), which resulted in version 1.1 of the document carried out an editorship review of the document. The latter version, together with Annexes 1 and 2 (code tables, symbols and conventional designations and order of using ice symbols) was posted in .pdf format at JCOMM SPA website, section 'sea-ice documents'. In this context the Team agreed to carry out its work on the update of the Sea Ice Nomenclature using the stated version 1.1 as the starting one with target date as December 2008 (**Action: ETSI Members with coordination of the Chairperson**).

2.7.1.7 The Team also agreed to start working on the complete update of the "Illustration Glossary of the Ice Terms" and to this effect investigated the existence of background resources for this activity. The Team noted that potential candidates to be included into the planned update would be:

- CIS - MANICE and ad-hoc huge collection of photos;
- Argentina – poster for the mariners;
- ASPeCT CD-ROM;
- USA - NOAA ad-hoc resources;
- FIMR - ad-hoc resources;
- UK – Marine Observers handbook and Admiralty mariners' handbook.

In this regard, the Team was invited to provide illustrations to the ETSI Chairperson and start its work on the updated document with target date as December 2008 **(Action: ETSI Members coordinated by the Chairperson)**.

2.7.2 Sea ice services in the World (WMO-No. 574)

2.7.2.1 Dr Vasily Smonyanitsky, Chairperson of the ETSI, presented the status information and suggestions for the technical mechanism for the provision of annual update of the publication *Sea Ice Services in the World* (WMO-No. 574). The Team agreed for ETSI Chairperson and WMO Secretariat to work as the Technical Managers of the publication and to commence revision of the publication's contents on an annual basis beginning from 1 April 2007, using the following scheme:

- Using content of the third current edition of the publication as a model;

- National ice services to submit corrections to the ETSI Chairperson and WMO Secretariat for appropriate paragraphs of Parts I-II and annexes, as needed and as appropriate **(Action: ETSI Members)**;
- After revision, the ETSI Chairperson in collaboration with the WMO Secretariat should incorporate these corrections or amendments, update the contents of the electronic version (including the 'Table for noting supplements received') within a three month period (this period may be extended, as necessary based on resources) and make the updated version officially available on the appropriate JCOMM SPA website via .pdf format in a restricted area **(Action: ETSI Chairperson and WMO Secretariat)**;
- The WMO Secretariat should inform the respective National Ice Services and sea ice community on the availability of the updated electronic version with the use of a mailing list and/or appropriate news sections and methods (similar to 'Arcticinfo') **(Action: WMO Secretariat)**;
- Updated or amended CD-ROM versions of the publication and/or supplements are prepared by the WMO Publishing Department on an annual basis **(Action: WMO Secretariat)**.

2.7.2.2 The Team also agreed that it would be more appropriate for publication to start each section for national ice service by an individual page and to include the following additional annexes **(Action: WMO Secretariat)**:

- List of abbreviations;
- Hemispheric map showing max/min ice extent plus dots showing location of ice services;
- List of contact persons, which serve as editors for the electronic version of the publication.

2.7.2.3 Based on discussion within this and previous agenda items, the Team urged the WMO Secretariat to establish the technical mechanism to publish officially the electronic versions of the WMO technical publications and to use them as the Master versions as means of more efficiently using available resources **(Action: WMO Secretariat).**

2.7.3 Review of common abbreviations list for NAVTEX messages related to sea ice

2.7.3.1 The Team recalled that JCOMM-I (Akureyri, Iceland, June 2001) had recognized that, because the International NAVTEX broadcast system is not well adapted to relatively long weather forecasts, some National Meteorological Services responsible for compiling meteorological data for this broadcast system encounter difficulties. These difficulties are mainly associated with the length of these reports, and consequently the risk of vessels not receiving these meteorological reports may be significant due to the broadcasts overrunning the allocated ten minutes time slots or the criteria adopted for rejection of corrupted messages on receivers.

2.7.3.2 The Team was informed that during the Second Session of the Expert Team on Maritime Safety Services (ETMSS-II, Angra dos Reis, Brazil, January 2007), Mr Michael Myrsilidis, from the Hellenic National Meteorological Services (Greece), presented the work undertaken by a Task Team to define a common abbreviations list for NAVTEX messages, including the first version of the guidelines and abbreviations list that were adopted by JCOMM-II (Halifax, Nova Scotia, Canada, September 2005). The Team stressed some concerns regarding communications problems that generate omission of some characters, creating some difficulties in understanding messages that include abbreviations. In this context, the Team strongly endorsed the use of plain text; however, recognizing the need for brevity and clarity for marine communications recommended that the Swedish Ice Service review the additional abbreviations for the MSI related to sea ice **(Action: Mr Amund Lindberg (Sweden))**.

2.7.4 Guidelines for sea ice information in WMO manuals and guides (WMO-No. 471, WMO No. 558, GMDSS Guides, etc.)

2.7.4.1 Dr Vasily Smolyanitsky, Chairperson of the ETSI, presented the proposal, developed during the Second Session of the Expert Team on Maritime Safety Services (ETMSS-II, Angra dos Reis, Brazil, January 2007), for a stronger collaboration between the ETMSS and ETSI, especially

with a view to further develop standards, guidelines and regulations for provision of complex sea ice information in MSI, for future inclusion in WMO Manuals and Guides.

2.7.4.2 The Team recalled that observational data from coastal stations, icebreakers, drifting buoys, aircraft and satellites are combined by the NIS with diagnostic and prognostic information from ice-ocean coupled numerical models to derive information on ice distribution, compression and divergence, wind and ice drift, ocean current, sea level and sea level oscillations. Sea ice informational products derived in real-time from these data are already used operationally to ensure the safety of navigation by all vessels, maximize time and fuel savings of icebreaker lead convoys, determine the most efficient and safest route, protect life and property associated with human activities on the ice, and include:

- routine ice charts with various complexity, scale and periodicity (usually 1-7 days), providing tactical and regional recommendations (binary product);
- sea ice boundary, icebergs propagation boundary with daily periodicity (textual product);
- high-resolution annotated satellite imagery, commonly providing tactical recommendations to the masters (1 hour – 1 day) (binary product);
- prognostic (usually 1-7 days) ice charts for ice parameters critical for safety and success of navigation (binary product);
- supplementary synoptic and prognostic (usually 1-7 days) meteorological charts or grids (binary or textual products);
- textual warnings and forecasts for ice and weather parameters critical for safety and success of navigation;
- medium to long-term ice and meteorological phenomena forecasts with a lead-time of more than 7 days (commonly based on empirical models) (mostly textual products).

2.7.4.3 The Team noted that there is a need to define what the mandatory products from this list are and to revise relevant sections in WMO Manuals and Guides, in particular, in the WMO-No.8, WMO-No. 558 and WMO-No. 471 **(Action: ETSI Members to TT PMSI)**. The Team expressed some concerns about the provision of MSI for the Southern Hemisphere, and urged TT PMSI to carefully review what is already established under the Antarctic Treaty **(Action**: **ETSI Members to TT PMSI)**.

2.7.4.4 The key challenges for the intersessional period identified for this Task Team, in cooperation with the other SPA ETs, are as follows:

(i) Make efforts to maintain relationships between the WMO, IMO, IHO and ISO on establishing ownership and developing Met-Ocean registers and catalogues, to identify focal points from these organizations on SPA four areas, and to formalize the relationship between the JCOMM ETs and analogous groups (generally Sub-committees) of these organizations;

(ii) Provide the IHO with the final documentation to: (a.) approve additional Met-Ocean parameters (sea ice, MSS, MAES and WS) within the ENC, and (b.) use the ENC within SafetyNET;

(iii) Contribute at the test phase, to identify contact points on the provision of Met-Ocean parameter layers in ENC, using the ECDIS with relevant bodies and private companies (e.g., Morintech, C-MAP and SevenCs), and explore its potential application within the GMDSS and SafetyNET;

(iv) Develop standards for Met-Ocean product presentations in accordance with OpenSource IHO and ISO standards (e.g., GML 19136);

(v) Prepare within the ETMSS, guidelines and recommendations for the provision of sea ice information and warnings for mariners to be included in *Manual on Marine Meteorological Services* (WMO-No. 558) and *Guide to Marine Meteorological Services* (WMO-No. 471);

(vi) Investigate further within the ETMSS and the Joint IMO/IHO/WMO CG on Arctic MSI Services, the best way(s) forward for providing full MSI services in Polar Arctic and Antarctic regions, including the use of other potential satellite service providers and the promotion of the continuity of MSI broadcast by radio-faxes;

(vii) Develop a cross-ET Pilot Project for the Arctic region, focused on maritime services, support and disaster-risk management (including sea ice, icebergs, oil spills, rogue waves, etc.).

2.7.4.5 The Team also noted that due to both the necessity of timely relay of information and the existence of numerous gaps in the Inmarsat coverage poleward of 77-79°, various telecommunication facilities are used to relay sea ice products (both textual and binary), to the users (Inmarsat-C, NAVTEX, HF Radio, Iridium/Inmarsat Internet connections, mobile phone providers for inland seas such as Baltic Sea, other national satellite providers). Regarding the dissemination issue, close cooperation with the IHO should also be organized, as the Joint IMO/IHO/WMO CG on Arctic MSI Services agreed that, despite limitations with Inmarsat-C coverage, there should not be a northern limit to any Arctic NAV/METAREA, and that the CG should investigate further the best way forward for providing full MSI services, including the use of other potential satellite service providers. This proposal was endorsed by IMO/COMSAR-XI in February 2007, in particular in the new Terms of References of the CG.

2.7.4.6 Regarding the same dissemination issue, a working item on extension of radio facsimile transmission of ice information for the Arctic was identified by the ETSI in 2006 as a crosscutting activity between the ETSI and ETMSS. Two RMCs, Deutscher Wettwetterdienst and the Moscow RMCs, were considered by the ETSI Experts as potential providers of such information. The BSH kindly provided information that the Deutscher Wetterdienst may potentially start in 2007 to use some slots used for several Baltic ice products (10:07, 15:20, 15:40 and 21:15 at frequencies 3855kHz, 7880kHz and 13882.5kHz) for Arctic ice charts transmissions. In strong winters in the Baltic all, these time slots will be used for Baltic ice charts, but in milder winters, at least one will be available for the Arctic and outside the Baltic ice season, all be used for Arctic charts. Input information may be submitted as PNG (other common graphic formats are also accepted) version of the charts in black and white via the BSH server and may include a 1 to 7 day interval analysis, prognostic ice charts and ice edge. Noting that Mr Timothy Rulon, from USA/NOAA, is compiling information regarding the transmission of MSI via radio facsimile, the Team agreed for ETSI Chairperson to summarize information received in March 2007 from Canada, Denmark, Germany, Norway and USA and submit a short report to the WMO Secretariat **(Action: ETSI Chairperson)**. With this information, the WMO Secretariat would update the publication WMO-No. 9, Volume D, accordantly **(Action: WMO Secretariat)**.

2.8 Status and future formats for operational and historical sea ice data exchange

2.8.1 Proposed Amendments to the SIGRID-3

2.8.1.1 Ms Marie-France Gauthier (Canada) presented a report on proposed amendments to SIGRID-3 code (provided in Annex XI). The Team noted that in the course of harmonizing the practical usage of SIGRID-3 for the North American Ice Service, the Canadian Ice Service (CIS) and the U.S. National Ice Centre (NIC) have encountered a number of difficulties with the code. To resolve these difficulties, the CIS and NIC have adopted solutions that they were proposing to the ETSI as amendments to the current SIGRID-3 Code (JCOMM Technical Report No. 23/TD-No. 1214 b). Noting that these amendments don't create any consequences in terms of software and are applicable for Arctic, Antarctic, as well as for the seas with seasonal ice cover (e.g. Baltic Sea), the Team approved all the amendments proposed to SIGRID-3 code and noted that there is also a need to harmonize the proposed amendments with the corresponding sections in the WMO Sea Ice Nomenclature, supplement on symbology. To this effect, the Team urged:

- The ETSI Chairperson to incorporate these amendments into the electronic version of the current SIGRID-3 Code and harmonize the changes with the WMO Nomenclature supplement on symbology **(Action: ETSI Chairperson)**;

- The WMO Secretariat to inform all relevant bodies about these changes **(Action: WMO Secretariat)**.

2.8.1.2 Mr John Falkingham (Canada) presented a report on additional recommendations for changes to ice coding and mapping standards, including SIGRID-3 and the Sea Ice Nomenclature and Symbology, introduced in the final report of the Canadian Ice Service (CIS) on the ECDIS Ice Objects Catalogue Revision Project, and intended to resolve internal inconsistencies in the standards or between standards. These additional recommendations are provided in the Annex XII. The Team agreed to discuss these recommendations during the intersessional period by email and/or teleconference **(Action: ETSI Members)** and invited Mr Falkingham (Canada) to coordinate these actions and act as the leader **(Action: Mr Falkingham (Canada))**. The Team agreed to consider under this discussion the "frost flowers" term (proposed by United Kingdom) and additional terms posted on ASPeCT web-site, in addition to the recommendations in the Annex. The Team recommended that after the approval, these definitions should be available in English, French, Russian and Spanish **(Action: ETSI Members and Secretariat)**.

2.8.2 Vision and strategy for the standards for sea ice coding and presentations

2.8.2.1 Dr Vasily Smolyanitsky, Chairperson of the ETSI, presented background information from the technical session on interoperability data formats during the Sixth Session of the International Ice Chart Working Group (IICWG-XI, Ottawa, Canada, 24-28 October 2005) which summarizes the ice services vision and strategy for the standards for sea ice coding and presentations. The Team approved the content of this document (provided in the Annex XIII) as the ETSI vision and strategy for the standards for sea ice coding and presentations.

2.8.2.2 The Team recalled that a major Data Management activity of the WMO is the development of the WMO Information System (WIS). The WIS is an overreaching approach based on widely accepted standards, such as those promoted by the ISO to meet information exchange requirements of all WMO Programmes. In this regard, the Team recommended that ETSI standards should (i) fit the WMO Information System; and (ii) be compatible with the requirements of JCOMM Data Management Programme Area (DMPA) strategy **(Action: ETSI Members)**.

2.9 Requirements for sea ice information and products (services and users)

2.9.1 Requirements for sea ice services

2.9.1.1 The Team reviewed the observational and sea ice information requirements for its applications. The Team agreed that maintenance of complete and up to date requirements is essential for the provision of relevant and high-quality marine services.

2.9.1.2 To proceed with this exercise, the Team identified three sets for requirements developed during the periods of 2003-2006 by the Experts of the International Ice Charting Working Group (IICWG) in collaboration with the ETSI, GCOS SST & SI, as well as other national experts:

- "National Operational Ice Information Requirements" (from "An International Collaborative Effort towards Automated Sea Ice Chart Production", www.nsidc.org/noaa/iicwg/presentations/IICWG_white_paper_final.doc, also included in the ETSI-II Meeting Report);

- "Observational Requirements for Key Ice Features/Optimum Future Value" (from "Ice Information Services: Socio-Economic Benefits and Earth Observation Requirements"; prepared for the Group on Earth Observation (GEO) and Global Monitoring for Environment and Security (GMES), September 2004, http://nsidc.org/noaa/iicwg/pdf/IICWG_GEO_Paper_4.pdf);

- "Summary of Current/Planned Capabilities and Requirements for Space-based Remote Sensing of Sea Ice and Iceberg Parameters" and "Summary of Current/Planned Capabilities and Requirements for lake and river ice parameters" (from: "IGOS

Cryosphere Theme - Report of the Cryosphere Theme Team", version 1.0r4, 13 March 2007, source: http://stratus.ssec.wisc.edu/cryos/documents.html).

2.9.1.3 The Team noted that these stated documents had been presented at SCG-III. SCG then agreed to include relevant information in the SPA URD. The Team also noted those requirements for climate applications as well as both satellite and in situ data were considered in the tables.

2.9.1.4 The Team considered the completeness and relevance of these documents and agreed on the following:

(i) Some deficiencies were noted in the tables and the team agreed that they could be improved. For example, tactical requirements should be for more than 6 hours as far as temporal resolution in order to match the spatial resolution. Also, in Antarctic region, geo-referencing within the charts is important and some differences between products have been noted because of the moving ice in Antarctica;

(ii) The three sets of requirements need to be revised by an ad hoc task team in such a way that they would eventually provide for the ETSI vision in terms of marine operations requirements, NWP, and climate applications;

(iii) Requirements for additional floating ice parameters, in particular for dynamic processes and snow on ice, would have to be considered;

(iv) Contribute to: (i) the SPA User Requirement Document (URD) and (ii) to the WMO CEOS database via submission of appropriate information to the CBS ET-EGOS;

(v) A Statement of Guidance (SOG) for Sea Ice Applications needs to be developed and provided to the SPA Coordinator for inclusion in the JCOMM SOG in addition to the existing JCOMM applications SOGs (i.e. marine services, and ocean meso-scale forecast).

2.9.1.5 The Team therefore decided to establish an ad hoc task team comprised of Dr Vasily Smolyanitsky (ETSI Chairperson), Mr Jonathan Shanklin (United Kingdom), Dr Soren Andersen (GCOS SST&SI Representative), Mr Paul Seymour (USA), tasked to: (i) refine the requirement tables, (ii) draft SOG for Sea Ice Applications, and (iii) prepare a new document containing the SOG, any required additional information, and the new updated tables **(Action: Task Team on Sea Ice Requirements (TT SIR))**. The WMO Secretariat was asked to provide examples of JCOMM SOG and requirements for the WMO/CEOS database **(Action: WMO Secretariat)**.

2.9.2 User feedback

2.9.2.1 The Team was informed on the marine meteorological services monitoring programme, with particular emphasis for future gathering of users' feedback. It was noted that, direct interaction with and feedback from users is an essential part of the provision of high quality and valuable marine services.

2.9.2.2 The new questionnaire, adapted for SOLAS and non-SOLAS vessels, was reviewed. The Secretariat informed the Team that the ETWS, in its second session (Geneva, Switzerland, 20-24 March 2007), added information on wind waves and storm surges. The Team noted some deficiencies in this questionnaire, in particular regarding sea ice and Icebergs information. In this context, the Team recommended a broad distribution of this questionnaire in order to obtain feedback from ships in Polar Regions, and suggested that it should be sent to "icebreaking services". The Team also proposed to add a new item after "Storm and Gale Warnings" related to "Sea Ice and Iceberg Information" (with similar sub-items clarity of information, accuracy of information and timeliness) to be applicable for mariners in areas with floating ice. The Team also suggested splitting the existing item 2. (e) in "via email" and "via web interface". A revised version of this questionnaire is provided in the Annex XIV.

2.9.2.3. The Team was informed that the revised version of this questionnaire, including both ETWS and ETSI suggestions would be presented to the forthcoming SOT meeting in April 2007 for approval and following dissemination through appropriate channels. To ensure effective dissemination of the questionnaire the Team was invited to provide contact details from potential users, in particular the icebreaking services, to WMO Secretariat **(Action: ETSI Members)**. The Team suggested cooperation with IMO for broader questionnaire distribution **(WMO Secretariat)**. The Team also suggested that WMO Secretariat should contact the Antarctic Treaty Secretariat to request that a copy of this questionnaire be given to all ships sailing in the Antarctic region **(Action: Secretariat and Mr Manuel Picasso (Argentina))**. The Team agreed that another potential way to disseminate this questionnaire would be through the radio-fax services provided by the BHS Deutscher Wettwetterdienst RMC **(Action: Secretariat and Dr Jürgen Holfort (Germany))**. It was also agreed that on the use of online questionnaire **(Action: SPA coordinator to prepare the on-line questionnaire)**.

2.10 IPY activities

General Preparation of the IPY 2007-2008

2.10.1 Dr Eduard Sarukanian, Special Adviser to the WMO Secretary-General on IPY, presented a progress report from the WMO/ICSU Joint Committee (JC) on the general preparation of the IPY 2007-2008, as well as future actions of the IPY. This report is provided in the Annex XV. The Team was pleased to know that the first Workshop on IPY Legacy is planned to be held in May 2008, in St. Petersburg.

2.10.2 Based on the information provided, the Team agreed that its contribution to IPY should be mainly as following **(Action: ETSI Members and GDSIDB co-Chairpersons)**:

1. Provision of climatology and statistical data sets. Data sets will be extended, e.g. mean state of the sea ice in the Arctic region and monthly variability information.
2. While sea ice nomenclature has been updated and standardized, and *Sea Ice Information in the World*, published as a WMO-No. 574, more work is needed and the ETSI will stress on those aspects during the next intersessional period. New standards for sea ice charts are being refined as well as the delivery of those charts in electronic form. Information on existing products will be made available electronically and mechanism for updating the information proposed.
3. Much progress has been made with regard to the Ice Information Portal, which should be ready by early May 2007.
4. Supporting the DBCP in Polar Regions for the deployment of buoys and the making of new types of observations. Mr Paul Seymour (USA) indicated that it was planning to deploy 18 buoys as a contribution to the IPY and to the IABP (a DBCP Action Group), including Ice Mass Balance (IMB) buoys, ICEX-Air buoys, ice-beacons, and new types of buoys capable of being air dropped and to survive in the free ocean and during freeze-up. Other experiments are planning for deploying Ice Tethered Platforms for making sub-surface temperature and salinity profile measurements. A report on US Arctic Buoy Programme is provided in the Annex XVI.

Status of Development of the IPY Ice Logistics Portal

2.10.3 The Team recalled that at the Second Session of the JCOMM (JCOMM-II, Halifax, Nova Scotia, Canada, September 2005), it was agreed that the Expert Team Sea Ice (ETSI) Member countries would collaborate with the Polar View (a GMES initiative), to establish an Ice Information Portal website for the IPY: "IPY: Ice Logistics Portal". The general concept was to develop an internet site that would provide:

- Convenient point of access for comprehensive ice-related information;
- Products contributed by the ETSI Members and created by the Polar View;
- "One-stop-shopping", offering a complete range of products and services that respond to user information requirements;
- Integration of data and products from different sources and multiple service providers;

- Operationally robust - sustainable beyond the IPY;
- Vehicle for standardization of sea ice products.

2.10.4 The Team noted that a session was held during the IICWG meeting in Helsinki, Finland in October 2006, to further develop this concept and begin work on the details of said concept. The initial goal was to have the portal operational by 1 March 2007 for the start of the IPY.

2.10.5 Polar View was to undertake the technical work to develop the portal. Due to administrative and contractual problems, there was a significant delay before the work began in late January 2007. Macdonald, Dettwiler, and Associates (MDA) was the company that Polar View had contracted to do the work. Since January, considerable progress has been made on the project, although not sufficient to meet the operational deadline of 1 March 2007. A design document and interface specification has been through several iterations. The developers and the relevant ice services are still discussing input product format specifications. A revised operational date of 1 May 2007 is achievable.

2.10.6 Mr John Falkingham (Canada) gave a presentation on the current state of development of the portal. The Team provided some comments and suggestions to Mr Falkingham who would compile and transmit them to Polar View. The Team also agreed that Dr Vasily Smolyanitsky (Russian Federation), Mr John Falkingham (Canada), and Mr Jonathan Shanklin (United Kingdom) would be the content advisers for the Ice Portal, and that Mr Falkingham would convey this decision to Polar View. **(Action: Mr John Falkingham (Canada))**.

2.11 Relations to other JCOMM bodies

2.11.1 Relations with other SPA bodies

2.11.1.1 A discussion on links to other groups within JCOMM and external to JCOMM was initiated by the SPA Coordinator. Two issues were raised:

(i) Could and should the ETSI try to establish a more obvious and formal link to the International Ice Charting Working Group (IICWG), recognising the important role and activities of the IICWG? The group held a lively discussion on this issue, which concluded that the ice community would be served much better by maintaining independence between JCOMM and the IICWG and the Team noted that relationships between the ETSI and IICWG were already exceptionally good and clearly satisfied the ETSI ToR with generally accepted role for the IICWG as ETSI Technical Advisor.

(ii) To build stronger cross-JCOMM links for ice activities and in particular with the DMPA and OPA with respect to ice information interoperability (codes, data formats, WIS issues including satellite and in situ). Following further discussion that noted the need to explore how best to achieve this aim, the Team agreed to establish a cross cutting Rapporteur for Sea Ice Matters to consider the matter further and report back to ETSI. The ToR are provided in Annex XVII. The Team nominated Mr Jonathan Shanklin (United Kingdom) as Rapporteur for Sea Ice Matters.

2.11.2 Support for JCOMM CB (input for OceanTeacher, Bilko, etc.)

2.11.2.1 The Team noted that the Services Programme Area (SPA) Coordination Group (SCG), during its Third Session, agreed that capacity needs to be developed appropriately for each Member in a manner that eventually results a fully functioning suite of Met-Ocean services satisfying national, regional and international needs. The Team noted that the SCG defined four stages of development for which the capacity building needs are very different:

- **Stage 0:** Countries/Regions with very little or no services, very limited resources, who does not recognize their needs;

- **Stage I:** Countries/Regions with little or no services, limited resources, who recognize their needs;

- **Stage II:** Countries/Regions with some infrastructure, resources and good knowledge of Met-Ocean requirements and limitations. These Countries/Regions are capable of implementing SPA systems;

- **Stage III:** Countries/Regions that have high-level infrastructures, resources, research and development activities Are Capable of developing the next generation of JCOMM services and products through innovations (e.g., graphic products, ecosystem models, etc.)

2.11.2.2 The Team also noted that for each stage, the most appropriate specialised training and regional cooperative projects would be different. For example, Stage III countries may require advanced training workshops. In contrast, it may be more appropriate to develop an initial capacity to use apply Met-Ocean products and services provided by other Member in countries that do not yet have operational services in place (Stage 0 and I). In this context, the SCG supported initiatives at all four stages of development, and agreed that should be developed e-learning tools (such as OceanTeacher and/or Bilko lessons) on the activities of each ET, covering the different stages.

2.11.2.3 The Team noted that the IOC/UNESCO Bilko Programme (see: http://www.bilko.org) is a complete system for learning and teaching remote sensing image analysis skills. Its primary goal is to make remote sensing training materials accessible to those without specialist resources at their disposal as well as to promote good teaching practices by tapping the diverse skills and expertise of an expert community. The Team also noted that Bilko system could be used to demonstrate more than just remote sensing data. Recently a new set of Bilko lessons and resources were developed that focus on the use of ocean forecast output systems that have proved extremely successful with graduate and post-graduate students. The SPA Coordinator, Dr Craig Donlon, provided background information on IOC/UNESCO Bilko Programme (http://www.bilko.org). Based on the discussions, the:

- CIS will investigate the feasibility of using existing training material to create a Bilko lesson **(Action: Mr John Falkingham and Ms Marie-France Gauthier (Canada))**;

- GCOS SST&SI Working Group will explore the feasibility of preparing a Bilko lesson on sea ice climatology **(Action: GCOS SST&SI Working Group)**;

- US NSIDC will examine the possibility of preparing a Bilko lesson on sea ice climatology **(Action: GDSIDB Co-chairperson (USA))**.

2.12 ETSI future activities and working plan for the next intersessional period

2.12.1 The Team agreed that a document containing a work plan for the Expert Team on Sea Ice for the next intersessional period would be compiled by the Secretariat using the list of actions introduced and agreed during the session. The meeting also noted that ETSI future tasks will include review and advice on scientific, technical and operational aspects of sea ice observations and forecasting, coordination of service development, training and cooperation with international programmes, in particular management of the WMO/IHO “Ice Objects Catalogue”, update of the Sea Ice Nomenclature, update and extension of the WMO technical documents related to marine safety and support for IPY 2007-2008. The final version of the agreed strategy and work plan are reproduced in Annex XVIII.

2.12.2 Recognizing the likelihood of increased economic activities in the Arctic in the future, the ETSI underlines the importance of sea ice services, standards, observations and data. In this respect, the scope of ETSI activities may expand in the future. The Team also noted that the aspects of future ETSI activities related to sea ice climatology would be discussed and adopted under item 3.

3. ELEVENTH SESSION OF THE STEERING GROUP FOR THE GDSIDB

3.1 Reports of the GDSIDB centers

Sea Ice Activities Related to the JCOMM during the period of 2005-2006, as reported by the U.S. National Snow and Ice Data Center and World Data Center for Glaciology, Boulder, Colorado, USA

3.1.1 The Team noted with appreciation the NSIDC report presented by Professor Roger Barry. Professor Barry informed that Team that in recent years, the Sea Ice Index (http://nsidc.org/data/seaice_index/) has gained popularity (currently about 60,000 hits from up to 13,000 unique users per month). Based on passive microwave data, monthly mean images of sea ice extent, concentration, anomalies, and trends have become readily available. In addition, graphics from the Sea Ice Index appear regularly in media and scientific talks. The Team noted that the Sea Ice Index and other products are being made available through virtual globes (i.e., Google Earth).

3.1.2 The NSIDC (Ms F. Fetterer and Dr W. Meier) took part in the GCOS SST and SI Working Group Meeting, Boulder, Colorado, USA, March 2006. The Group made plans to work together to formulate a "best" sea ice product for GCOS needs. Relevant documents and meeting summaries can be found at the sea ice website of the GCOS SST&SI Working Group at the following address: http://ocean.dmi.dk/GCOS/.

3.1.3 The Team noted that the NSIDC worked in collaboration with the NIC to publish the NIC chart series (National Ice Center Arctic Sea Ice Charts and Climatologies in Gridded Format) on line at http://nsidc.org/data/G02172.html. This data set is an Arctic sea ice concentration climatology derived from the NIC weekly or bi-weekly operational ice chart time-series. The charts used in the climatology are from periods of 1972 through 2004, and the monthly climatology products are median, maximum, minimum, first quartile, and third quartile concentrations, as well as frequency of occurrence of ice at any concentration for 33 year, 10 year, and 5 year periods. These climatologies and the charts from which they are derived are provided in 25 km EASE-Grid (gridded binary). Ice extent can be derived from concentration by summing the number of equal area EASE-Grid cells. GIF browse files are also provided. The climatologies are also made available in a Geographical Information System (GIS) compatible format. Data set citation: National Ice Center 2006. *National Ice Center Arctic sea ice charts and climatologies in gridded format.* Edited and compiled by Ms F. Fetterer and Mr C. Fowler., from Boulder, Colorado, USA: National Snow and Ice Data Center.

3.1.4 The Team was informed that the NSIDC is currently working with the AARI (Dr Vasily Smolyanitsky) to publish an updated version of the AARI chart series in EASE-Grid format. In addition to releasing the chart series, the work includes study of the influence of atmospheric circulation on sea ice in the Russian Arctic during the 20th century. Postdoc Andy Mahoney is conducting the analysis for the NSIDC.

Report on sea ice activities related to the GDSIDB Project during the current intersessional period (2004-2007), which was developed by the Arctic and Antarctic Research Institute (AARI, St. Petersburg, Russian Federation)

3.1.5 The Team noted with appreciation the report on sea ice activities related to GDSIDB Projects developed by AARI during the intersessional period, presented by Dr Vasily Smolyanitsky, Chairperson of the ETSI. Dr Smolyanitsky informed the Team that the Arctic and Antarctic Research Institute (AARI) of Roshydromet, St. Petersburg, Russian Federation, continued to support the WMO GDSIDB Project during the intersessional period of 2004-2007. The Steering Group experts for the project, Co-chaired by the AARI Director, Dr Ivan Frolov, provided expert resources to maintain and extend archived data and enhance processing techniques in the interest of climate-oriented programmes. Information regarding GDSIDB project information and data at the Arctic and Antarctic Research Institute can be located at the following web address: http://www.aari.ru/gdsidb.

3.1.6 The Team noted the status of GDSIDB archive and potential contributions. To date, historical ice charts in SIGRID format (WMO, 1989) continue to dominate the project archive. The

AARI ice charts for Eurasian Arctic (which dates back to 1933) comprise the longest temporal series, the CIS ice charts for Canadian Arctic being the second longest one, while the NIC ice charts provide the unique hemispherical view. Table 1 summarizes factual content of the project in SIGRID format for March 2007. The Japan Meteorological Agency (JMA) continues to provide information in SIGRID-2 format (WMO, 1994) and text, which is translated into SIGRID at the AARI, which is so far stored in two formats. Other formats include the NSIDC Ease-Grid (mainly for derived climatic products), ESRI shapefile (for operative data), and new SIGRID-3.

Table 1. Sea ice charts in SIGRID format presently archived within GDSIDB

#	Data set title	Format	Interval / periodicity	Gaps	Sea ice parameters	Number of charts
1a	AARI 10-days period ice charts for Eurasian Arctic	SIGRID-1	1950-1992 /10 days	Yes	CT, SD, FI	1988
1a'	AARI 10-days period ice charts for Eurasian Arctic	SIGRID-1	1933-1949 /10- days	Yes	CT, SD, FI	384
1b	AARI 10-days period ice charts for Antarctic Region	SIGRID-1	1971-1990 /10 days	Yes	CT, SD, FI	475
1c	AARI 7-days period ice charts for Eurasian Arctic	SIGRID-1	1997 – present moment / 7 days	No	CT/SD, FI	> 500
2a	NIC weekly ice charts for the Northern Polar Region (northward 39°N)	SIGRID-1 e00	1972-1994 / 7 days	No	CT, SD, FI	1200
2b	NIC weekly ice charts for the Northern Polar Region (northward 39°N)	SIGRID-3/ EASE-GRID	1995-2004 / 7-14 days	No	CT, SD, FI	Under processing
2c	NIC weekly ice charts for the Southern Polar Region (southward 50°S)	SIGRID-1	1973-1994 / 7 days	No	CT	1150
3	CIS ice charts for Canadian Arctic (Eastern Arctic, Eastern Coast, Western Arctic, Hudson Bay)	SIGRID-1	1968-1998 / 7 days	Yes	CT, SD, FI	3437
4	BSIM ice charts for the Baltic Sea	Baltic code SIGRID-1	1960-1979 / 3-4 days	No	CT, SV, FI	1042
5	JMA total concentration ice charts for the Sea of Okhotsk	SIGRID-1 SIGRID-2 .txt	1970-2006 / 5 days	No	CT	>1200

Notes:

(viii) Sea ice identifiers: CT – total concentration, SD – stages of development, SV – ice thickness, FI – fast ice indicator.

(ix) Institutions acronyms: AARI – Arctic and Antarctic Research Institute, St Petersburg, Russian Federation, BSIM – Baltic Sea Ice Meeting (Finnish and Swedish ice services), CIS – Canadian Ice Service, JMA – Japan Meteorological Agency, NIC – USA National Ice Center.

(x) New datasets are underlined by grey colour.

3.1.7 Other sea ice data sets in non-SIGRID format include:

1. Ice concentration and thickness 0,1° by 0,1° daily grids for the Sea of Bohai for the periods of 1998 to 2000 from the National Marine Environment Forecast Center (NMEFC) and Qingdao Marine Forecasting Observatory (QMFO) of State Ocean Administration (SOA), China;

2. Routine coastal station and shipborne observations from the Glaciological Division of the Argentine Navy Meteorological Service (SMARA) in the Weddell and Bellingshausen Seas from 1990s to present.

3.1.8 Based on the discussions of both reports, the Professor Barry stressed the importance for the GDSIDB Project to continue to collect and archive data, and invited ETSI Members to provide new contributions for the projects **(Action: ETSI Members)** and urged Dr Smolyanitsky to include them in the database **(Action: ETSI Chairperson)**. Professor Barry also expressed that they have some difficulties in obtaining data from China and urged the WMO Secretariat to assist the GDSIDB Co-chairpersons on this issue **(Action: GDSIDB Co-chairpersons and Secretariat)**.

3.1.9 Based on the proposal from the CIS, the Team noted the need for easy web-visibility of all datasets archived within the GDSIDB project and to this effect asked the project co-chairs to undertake appropriate technical actions (**Action: GDSIDB Co-chairpersons**).

3.2 Development of sea ice historical data processing

3.2.1 The Team noted that the NSIDC has become less involved in historical data processing (with the exception of the work with AARI noted in the previous item). However, NSIDC wish to effectively endorse the active role the operational ice centres have taken in format development and definition (e.g. SIGRID-4), in nomenclature standardization, and in cross-walking electronic hydrographic chart objects with digital ice charts. All of these efforts, that are being championed and carried out by the operational centers, contribute to good data stewardship, and increased utility of archived charts.

3.2.2 The Team noted that access to the GDSIDB factual data at AARI is provided by means of Internet and can be located at the following web addresses:

- In tabular form or interactive scrolling to graphical replicas in .gif format (AARI weekly charts) http://www.aari.ru/clgmi/sea_charts/sea_charts_en.html;
- As a series of .gif images with a JavaScript interface – http://www.aari.ru/odata/_d0001.php;
- By a special Java-class to the whole GDSIDB archive, with nested structure – http://www.aari.ru/gdsidb/sea_ice/real_sigrid/toc.html.

3.2.3 The Team was informed that presently, the GDSIDB holds a 5 to 30 day period mapped ice data for the Arctic starting from 1933 and for Antarctic from 1971 to present for both regions. There are a number of gaps in factual data: temporal (mostly in wintertime) and spatial (mostly outside navigable areas like Eastern passage/Northern Sea Route or Western passage). From the 1970s, the GDSIDB ice charts may serve as a ground-truth to SSM/I products (as it is based on comprehensive usage of all available sources of ice information and expert knowledge), or be the unique source of ice conditions and climate for the period earlier than 1978. Ice charts from the separate ice services have different temporal attributes (i.e., starting moment, validity period) and in a number of cases overlap each other, so blending of individual data sets enhances usage of factual data. During the periods of 2002 to 2003, the first blending technique for Northern Hemisphere GDSIDB charts was developed and implemented at the AARI. The principal blending scheme for constructing the monthly 15'x15' total concentration dataset for the periods of 1950 to1998, included merging of five GDSIDB (specified in table 1 – AARI, BSIM, CIS, JMA, NIC) to monthly spacing by means of averaging to middle of month. Output dataset (as consequent revised versions) was provided in 2003-2005 for the testing and intercomparison purposes to the United Kingdom Met Office (Hadley Center) and presented at MARKDAT-II seminar (October 2005).

3.2.4 Output contains total concentration values with 1% accuracy and corresponding flags of origin for each value. As the resulting blended data set presently contains the greatest amount of factual ice data for the periods of 1950 to 1998, it is proposed to accept statistics assessed on its basis as the WMO "norms" for ice conditions in the Arctic during corresponding period and make them available at the developed Ice Logistics Portal for the current IPY.

3.3 GCOS report on SST&SI WG activities

3.3.1 Dr Soren Andersen presented the GCOS report on SST&SI Working Group activities. The Team recalled that GCOS SST&SI Working Group was founded in 1999, with roughly 25 Members, and reformed in October 2005 with the decision to form a specific subgroup on sea ice (SI). The Working Group is tasked to monitor, recommend and implement improvements in the homogeneity of Sea Surface Temperature (SST) and Sea Ice time series. Important issues have been identified in terms of differences between the sea ice data sets. These differences are apparent between data sets, based on satellite observations as well as between satellite and ice

chart data sets. Other issues pertain to the lack of available historical observations, in particular in the Antarctic. Finally, there is a general lack of uncertainty estimates detailed enough to facilitate the meaningful combination of different data sets. While the Working Group recognizes the importance of ice thickness, but satellite-based methods are still in the research phase and it was decided to keep the subject open to keep the high priority on sea ice concentration. A detailed summary of the Terms of References (ToR) and objectives (as detailed in Annex XIX) and the SI Sub-group has a number of additional documents and meeting minutes available at the following web address: http://ocean.dmi.dk/GCOS/.

3.3.2 The Group held its inaugural meeting in March 2006 in Boulder, Colorado, USA, establishing the Membership and initial actions of the working group in detail, including the relations with the wider SST&Sea Ice Working Group. In particular, this Meeting defined the next steps involving the participation at the 2006 International Ice Charting Working Group meeting in Helsinki to facilitate the broader involvement of the ice charting community and confirm activities on ice chart based data sets. The Working Group was currently progressing out of the formative stages and into operations with a detailed plan for initial as well as long term, activities (see Annex XIX).

3.3.3 The implementation of the full range of activities will be dependent on the availability of funding and resources, however, various Group Members have committed to a number of initial activities. These activities include an initial intercomparison demonstration with limited number of data sets and the definition of a project to investigate derivation of error estimates on ice edge time-series based on ice charts. The latter supported by the IICWG received positive feedback in the form of an informal inquiry with the NSF. Following a presentation of ASPeCt activities on deriving ice thickness from stage of development analyses in the NIC ice charts for the Antarctic, the Group agreed to make a recommendation to reinstate the analysis that was abandoned. The ice chart derived data set, in the absence of other observations with a similar wide coverage, is thought to represent a unique source of information on a field that is rarely measured in a region (the Antarctic), that is already subject to poor data coverage in many respects.

3.3.4 The Team also noted the GCOS SST&SI Working Group relations with ice charting community. Ice charts are recognized as a fundamental data source to extend time series into the pre-satellite era. It is broadly accepted that the ice concentration values from ice charts are likely to be more accurate than satellite derived estimates; however, issues exist concerning the homogeneity. Inter-comparisons throughout the periods of overlap may provide insight into such issues and the consolidation of ice charts into climatic databases, such as the GDSIDB, provides an important simplification in the comparison process, while making the information available to a wider range of users. It is clear that a careful recording of changes in practices and capabilities is prerequisite for the interpretation of ice chart-based time series. Such information already exists from some sea ice centers, and it is hoped that the SST&SI Working Group activities, in cooperation with the ETSI and IICWG may help to extend this practice throughout the user community. In this context, the Team discussed the inconsistency between sea ice charts due to the slightly different analysis methods and procedures at different ice centers. In order to address this issue, a workshop was proposed to compare sea ice analysis charts, methods, and techniques in order to establish a common approach to sea ice charts to maintain consistency of operational sea ice charts from different centers. The Team agreed with the proposed by the SCG-III session "Ice Data Analysis and Assimilation Workshop" and urged the Secretariat to make the necessary arrangements to make it happen **(Action: Secretariat).** The Team agreed that the main themes for this workshop would be a) Changes in sea ice charts procedures and b) Intercomparison of historical and operational sea ice charts and to this effect asked the ETSI and the GCOS SST&SI Chairpersons together with IICWG experts develop detailed proposals for the workshop agenda **(Action: ETSI Chairperson, and representatives of the GCOS SST&SI and IICWG to ETSI).** The Team suggested that this workshop would be held in Germany between April and October 2008 **(Action: Dr Jürgen Holfort (Germany))**, in order to present the results during the IMMSC 2008.

Expert Team on Marine Climatology

3.3.5 Mr Scott Woodruff (USA), Chairperson of the JCOMM Expert Team on Marine Climatology (ETMC), reported on several items from that Team's second session (26-27 March 2007) of interest to ETSI and GDSIDB. The Team noted that a major past focus of ETMC has been on the Marine Climatological Summaries Scheme (MCSS), which was initiated in the early 1960s, and has two distinct elements: (1) The management, including formats and quality control (QC), of delayed-mode Voluntary Observing Ship (VOS) data; and (2) MCSS Summaries (MCS) climatologies. With a view toward modernizing and refocusing these important elements, JCOMM-II (2005) urged ETMC to examine how marine, oceanographic, and ice climatologies could be "coordinated so as to been seen as an integrated product". Moreover, DMCG-II (Geneva, Switzerland, October 2006) and SCG-III (Geneva, Switzerland, November 2006) suggested enhanced linkages between SPA (ETSI and ETWS) and DMPA (which includes ETMC), as well as strengthening external linkages including with the WMO Commission for Climatology (CCl).

3.3.6 The Team also noted longstanding ETMC connections with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS). ICOADS includes VOS data back into the late 18th century, plus reports from drifting and moored buoys and some oceanographic data. New linkages between ETMC and SPA might include the proposed Internationalization of some ICOADS tasks. Sea ice groups reported by VOS within ICOADS were noted as of potential historical data interest for ETSI, as was the new ICOADS-related Recovery of Logbooks and International Marine Data (RECLAIM) Project, which among other national contributions for imaging and digitization has worked closely with the US NOAA Climate Database Modernization Program (CDMP).

3.3.7 A related development was JCOMM's partnership initiated in 2006 on the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) to better link marine meteorology and oceanography together with previous (mainly terrestrial) work. Working together with ETMC, the SPA Expert Teams would provide new synergies for climate indices, including already well-developed proposals from ETSI (presented by Dr V. Smolyanitsky, Chairperson of the ETSI, at ETMC-II) for these indices:

- Ice extent on global scale; regional ice extents for shelf seas which are regarded are more variable than the basins. Trends and differences for sea ice total concentration (e.g. last decade vs. last 50 years);
- Ice thickness/stages of development;
- Distribution of old ice for the Arctic region;
- Iceberg propagation.

3.3.8 In response to the needs for modernization of the two elements of MCSS, firstly, a new Task Team on Delayed-Mode VOS (TT-DMVOS) was established by DMCG-II, crosscutting with OPA/SOT, which will explore convergences and streamlining of the VOS data flow. Secondly, ETMC-II proposed a new self-funded Task Team on Marine and Oceanographic Climatological Summaries (TT-MOCS), which is intended to explore linkages with ETCCDI, QC issues, and resolve the future of the MCS climatologies. A working group was tasked to formulate a proposed Terms of Reference by August 2007 including Members from ETMC: Mr M. Rutherford (WG leader), Ms E. Kent, Mr E. Gowland, and Mr R. Zoellner; from CCl: Mr W. Wright or alternative CCl OPAG2 representative; and from SPA: Dr C. Donlon (SPA Coordinator), Dr V. Smolyanitsky **(Action: ETSI Chairperson)**, Mr V. Swail (Chairperson of the ETWS, or alternative ETWS representative).

3.4 Submission of new sea ice data to the GDSIDB

3.4.1 The Team discussed the provision of new datasets (as presented in the report from the Arctic and Antarctic Research Institute (AARI)) and noted that in particular the new sea ice data are for the Arctic region as follow:

- 1933-1949 from the AARI;

- 1995-2004 from NIC;
- 1998-up to the present from CIS; and
- up to 2005 from JMA.

3.5 Sea ice products based on GDSIDB data

Sea ice atlases and climatology

3.5.1 In December 2006, NSIDC and NIC published National Ice Centre Arctic Sea Ice Charts and Climatologies in Gridded Format, available at http://nsidc.org/data/G02172.html. This is considered a contribution to GDSIDB. If funding can be secured, NSIDC and NIC will update this product yearly. In addition, NIC and NSIDC plan similar gridded chart series and climatologies for Antarctic, and the Yellow Sea. The Team noted with interest that NSIDC developed an extensible interactive resource to sea ice monthly extent, concentration, and anomaly assessed on a basis of satellite passive microwave data and available at http://nsidc.org/cgi-bin/wist/wist_nt.pl. The Team noted that by autumn 2006 (in addition to existing electronic atlases on CD-ROM developed during the previous years (e.g. by the USA-Russia EWG)), climatic statistics (16 non-robust and robust statistics) for sea ice total concentration and fast ice have an additional parameter for (i) 12 monthly intervals, (ii) winter (October – May), (iii) summer (June – September) and (iv) yearly periods as maps (in polar stereographic projection), for the whole Arctic and 11 sub-regions. These are posted at the AARI website and available on URL: http://www.aari.ru/gdsidb/data/arctic_ocean/ct_climate.asp?lang=0. Interfaces to the stated climatological data are shown as Figures 1 and 2.

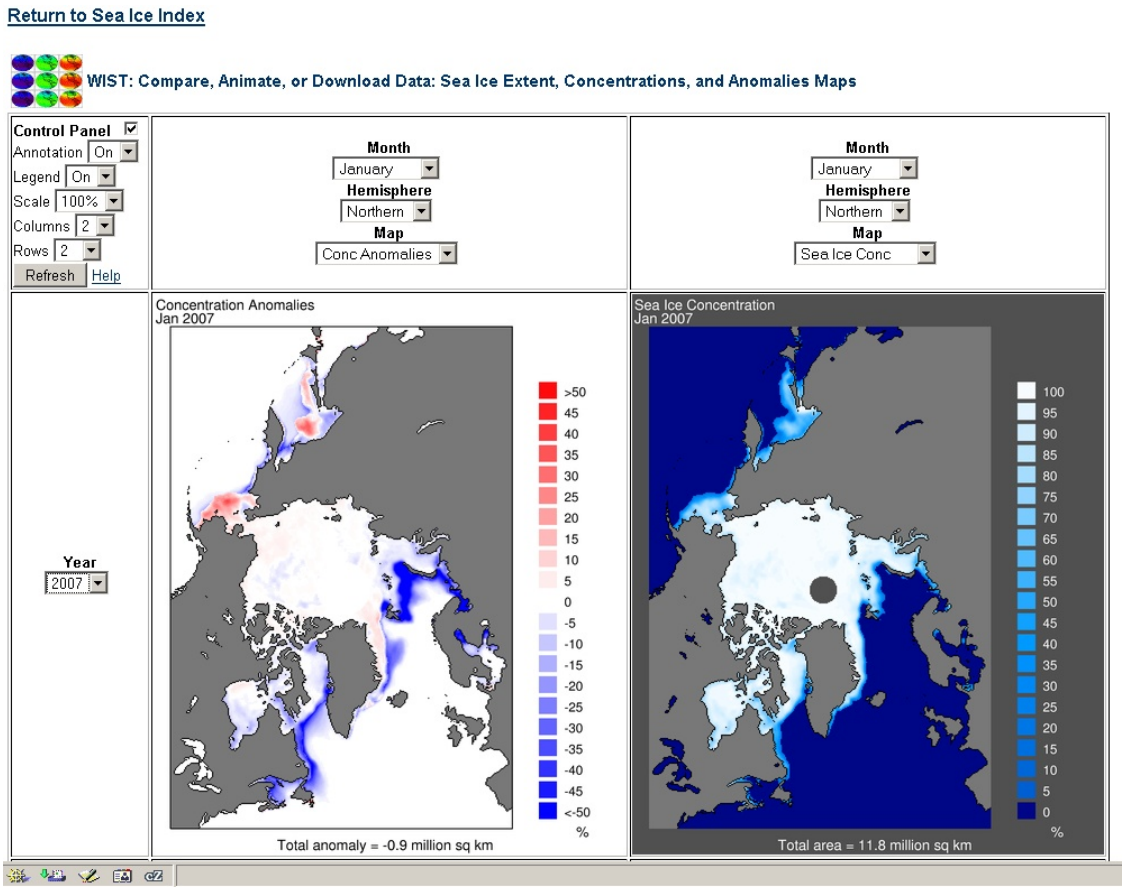

Figure 1 – Interface to sea ice monthly extent, concentration and anomaly maps at NSIDC website

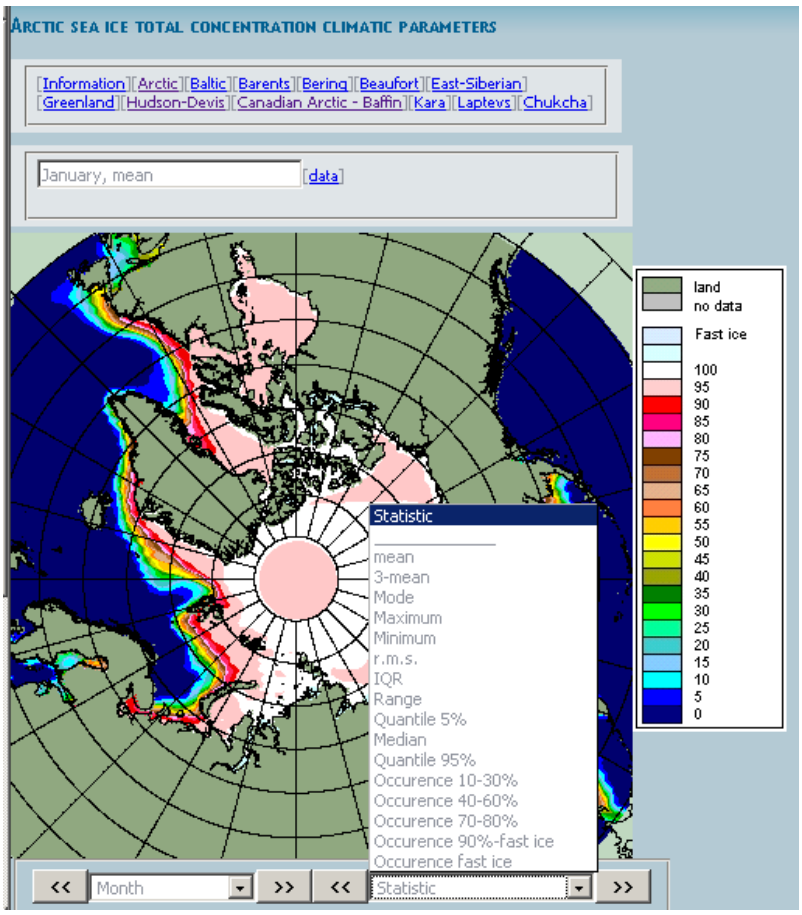

Figure 2 – Interface to sea ice total concentration climatic statistics at AARI GDSIDB website.

3.5.2 The Team was also informed that during 2006, the AARI Experts were involved in a project on assessing the optimal (in terms of marine safety and most favorable marine meteorological conditions) navigable routes between the Barents Sea and USA ports. To this effect an archive of daily icebergs observations provided by the International Ice Patrol (IIP) for the period of 1960 to 2003 and disseminated by the NSIDC was processed to assess such statistics as probability of encountering iceberg(s) and a number of icebergs (maximum and mean) observed within a specific 1°x1° area. Figure 3 provides sample maps of stated statistics for the monthly period of their maximum propagation in Northern Atlantic (May). It is proposed to further this activity in collaboration with the IIP and the NSIDC and publish the output data at the Ice Logistics Portal for IPY.

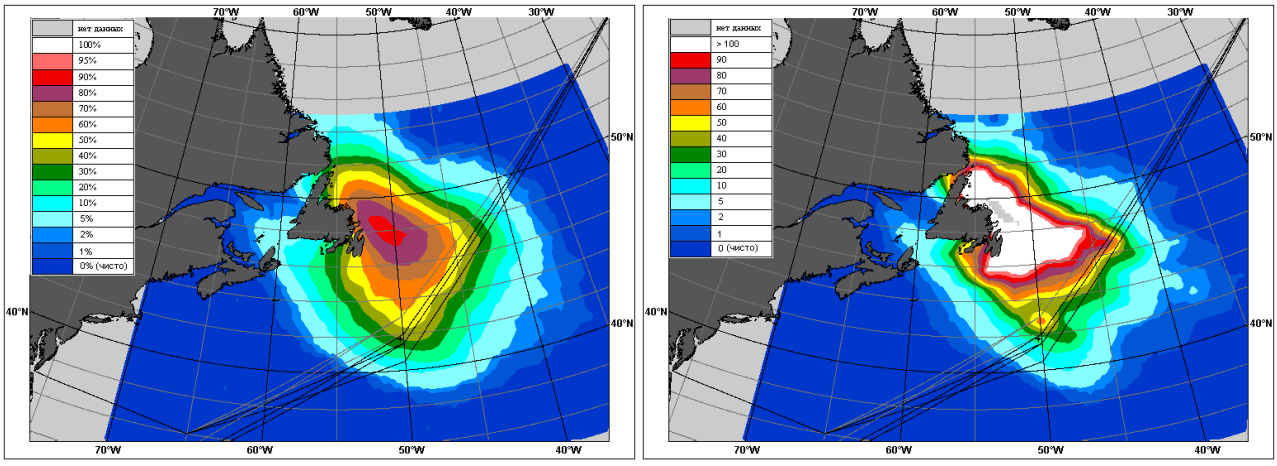

Figure 3 – Sample charts showing probability of encountering and maximum number of icebergs observed in May based on IIP data for 1960-2003.

3.5.3 Arctic Marine Shipping Assessment (AMSA)

3.5.3.1 Mr John Falkingham (Canada) informed the Team that the Arctic Marine Shipping Assessment (AMSA) is being conducted by the Arctic Council's program for Protection of the Marine Environment. It is a major initiative similar in scope to the Arctic Climate Impact Assessment. The Terms of Reference for the AMSA are provided in the Annex XX.

3.5.3.2 The Team noted that AMSA is using 2004 as the baseline year to document current Arctic shipping. As ice information is a significant factor in determining the level(s) and pattern(s) of Arctic shipping, the AMSA Leads would like to receive input, advice, and assistance from the respective ETSI Members. In this context, the GDSIDB agreed to consider providing a Northern Hemispheric overview of ice conditions for each month of 2004 **(Action: GDSIDB co-Chairpersons)**.

3.5.3.3 In addition, regional snapshots of more detailed ice conditions in selected areas of interest and regional case studies or expected trends in ice conditions and shipping may be required by the AMSA. The Team agreed to consider favourably requests for these that may come from Mr. Falkingham.

3.5.3.4 The AMSA will also develop expected scenarios for the years 2020 and 2050. The Team agreed to review these for plausibility when requested by Mr. Falkingham **(Action: ETSI Members)**.

3.5.3.5 The Team also agreed to review of material prepared by other relevant bodies and the AMSA report **(Action: ETSI Members)** and urged Mr Falkingham to circulate these materials and coordinate this activity **(Action: Mr John Falkingham (Canada))**.

3.6 New Contributions to the GDSIDB from Members

3.6.1 The Team received detailed information from Members on new sea ice data sets to be submitted to the GDSIDB during the next intersessional period. As China and Iceland were not represented in this session, the Team urged the GDSIDB co-Chairpersons and the Secretariat to contact these countries in order to obtain detailed information of their contributions to the GDSIDB **(Action: GDSIDB Co-Chairpersons and Secretariat)**.

3.7 Working plan for the next intersessional period

3.7.1 The Team discussed and adopted a comprehensive work plan for the Steering Group of the GDSIDB for the next intersessional period. It was noted that this work plan (Annex XXI) would be implemented through the Steering Group, in close cooperation with the ETSI and other relevant bodies as described in the work plan.

4. RELATIONS TO OTHER WMO/IOC AND INTERNATIONAL PROGRAMMES

4.1 Under this item, the Team noted that it discussed and agreed upon a list of its actions to provide support to IPY 2007-2008 activities and legacy under agenda item 2.10, including extension of sea ice climatology and maintenance of IPY Logistics Portal.

4.2 The Team noted that under agenda items 2.6 and 2.7 it held through discussions on its relationship with the IHO and agreed upon a new joint WMO/IHO technical document "Ice Objects Catalogue" as well as on terms of reference for an Electronic Navigational Chart Ice Objects Task Group.

4.3 The Team also recalled that under agenda item 3.5 it discussed and agreed upon its input for the Arctic Marine Shipping Assessment project conducted by the Arctic Council's program for Protection of the Marine Environment.

4.4 The Team then noted the information provided by Mr P. Seymour (USA) on problems concerning the future implementation of the US Interagency Arctic Buoy Programme (USIABP), which is the national contribution to the International Arctic Buoy Programme (IABP) of the DBCP. The funding for this interagency programme comes from several US agencies. However, due to

tight fiscal constraints, the continuation of this programme is constantly in jeopardy. It is critical that this programme be continued, as it currently is the key operational observing system for the Arctic Ocean, especially for the period of IPY 2007-2008. To this effect the Team asked the ETSI Chairperson and the Secretariat to provide appropriate support to this issue in collaboration with the USA Member to ETSI and the US focal point for the DBCP **(Action: Mr P. Seymour (USA), ETSI Chairperson and Secretariat)**.

4.5 The Team noted that many of the International bodies with remits in Antarctica had interest in sea-ice. These included the Scientific Committee on Antarctic Research (SCAR), the Council of Managers of National Antarctic Programs (COMNAP), the Antarctic Treaty Consultative Meeting (ATCM) and the WMO EC-WGAM (Working Group on Antarctic Meteorology). The Team requested the ETSI Chairperson to maintain liaison with these organizations **(Action: ETSI Chairperson)**.

5. DATE AND PLACE OF THE NEXT SESSION

5.1 The Team agreed that it would need to meet again in 2 years after the end of IPY 2007-2008 (March 2009) but before the third session of the JCOMM (Morocco, October 2009). Following discussions during the session, the Team suggested that ETSI and GDSIDB sessions might be timed to take place in Norway (Tromso or Longjir, Spitsbergen) or United Kingdom (Cambridge) in April - May 2009. The Chairperson and Secretariat were requested to finalize arrangements for the timing and venue for the meeting in due course, and notify ETSI Members accordingly **(Action: Chairperson and Secretariat)**.

6. CLOSURE OF THE SESSION

6.1 The meeting reviewed and approved the final report of the meeting, including action items and recommendations.

6.2 Mr Paul Seymour (USA) proposed to the Team that a Certificate of Recognition should be awarded to Mr John Falkingham (Canada) for his outstanding services. Mr Falkingham has actively participated as a Member of the Expert Team on Sea Ice for nearly 30 years of service to the World Sea Ice Community, providing valuable guidance during his tenure, as well as actively contributing to the WMO Sea Ice publications, in particular to the *WMO Sea-Ice Nomenclature* (WMO No. 259) and *Ice Objects Catalogue*. Mr Falkingham should be recognized for his vital role during the transitional process from the former WMO Commission for Marine Meteorology (CMM) to the current Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). It is with much regret that Mr Falkingham will be retiring from service in 2008, and that this will be the last session in which he will be attending. The Team agreed with this proposal and urged the Secretariat to make the necessary arrangements to award a Certificate of Recognition to Mr John Falkingham **(Action: Secretariat)**.

6.3 In closing the meeting, the Chairperson, Dr Vasily Smolyanitsky, thanked all the experts from ETSI and GDSIDB, SPA Coordinator, experts from other JCOMM ET and the WMO Secretariat for stimulating discussions and valuable input to very productive ETSI and GDSIDB meetings, and looked forward to working with them on the many ongoing action items during the next intersessional period. He also thanked the Secretariat for providing excellent local logistics and support for the participants of the meeting.

6.4 .... On behalf of the Secretariat, Mr Edgard Cabrera expressed his sincere appreciation and thanks to all participants, especially to the ETSI Chairperson, Dr Vasily Smolyanitsky, who provided a very important and valuable input to the meeting, being far away from the place of the meeting. He concluded by expressing his appreciation to the Scientific Officer in charge of the meeting, Ms Alice Soares, for the preparation of the documents and for the meeting itself.

6.5 The third session of the JCOMM Expert Team on Sea Ice and the eleventh session of the Steering Group for the Global Digital Sea Ice Data Bank closed at 12.35 hours on Saturday, 31 March 2007.

Annex I

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Annex II

AGENDA

1. OPENING OF THE MEETING

1.1 Opening
1.2 Adoption of the agenda
1.3 Working arrangements

2. THIRD SESSION OF THE JCOMM ETSI

2.1 Report of the Services Programme Area Coordinator
2.2 Report by the Chairperson of the ETSI
2.3 Report by the Secretariat
2.4 Reports by the Members of the ETSI
2.5 BSIM and IICWG reports
2.6 Provision of Marine Safety Information (MSI) related to sea ice
- 2.6.1 IHO Report
- 2.6.2 Proposals for the new potential Arctic NAV/METAREAS
- 2.6.3 Ice Information for Electronic Navigation Systems (ECS)
- 2.6.4 Ice Objects Catalogue

2.7 WMO sea ice documents and publications
- 2.7.1 Sea ice nomenclature
- 2.7.2 Sea ice services in the World (WMO-No. 574)
- 2.7.3 Review of common abbreviations list for NAVTEX messages related to sea ice
- 2.7.4 Guidelines for sea ice information in WMO manuals and guides (WMO-No. 471, WMO No. 558, GMDSS Guides, etc.)

2.8 Status and future formats for operational and historical sea ice data exchange
- 2.8.1 Proposed Amendments to the SIGRID-3
- 2.8.2 Vision and strategy for the standards for sea ice coding and presentations

2.9 Requirements for sea ice information and products (services and users)
- 2.9.1 Requirements for sea ice services
- 2.9.2 User feedback

2.10 IPY activities
2.11 Relations to other JCOMM bodies
- 2.11.1 Relations with other SPA bodies
- 2.11.2 Support for JCOMM CB (input for OceanTeacher, Bilko, etc.)

2.12 ETSI future activities and working plan for the next intersessional period

3. ELEVENTH SESSION OF THE STEERING GROUP FOR THE GDSIDB

3.1 Reports of the GDSIDB centers
3.2 Development of sea ice historical data processing
3.3 GCOS report on SST&SI WG activities
3.4 Submission of new sea ice data to the GDSIDB
3.5 Sea ice products based on GDSIDB data
- 3.5.1 Sea ice atlases
- 3.5.2 Sea ice climatology
- 3.5.3 Arctic Marine Shipping Assessment (AMSA)

3.6 New Contributions to the GDSIDB from Member States
3.7 Working plan for the next intersessional period

4. RELATIONS TO OTHER WMO/IOC AND INTERNATIONAL PROGRAMMES

5. DATE AND PLACE OF THE NEXT SESSION

6. CLOSURE OF THE SESSION

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Annex III

SPA TOP LEVEL OBJECTIVES (TLOs)

Top Level Objectives (TLOs) for the SPA work plan which are applicable to all activities of ETMSS and other ETs within the SPA:

- TLO-1: Support to maritime safety, hazard warning and disaster mitigation systems. The objective is to monitor and develop modifications to maritime safety, hazard warning and disaster mitigation systems as necessary and to assist Members/Member States as required. Systems include: the WMO marine broadcast system for the GMDSS, as well as MPERSS; storm surges; tropical cyclones; Tsunami; search and rescue; marine pollution; ice and iceberg warnings; rogue waves and dangerous sea state.

- TLO-2: The Importance of a User Focused Programme. The Objective is to understand and respond to present and future needs of the maritime service industry and ensure that the services provided to users meet these requirements, including content, delivery timeliness and quality. A key priority for the JCOMM SPA is to provide mechanisms and services that engage the user community in JCOMM discussions, plans and activities and to manage user feedback on all aspects of JCOMM.

- TLO-3: Working Effectively with Members/Member States. The Objective is to keep under review and to respond to the requirements of Members/Member States for guidance in the implementation of their duties and obligations with regard to marine services, in particular those specified in the WMO *Manual on Marine Meteorological Services* (WMO-No. 558);

- TLO-4: Pulling through scientific and technical expertise to operational systems. The Objective is to build on international scientific and technical excellence to better meet the needs of the international maritime service industry by developing the preparation and dissemination of ocean products and services;

- TLO-5: Communications and ‘joining up’ the SPA. The Objective is to integrate the internal cross-programme area activities of JCOMM, with international regional/global efforts and with that of others to increase efficiency and capability including the relevant programmes of WMO and IOC (e.g., DPM, WWW, WCP, GOOS, GCOS), as well as with other organizations such as IMO, IHO, IMSO and ICS in the provision of marine services and information;

- TLO-6: Maintaining and monitoring international standards. The Objective is to ensure that the JCOMM SPA acts as a flexible, streamlined organization capable of coordinating international maritime services;

- TLO-7: Building appropriate capacity within JCOMM. The Objective is to build appropriate capacity within JCOMM to make the most of international collaboration (e.g., GOOS, GEO/GEOSS) to share marine meteorological and oceanographic knowledge, infrastructure and services for the benefit of the Maritime community.

Annex IV

REPORT BY THE CHAIRPERSON OF THE EXPERT TEAM ON SEA ICE

Introduction

1. The Expert Team on Sea Ice (ETSI) was formally constituted at JCOMM-I (Akureyri, Iceland, June 2001) and re-established at JCOMM-II as a part of the JCOMM Services Programme Area (SPA). The current work plan for the ETSI was developed at JCOMM-II and included in the JCOMM intersessional work programme. Dr Vasily Smolyanitsky (Russian Federation) was elected Chairperson of the ETSI. The Members of the ETSI comprise of a Chairperson; eleven experts representing the national services related to sea ice and the ice-covered regions from Argentina, Canada, China, Denmark, Finland, Iceland, Japan, Norway, Sweden, United Kingdom,USA; and invited representatives of regional and international sea ice bodies, in particular the Global Digital Sea Ice Data Bank (GDSIDB) project, the Baltic Sea Ice Meeting (BSIM) and the International Ice Charting Working Group (IICWG). The Group Terms of Reference are included in the Appendix A.

Strategy and Work Plan for the ETSI

2. The strategy and work plan were firstly developed at JCOMM-I, revised and updated at the ETSI-I session (Buenos Aires, Argentina, October 2002), discussed and agreed at ETSI-II/GDSIDB-X session (Hamburg, Germany, April 2004) and adopted at SCG-II session (Toulouse, France, May 2004). A complete work plan for the ETSI/GDSIDB intersessional period 2004-2007 is given in Appendix B together with the Chairperson's remarks on the implementation of the work plan items. The new items for ETSI future activity related to inter-SPA collaboration were developed during the SCG-III session (Exeter, United Kingdom, November 2006) and ETMSS-II and ETMAES-I sessions (Angra dos Reis, Brazil, January 2007) and will be introduced under agenda items 2.3 and 2.7.4.

Implementation of the Work Plan

3. National activities of ice services from Argentina, Canada, China, Denmark, Iceland, Japan, Russia, United Kingdom, USA, and 11 national ice services that participate in the Baltic Sea Ice Meeting are periodically reviewed by ETSI (usually once a year) in the form of progress reports. These reports are discussed and reviewed during the formal or ad-hoc ETSI meeting, ground for the latter are provided during the International Ice Charting Working Group (IICWG) or Baltic Sea Ice Meeting (BSIM) sessions. Such reports cover several items on the ETSI action sheet including information on data acquisition, services provision and training activities.

4. The two main objectives of the national ice services' mandates are: (1) to ensure the safety of marine activities in ice-infested waters and protect the environment; and (2) to advise on ice environment in order to support environmental sciences and the development of informed policies. An accepted paradigm for specific ice informational systems defines the way that ice information is acquired, processed and relayed to the users.

5. The prime source of initial information on sea ice cover remains the satellite imagery, type and number of scenes varying from service to service, regionally and seasonally. Satellite imagery is complemented by routine or episodically air reconnaissance and other sources of information including coastal radars (e.g. Baltic Sea) and observations from coastal stations and ships. Sea ice informational system data cycle includes expert and numerical analysis, numerical forecasts, ice mapping or compilation of operative and climatic ice informational products and their relay to the users. Various sources of imagery, ground-truth, sea ice climatic and numerically processed data, and accompanying meteorological data are fused in Geographical Information Systems (GIS) and analyzed by ice experts. The results of the analysis may be used to compile informational products or directly feed numerical models of various complexities.

6. The predominant informational product remains the operative or forecast 1-7 periodicity ice charts underlining significant sea ice parameters, coded either as graphical .jpg/.gif or ArcInfo .e00 or from 2003/2004 in standard WMO SIGRID-3 format. Other typical products include annotated imagery, ice edge, textual reports etc. In most of the cases, those products are freely available on the web from individual ice services web sites or informational portals like GMES Polarview/tailored support is available to qualified users and includes detailed ice charts, annotated imagery etc. Practically all ice services provide ice information close to the area of national responsibility or economic activity (North American Ice Service – Great Lakes, CIS – Canadian Arctic, DMI – Greenland Sea, Baltic countries – Baltic Sea, etc.) with one major exception of NIC routinely providing global coverage bi-weekly ice charts for the Northern and Southern Polar Regions.

7. An integral part of the national ice services' activities remains the feeding of the WMO GDSIDB project with ongoing future and past sea ice information. Ice charts are either coded in raster SIGRID (WMO, 1989), SIGRID-2 (WMO, 1994) or in vector SGRID-3 (from 2003) formats and submitted to GDSIDB centres at NSIDC (http://nsidc.org/noaa/gdsidb) or AARI (http://www.aari.nw.ru/gdsidb) with proper documentation.

8. The current trend is for ice services' current activities to be closely collaborated and integrated. In 2004, the close long-standing collaboration between the CIS and the U.S. NIC resulted in establishing the North American Ice Service (NAIS), now operatively monitoring the Great Lakes area with plans to monitor the all ice-covered areas in the North American region. As of 2003, there is a common web site of Baltic Sea ice services hosted by the German ice service: http://www.bsis-ice.de. It should be also noted that ice services are now closely cooperating within other sea ice-related programmes financed by the European Union and ESA (GMES, Polarview, etc.).

9. Information on national ice informational systems is tracked by the special WMO publication No. 574 "Sea Ice Information Services in the World".

WMO Sea-Ice Nomenclature

10. ETSI activities on the topic comprised the work on:

(xi) Amendments to current WMO Sea-Ice Nomenclature (publication WMO-No. 259);
(xii) Corrections to national English/French/Russian/Spanish equivalents in order to eliminate discrepancies in translations and make sure that equivalents are factually used in operational practice;
(xiii) Development of an electronic version of Nomenclature aiming to facilitate further tetra-lingual comparisons and possible inclusion into the WMO Marine Glossary;
(xiv) Development of new drafts for WMO Sea-Ice Nomenclature.

11. ETSI sessions II and I approved seven amendments to sea ice terms and symbol definitions published in the ETSI-I and II reports, agreed on revised Spanish/French versions of the WMO Sea Ice Nomenclature and English/French/Russian/Spanish electronic versions of the WMO Sea Ice Nomenclature (2004). A proposal on new terms/amendments is anticipated at the ETSI-III session. Following CMM and JCOMM-I recommendations, the ETSI in 2002 initiated the process of a profound update of the Nomenclature to eliminate obsolete terms of pre-satellite era as well as to make the document relevant to the needs of the modern ice information system. To this effect during the period 2002-2006, a draft version for the new "WMO Sea Ice Nomenclature" was prepared by Dr Sc. Andrey Bushuev (consisting of 11 sections including 120 terms). During ETSI-II, at ad-hoc meetings and by correspondence it was agreed that proposed version would be used as a source to revise and update the publication WMO-No. 259 jointly with ETSI activity on standardization of sea ice presentation in ENC. Simultaneously, ETSI-II agreed that ETSI would also start to work on a new version of the Illustrated Glossary of Sea Ice Terms as part of the updated Nomenclature. Complete discussion on the item is included under agenda item 2.7.1.

WMO Publication No. 547 "Sea Ice Information Services in the World"

12. Reports from national operational ice services and centers delivered at IICWG sessions and ETSI-I and II showed the need for regular corrections to WMO publication No. 574 “Sea Ice Information in the World". As parts of the publication (lastly published in 2000) have became obsolete, ETSI-II proposed that it be revised annually and be available in an electronic form as a on the JCOMM web site. To this effect during 2005-2006 (pre-print draft available in November 2006) a third edition of the publication was finalized. Further discussion on the item is included under agenda item 2.7.2.

Standards for ice chart presentation

13. During 2002-2004 ETSI experts prepared two JCOMM Technical Reports – SIGRID-3: a vector archive format for sea ice charts (WMO/TD-No. 1214) and the Ice Chart Colour Code Standard (WMO/TD-No. 1215). Among with the WMO “Sea Ice Nomenclature” symbology, JCOMM-II recommended that those publications be used by NMSs as an ice chart model. From 2004 ETSI jointly with IICWG started a set of activities on development of the next generation of standards for sea ice presentations, including SIGRID-4 in alignment with ISO GML (ISO 19136) and an extension of the S57 format (will serve in the interim to carry ice information in Electronic Ice Systems). Further discussion on this item is included as a special agenda item 2.6.4 and 2.8.

Ice decay/stages of melting

14. An extension of the summer season ice description, by introducing ice decay parameter measured from radar backscatter, is a result of research undertaken by Canadian Ice Service experts under the Arctic Sea Ice Regime Shipping System (AIRSS). The ETSI-II reviewed the comprehensive report on the results of research and agreed to the Canadian experts’ proposal that “Ice Decay/Stages of Melting” be dropped as a separate work topic for future ETSI meetings, and be incorporated into the further ET activities on the update of the Sea Ice Nomenclature.

Requirements for Sea Ice Observations

15. In October 2002, the WMO Secretariat provided first drafts for requirements for sea ice observations to be finalized by ETSI experts. During 2002-2004 ETSI in collaboration with IICWG provided draft requirements for sea ice observations as a part of the “An International Collaborative Effort towards Automated Sea Ice Chart Production” (ETSI-II report Annex). Further extension of the requirements was carried out during 2004-2006 within a joint activity of ETSI and IICWG experts and was provided as the “Observational Requirements for Key Ice Features/Optimum Future Value” and within the IGOS theme as the “Summary of current/planned capabilities and requirements for space-based remote sensing of sea ice and icebergs parameters”. It is expected that these documents will be used as an input on sea ice within the development of the SPA User Requirement Document. Further discussion on this item is included as a special agenda item 2.6.4 and 2.8

Sea Ice in Marine Safety Information

16. Based on the input from national ice services (summarized in ETSI reports) the ETSI Chairperson submitted reports on the provision of Maritime Safety Information related to sea ice, in particular on sea ice graphical products and within the GMDSS, during the ETMSS-II session (Angra dos Reis, Brazil, January 2007) and exchanged existing expertise on developing sea ice standards for ECDIS. It is also expected that under agenda item 2.7.4 the Session will review the status of the WMO publications *Manual on Marine Meteorological Services* (WMO-No. 558) and *Guide to Marine Meteorological Services* (WMO-No. 471) in terms of their completeness for the provision of sea ice information and warnings for mariners.

International Ice Charting Working Group (IICWG)

17. ETSI/GDSIDB continued to provide strong and beneficial interrelation with IICWG. IICWG now joins practically all Northern Hemisphere operational ice bodies, provides vital expertise in developing ice related documents, and maintains linkages with a variety of governmental and commercial bodies like icebreaker services and satellite data suppliers. Moreover, IICWG meetings provide opportunities for ad hoc ETSI expert meetings. The last 7th IICWG Meeting held in Helsinki, Finland, 25-29 September 2006 was hosted by the Finnish Institute for Marine Research (FIMR). A full list of meeting documents is available from the IICWG central page at NSIDC: http://nsidc.org/noaa/iicwg/. The IICWG meetings are traditionally preceded by the science workshops dedicated to sea ice modeling, data assimilation, and advances in satellite observational systems. Thematic sessions during the meetings are dedicated to sea ice modeling and data assimilation, ice centre relationships including GMES (Global Monitoring for Environment and Security), ECDIS, satellite data access, and development of sea ice mapping systems. The next 8th IICWG Meeting is planned to be hosted by ESA in Italy in autumn 2007.

Baltic Sea Ice Meeting (BSIM)

18. Similar to the IICWG, the ETSI/GDSIDB continues to provide traditional and successful interrelation with the BSIM. The BSIM joins all 11 Baltic Sea ice services thus presenting a fine example of the progress in harmonization of ice services production and relay. BSIM Members have some of the oldest sea ice expertise and ice data records in the world. The BSIM like the IICWG maintains linkages with a variety of governmental and non-governmental bodies like icebreaker captains/services, satellite data suppliers, etc. As of 2003, there is a common web site of Baltic Sea ice services hosted by the German ice service: http://www.bsis-ice.de. The Estonian Meteorological Service in Tallinn, Estonia, hosted the last 22nd Baltic Sea Ice Meeting September 2005. The agendas included the chair's report, ETSI and national ice service reports describing ice related data acquisitions, processing and products relay to the users. Reports of the icebreaking services presently acting within the Nordic level agreement between Denmark, Finland and Sweden followed ice services reports. Part of the agenda was dedicated to Baltic Sea climatology. Other items on the BSIM-22 agenda included reports on BOOS, PAPA, scientific session on KSAT and SAR data possibilities in ice monitoring, reports on ice informational systems like IceMap, IBNet and IceView, EU projects like GMES, ICEMON and IWICOS. The Meeting also discussed deficiencies in ice services' and icebreaking systems, future requirements for data and candidates for new products/services. The strategy for future cooperation was discussed while considering the progress in joining the Memorandum of Understanding (MoU) to formalize the cooperation of the Baltic Sea ice services by Baltic ice services. The MoU, which is now joined by the majority of the Baltic ice services, is the first step to build up a single entry Baltic Sea ice information service.

Global Digital Sea Ice Data Bank (GDSIDB)

19. ETSI continued its close relation and supervision of the GDSIDB project during the period 2004-2006. The latest progress reports of the project by experts from two GDSIDB centers at the Arctic and Antarctic Research Institute (AARI, St. Petersburg; Russian Federation), and the USA National Snow and Ice Data Centre (NSIDC, Boulder, CO, USA) was provided at ETSI-II/GDSIDB-X sessions (April 2004). The sessions discussed and adopted a comprehensive work plan for the SG of the GDSIDB for the next 2004-2007 intersessional period, which are included in the overall JCOMM work. Sessions also recommended that future assessment of the accuracy of sea ice observations for GCOS should be completed and accurate, and that WMO ensure close coordination between ETSI and GOOS with respect to sea ice observations. It was also agreed that ETSI should be designated the responsible body for information and assessment of sea ice as an Essential Climate Variable (ECV). To this effect, ETSI experts participated at GCOS meetings in 2005 and 2006, where progressive information was submitted on historical sea ice charts archived within the project as well as specifications of the operative sea ice products (point of the view of national ice services).

20. Presently, the GDSIDB holds the largest digital sea ice chart collection for the Arctic (from 1933) and the Antarctic (from January 1973) to near the present. Ice charts from the separate ice services have a number of gaps in factual data (temporal - mostly in winter time and spatial - mostly outside navigable areas), have different temporal attributes (starting moment, validity period) and in a number of cases overlap each other, so blending of individual data sets enhances usage of the data. During 2002-2003, the first blending technique for the Northern Hemisphere GDSIDB charts was developed and implemented at AARI. Before IPY 2007/2008, the product will be extended as new data up to the year 2006 becomes available. At GCOS meetings, it was agreed that such GDSIDB data products as well as individual data sets would be widely used for implementation of the GCOS tasks including validation and co-analysis with SSM/I, products and provision of sea ice climatology.

21. To the effect of support, the preparation and assimilation of sea ice and icebergs analysis and climatology products in numerical forecasting and climatic analysis the SCG-III session proposed to convene a sea ice data analysis and assimilation workshop in early 2008. Further discussion on this item is under agenda item 3.

Relations to other WMO/IOC and International Programmes

International Polar Year 2007 – 2008

22. Following Resolution 34 (Cg-XIV) and JCOMM-II recommendations, the ETSI agreed on the following actions to the effect of IPY:

(i) To provide tailored information for the IPY at GDSIDB centers, including web pages dedicated to GDSIDB normals, ice records and national ice data, available on a timely basis;
(ii) To encourage national ice services to supply updates and historical documents, and ice data from coastal stations to the GDSIDB centres
(iii) To encourage ETSI Members to enhance sea ice observations and data archiving at the designated centres through: (a) filling gaps in the current Arctic and Antarctic buoy networks, beginning in 2006, (b) additional ULS deployment in both polar oceans and transfer of data already collected to the GDSIDB centre in NSIDC.

23. Following discussions since ETSI-II, JCOMM-II, IICWG-VI (Canadian Ice Service, Ottawa, Canada, October 2005) and *ad hoc* ETSI and Polarview teleconference (June 2006), it was tentatively agreed, on the level of IICWG, that most of the national ice services general and tailored support for IPY 2007-2008 activities would be provided through the Ice Information Portal to be developed before IPY 2007-2008. To that effect during the 7th session of the IICWG in September 2006 a special work session, was convened on the topic of Ice Information Portal implementation. Actions of the session were endorsed by MAN-V and SCG-III sessions. During October 2006 – March 2007 working plan was implemented extensively and intensively by C-CORE with supervision and partnership with ETSI and IICWG experts so that by mid-March 2007 a static version of the IPY Ice Logistics Portal was implemented. It should be noted that ETSI intention is to utilize the portal also for the IPY legacy as well as potential prototype of an element of a future integrated ice dissemination system. Discussion and presentation of the portal is under the agenda item 2.10.

International Hydrographic Organization (IHO) and Electronic Chart Display and Information Systems (ECDIS)

22. The ETSI established formal relations (November 2005) with IHO TSMAD on the ownership of the Ice Objects register within the Electronic Navigation Charts (ENCs), which are a subset of the Electronic Chart Display and Information Systems (ECDIS). Letter of liaison is included as Appendix C. ENC standards are controlled by the International Hydrographic Organization (IHO). IHO has many committees and working groups to control the standards for navigation information. Since sea ice and icebergs are navigation hazards that are charted by

national ice services, it is critical that ice information be incorporated into ENCs under the Register Structure and Registration Process for an IHO Object Register. By March 2007 ETSI, experts completed a final draft of Ice Objects Catalogue version 4.0 to be accepted by JCOMM and further submitted to IHO.

24. To facilitate further discussions a scheme of existing relations between ETSI, other SPA ETs (including new TT), WMO, and other external bodies is attached as Appendix D.

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Appendices: 4

Appendix A

Terms of Reference
(JCOMM-II report, Halifax, Canada, September 2005)

The Expert Team on Sea Ice shall:

3. Review and catalogue the products and services required by user communities in sea ice areas;

4. Encourage and advise on the relevant numerical models and forecast techniques for products and services;

5. Develop technical guidance material, software exchange, specialized training and other appropriate capacity building support with regard to sea ice observations and services and provide assistance and support to Members/Member States as required;

6. Interact closely with the ETMSS and ETMAES on all aspects of the impacts of sea ice relevant to maritime safety, marine pollution response and search and rescue services;

7. Maintain linkages with relevant international organizations and programmes, in particular BSIM, CLIC, IICWG, ASPeCt, GCOS and IHO

8. Keep under review and provide guidance as appropriate on the operations of the Global Digital Sea Ice Data Bank, including appropriate QC, error analysis and archiving mechanisms, and encourage and facilitate enhanced submissions of sea ice data to the bank;

9. Review and propose amendments to formats, nomenclatures and procedures for sea ice data and information exchange as well as to relevant terminology, coding and mapping standards, including management of an ice objects register within ECDIS, and requirements for sea ice information as an Essential Climate Variable (ECV) within GCOS;

10. Provide advice to the Services CG and other Groups of JCOMM, as required on issues related to sea ice and the ice-covered regions;

11. Play a key role in JCOMM involvement in major international polar projects such as IPY 2007-2008

General Membership

The Membership is selected to ensure an appropriate range of expertise and to maintain an appropriate geographical representation.

Up to twelve Members, including the Chairperson, representative of the range of activities related to sea ice and the ice-covered regions within JCOMM. (It is expected that, in general, the ETSI will be self-funding.)

Representatives of regional and international sea ice bodies in particular the Baltic Sea Ice Meeting and the International Ice Charting Working Group will also be invited to participate at their own expense.

Appendix B

JCOMM Meeting Report Series, No. 30. JCOMM Services Programme Area (SPA) Coordination Group (SCG), Second Session, Toulouse, 19-21 May 2004 - Final Report.

Services Programme Area Work Strategy
Work Plan of ETSI

High Priority

- Implement revision of the new updated version of the Sea Ice Nomenclature to be submitted in final form at ETSI-III and before IPY 2007/2008 (**draft prepared, action is decided to be extended beyond 2007)**

Medium term/High Priority

- Ask Secretariat to ensure close coordination between ETSI and GOOS with respect to sea ice observations and to undertake appropriate steps to be designated as the responsible body for information and assessment of sea ice as an Essential Climate Variable (ECV) (**implemented)**
- Undertake appropriate steps to be established as the owner for Ice Objects register, contact IHO on the mentioned subject and advise the TSMAD of JCOMM ETSI intention to adopt and control this register in the part related to sea ice (**implemented, will be continued directly and within TT MIGF)**
- Develop working plan for tailored support of IPY 2007/2008 from ETSI, GDSIDB and national ice services (**implemented in a form of IPY Ice Logistics Portal)**;
- Submit to Secretariat agreed draft of English/French/Russian/Spanish electronic version of WMO Sea Ice Nomenclature for formal approval (**done)**;
- Revise (once per year) WMO publication No 574 "Sea-Ice Information in the World" to be published in electronic form as JCOMM Technical Report Series – (**done, will be continued on annual basis)**;

Intersessional/Moderate Priority

- Develop and revise Sea Ice Nomenclature, terminology, data formats and software codes **– (implemented a form of supplements to stated documents);**
- Begin to work on a new version of the Illustrated Glossary of Sea Ice Terms as part of the updated Nomenclature (**not started, needs action on ETSI level);**
- Develop appropriate sections on Ice Decay/Stages of Melting to the new Sea Ice Nomenclature (**will be included into an updated Sea Ice Nomenclature);**
- Review and provide guidance on the GDSIDB including QC, error analysis and archiving and recommend action (**implemented continuously);**
- Develop techniques and capabilities to systematically measure ice parameters including thickness by means of remote sensing (**implemented partially via IGOS/ possibly needs rewording);**
- Prepare historical sea ice data sets (**implemented continuously)**;
- Review and catalogue user requirements, products, services required in sea ice areas (**implemented continuously)**;
- Cooperate with DBCP in addressing problems in program implementation in the Polar Regions **(addressed indirectly / needs rewording)**;
- Provide support to Southern Hemisphere countries to enhance Antarctic sea ice services (**action was outside of ETSI activities / needs rewording);**

On-going/Moderate Priority

- Develop technical guidance, software exchange, specialized training and other capacity building support concerning sea ice, observations and services (**implemented continuously)**;
- Develop cooperation and coordination with climate oriented programmes such as WCRP, WCP, CLIC, GCOS (**implemented continuously)**;
- Continue collaboration with BSIM, IICWG, and ECDIS (**implemented continuously)**.

Appendix C

Letter of liaison between WMO/IOC JCOMM ETSI and IHO/TSMAD

09 November 2005

Mr. Mike Brown
Chairperson of IHO/TSMAD

Chief, Cartographic and Geospatial Technology Programs
Office of Coast Survey
National Oceanic and Atmospheric Administration
Silver Spring, MD 20910 USA

Dear Mr. Brown,

The Expert Team on Sea Ice (ETSI) was formally constituted by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) at its first session in June 2001. ETSI is the successor to the former WMO CMM Sub-Group on Sea Ice (which was in existence since the 1950s). At the WMO/IOC JCOMM level, ETSI is formally responsible for coordination between the national ice services worldwide, including advice to JCOMM subsidiary bodies on the issues relevant to sea ice as well as review, advice and coordination of scientific, technical and operational aspects of sea ice observations and services.

In September this year, JCOMM convened its second session and, considering the continuing and expanding requirements of marine users for timely and extended marine meteorological and oceanographic services, approved the new ETSI Terms of Reference (ToRs) specifically tasking the group to "review and propose amendments to … relevant terminology, coding and mapping standards, including management of an ice objects register within ECDIS…", and to "maintain linkages with relevant international organizations and programmes, in particular BSIM, IICWG, IHO…". In the context of these ToRs, the Baltic Sea Ice Meeting (BSIM) and the International Ice Charting Working Group (IICWG) are named as the regional and global alliances of the national ice services providing important technical advice and feedback from various user communities for ETSI.

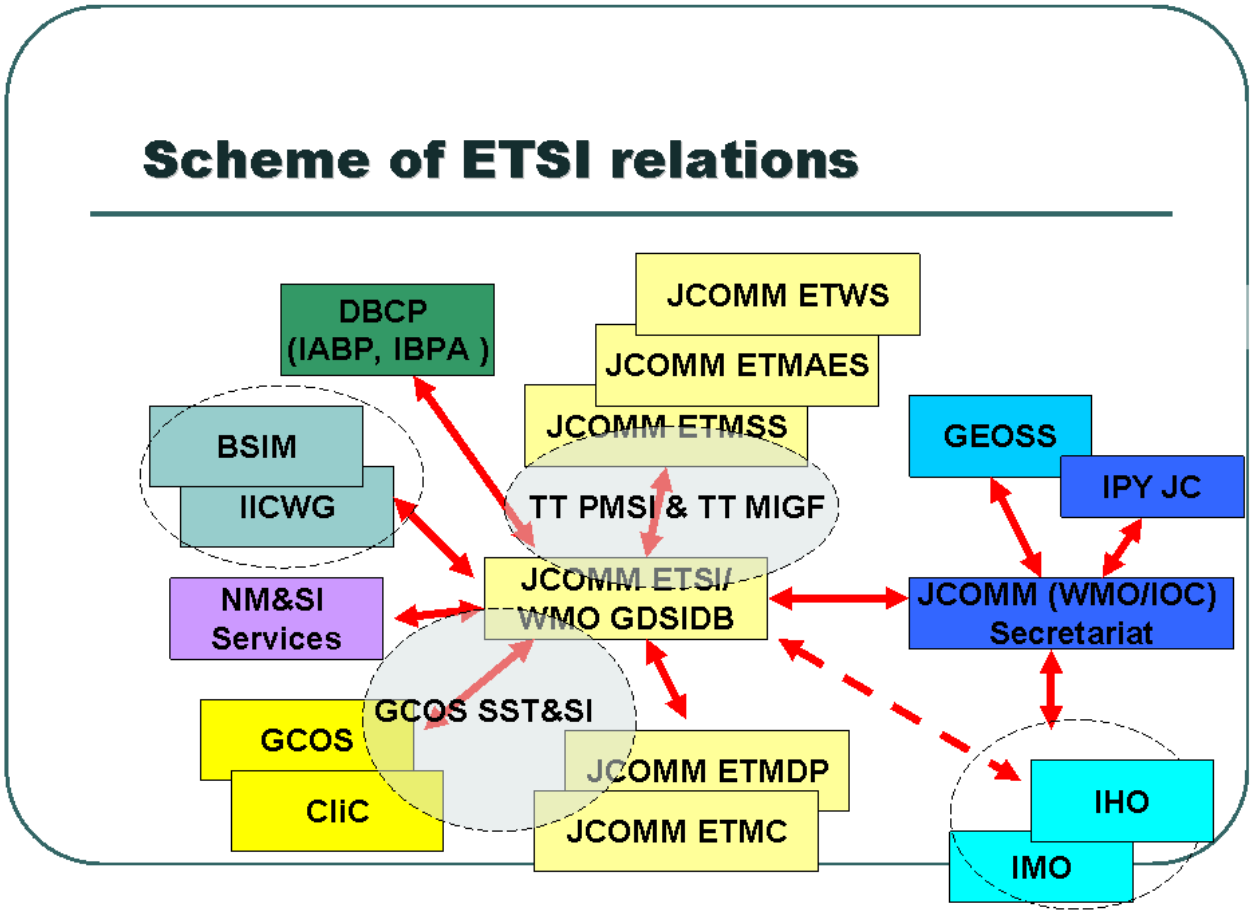
I am pleased to inform you that ETSI estimates its work on the discussed subject as one of the priority activities for the current JCOMM intersessional period of 2005-2009. To this effect, participants of the ETSI second session (April 2004) agreed to be responsible for the management of an ice objects register within ECDIS. Following JCOMM-II resolutions, further detailed work plans were elaborated during the recent IICWG sixth meeting (October 2005) during a special session on the status and future of interoperability between ice services and with users. Participants of the session agreed that the IHO Ice Register (Ice Object Catalogue) should reference and be compatible in content and presentation standards with the WMO Sea Ice Nomenclature, Symbology and Colour Standards and that ETSI should be responsible or the "control body" for that action. ETSI, in collaboration with IICWG, agreed upon both short-term actions including completion of the final version of the IHO Ice Register (by 1 March 2006), establishing formal relationships with IHO and ISO (November 2005 – May 2006), as well as on longer term actions including standardization on the ISO level of the sea ice formats, metadata, annotated imagery and presentation content for sea ice products.

Essential to the success of JCOMM ETSI are the standards for data and technology that facilitate compatibility, sharing and relay of products to users in Electronic Chart Systems. Therefore, the ETSI Members, unanimously with the participants of the recent IICWG sixth session, agreed to seek Liaison with the IHO/TSMAD. On behalf of the ETSI Members, I am asking IHO/TSMAD approval of ETSI for Liaison with appropriate status so that our activities can be harmonized with those of IHO/TSMAD that are crucial to the successful and timely implementation of the JCOMM vision of marine safety in ice covered waters. The proposed point of contact is the Chairperson of the JCOMM ETSI until further notification.

Sincerely yours,

Dr Vasily Smolyanitsky
Chairperson, JCOMM Expert Team on Sea Ice
Head, Laboratory for sea ice climate manuals
Arctic and Antarctic Research Institute

Appendix D


Scheme of ETSI relations
DBCP
(IABP, IBPA)
JCOMM ETWS
JCOMM ETMAES
JCOMM ETMSS
BSIM
IICWG
TT PMSI & TT MIGF
GEOSS
IPY JC
NM&SI
Services
JCOMM ETSI/
WMO GDSIDB
JCOMM (WMO/IOC)
Secretariat
GCOS SST&SI
GCOS
CliC
JCOMM ETMDP
JCOMM ETMC
IHO
IMO

Annex V

TERMS OF REFERENCE OF THE TASK TEAM ON PROVISION OF MSI IN POLAR REGIONS (PMSI)

The TT will provide additional expertise to the ETSI, ETMSS and ETMAES in the following issues:

- Survey user (e.g., shipmasters, ship-owners) requirements on the PMSI, in particular related to sea ice and emergency situations, extend and update existing the ETMSS questionnaires;
- Review standards for presentation and dissemination of the PMSI (both binary and textual) via ground-based and satellite systems;
- Keep under review, in cooperation with the sat rap, existing and prospective satellite and automatic information systems (AIS) for PMSI dissemination including those coordinated by the IALA;
- Review and propose updates to the WMO-No. 558 and WMO-No. 471 publications;
- Keep under review scientific activities related to modelling scenarios of emergency situations, in particular related to the MPERSS;
- Keep under review existing and planned projects/works on standards for coding and presentation of Met-Ocean information, in particular for sea ice and surface contaminants, within other WMO bodies, including the WMO CBS, IHO and ISO levels;
- Review existing NMS Capacity Building resources related to the provision of PMSI, and provide recommendations on training, as appropriate;
- Submit progressive reports of the stated activities, initiate appropriate actions within the ETMSS, ETMAES and ETSI and the WMO Secretariat, as appropriate.

General Membership:

- ETSI Chairperson (Dr Vasily Smolyanisky, Russian Federation)
- SPA Coordinator (Dr Craig Donlon, United Kingdom)
- ETMSS Chairperson (Mr Henri Savina, France)
- Three Experts from the ETSI (Captain Manuel Hipólito Picasso (Argentina), Ms Nora Adamson (Denmark), Dr Jürgen Holfort (Germany) and Mr Amund Lindberg (Sweden))
- Three Experts from the ETMSS (Finland (to be appointed), Canada (to be appointed), additional Expert (to be appointed))
- One Expert from the ETMAES (USA – to be appointed)
- IHO Representative (Mr Peter Doherty, Chairperson of CPRNW, USA)

Annex VI

REPORT OF THE IMO/IHO/WMO CORRESPONDENCE GROUP ON ARCTIC MSI SERVICES PRESENTED AT THE ELEVENTH SESSION OF THE IMO/COMSAR (London, United Kingdom, 19-23 February 2007)

The Sub-committee considered the information provided in the Report of the Joint IMO/IHO/WMO Correspondence Group and the working document from Norway, and agreed upon the following items:

- that all new Arctic NAVAREAs should extend up to 90 degrees North and be responsible for the promulgation of maritime safety information (MSI) in navigable waters within those areas;

- that the new Arctic NAVAREAs should be fully operational 365/24/7, bearing in mind that certain parts of the NAVAREAs will not be navigable during certain times;

- to expand the Arctic WWNWS and accept Canada as the NAVAREA Coordinator for new NAVAREAs XVII and XVIII, Norway as the NAVAREA Coordinator for new NAVAREA XIX, and the Russian Federation as the NAVAREA Coordinator for new NAVAREAs XX and XXI;

- that new Arctic NAVAREAs be established rather than Sub-areas of an existing NAVAREA;

- that agreed changes to the coverage areas under the WWNWS, to include the Arctic expansion and other existing coverage gaps, within the Inmarsat system definition manual, should be implemented at the same time; and

- the boundary limits for the five (5) new Artic NAVAREAs should be:

  - NAVAREA XVII bound by:
    67°00’. 00N 168°58’. 00W,
    90°00’. 00N 168°58’. 00W,
    90°00’. 00N 120°00’. 00W,
    south to the Canadian Coastline along the 120°00’.00W meridian,

  - NAVAREA XVIII bound by:
    A position on the Canadian Coastline at the 120°00’.00W meridian to:
    90°00’. 00N 120°00’. 00W,
    90°00’. 00N 035°00’. 00W,
    67°00’. 00N 035°00’. 00W;

  - NAVAREA XIX bound by:
    From a position on the Norwegian Coastline at 65°00’.00N to:
    65°00’.00N 005°00’.00W,
    75°00’.00N 005°00’.00W,
    west to a position on the Greenland Coastline,

    From the border between Norway and Russia (Inland) to:
    69° 47’. 68N 030° 49’. 16E,
    69° 58’. 48N 031° 06’. 24E,
    70° 22’. 00N 031° 43’. 00E,
    71° 00’. 00N 030° 00’. 00E,

    From this co-ordinate (71° 00’.00N - 030°00’.00E) further north along the 030°00’.00E Meridian to:

90° 00'. 00N 030° 00'.00E,
90° 00'. 00N 035° 00'.00W,
south to the Greenland coastline along the 035° 00'.00W meridian.

- NAVAREA XX bound by:
  From the border between Norway and Russia (Inland) to:
  69° 47'. 68N 030° 49, 16E,
  69° 58'. 48N 031° 06, 24E,
  70° 22'. 00N 031° 43, 00E,
  71° 00'. 00N 030° 00, 00E,

  From this co-ordinate (71° 00'. 00N - 030°00'. 00E) further north along the 030° 00'.00E Meridian to:
  90°00'. 00N 030°00'. 00E,
  90°00'. 00N 125°00'. 00E,
  then south to the Russian Federation Coastline along the 125°00'. 00E meridian; and

- NAVAREA XXI bound by:
  From a position on the Russian Federation Coastline at the 125°00'. 00E meridian to:
  90°00'. 00N 125°00'. 00E,
  90°00'. 00N 168°58'. 00W,
  67°00'. 00N 168°58'. 00W,
  west to a position on the Russian Federation Coastline along the 67°00'. 00N parallel;

- that the provision of SAR information within these new NAVAREAs would continue to be provided in accordance with currently agreed SAR regions; and

- that all WWNWS guidance and other relevant documents should be updated as part of the IHO WWNWS Guidance Document Review Correspondence Group.

Accordingly, the Sub-committee endorsed the above-mentioned recommendations of the Joint IMO/IHO/WMO Correspondence Group.

The Sub-committee re-established the Joint IMO/IHO/WMO Correspondence Group on Arctic MSI services with the following terms of reference under the coordination of the IHO Coordinator, Mr. Peter M. Doherty, Chairperson of the Commission on Promulgation of Radio Navigational Warnings. The Joint IMO/IHO/WMO Correspondence Group on Arctic MSI Services should give consideration and provide comments on the following issues, as appropriate:

1) Who will act as METAREA Issuing Service?
2) How will warnings be transmitted, and can they be monitored as required? Systems other than Inmarsat (such as the HF NDBP, NAVTEX and other satellite service providers) need to be considered;
3) How will Inmarsat system definition manual and existing SafetyNET terminals be updated to allow receipt of MSI within the new NAVAREAs?
4) Required training, assistance, and support from the IHO/CPRNW to support new NAVAREA coordinators and/or from JCOMM/ETMSS for METAREA issuing services; and
5) Submit its report for upcoming IMO/COMSAR 12 Session.

Annex VII

REVISED ETSI TERMS OF REFERENCE

The Expert Team on Sea Ice (ETSI) shall:

(a) Review and catalogue the products and services required by user communities in sea ice areas;

(b) Encourage and advise on the relevant numerical models and forecast techniques for products and services;

(c) Develop technical guidance material, software exchange, specialized training and other appropriate capacity building support with regard to sea ice observations and services and provide assistance and support to Members/Member States as required;

(d) Interact closely with the ETMSS and ETMAES on all aspects of the impacts of sea ice relevant to maritime safety, marine pollution response and search and rescue services;

(e) Maintain linkages with relevant international organizations and programmes, in particular BSIM, CLIC, IICWG, ASPeCt, GCOS and IHO;

(f) Keep under review and provide guidance as appropriate on the operations of the Global Digital Sea Ice Data Bank, including appropriate QC, error analysis and archiving mechanisms, and encourage and facilitate enhanced submissions of sea ice data to the bank;

(g) Review and propose amendments to formats, nomenclatures and procedures for sea ice data and information exchange as well as to relevant terminology, coding and mapping standards, including management of an ice objects register for Electronic Navigation Chart Systems, and requirements for sea ice information as an Essential Climate Variable (ECV) within GCOS;

(h) Provide advice to the Services CG and other Groups of JCOMM, as required on issues related to sea ice and the ice-covered regions;

(i) Play a key role in JCOMM involvement in major international polar projects such as IPY 2007-2008.

General Membership

The Membership is selected to ensure an appropriate range of expertise and to maintain an appropriate geographical representation.

Up to twelve Members, including the Chairperson, representative of the range of activities related to sea ice and the ice-covered regions within JCOMM (It is expected that, in general, the ETSI will be self-funding).

Representatives of regional and international sea ice bodies in particular the Baltic Sea Ice Meeting and the International Ice Charting Working Group will also be invited to participate at their own expense.

Annex VIII

MARINE INFORMATION OBJECTS (MIO)
Recommended Procedures for Development[1]

Edition 1.0 - December 2004

1. Introduction

Marine Information Objects (MIO) consist of supplementary information to be used with an Electronic Chart Display and Information System (ECDIS) that are not Electronic Navigational Chart (ENC) objects ,specified navigational elements or parameters. Supplementary means additional, non-mandatory information not already covered by existing International Maritime Organization (IMO), International Hydrographic Organization (IHO), and International Electro-technical Commission (IEC) standards or specifications. Examples of MIOs include ice coverage, tide/water level, current flow, meteorological, oceanographic, and marine habitats. Depending on the navigation situation or task-at-hand, the provision and use of MIOs (e.g., ice coverage, weather conditions, etc.) can be crucial in terms of improving both the safety and efficiency of maritime navigation, as well as ensuring the protection of the marine environment.

As defined in the IMO Performance Standards for ECDIS, an "*Electronic Navigational Chart (ENC) means the database, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation*." In terms of being "supplementary information", MIOs are not contained within nor are they an integral part of an ENC. MIOs are separate, supplementary information that are displayed in conjunction with the overall System ENC[2] (SENC). This is similar in concept to adding radar and AIS information to an ECDIS display and is covered in the IMO ECDIS Performance Standards, "*Radar information or other navigational information may be added to the ECDIS display. However, it should not degrade the SENC information, and should be clearly distinguishable from the SENC information*".

The IMO Performance Standards for ECDIS require chart data to conform to IHO S-57 data standards, and that IHO colours and symbols are used to represent the System ENC (SENC) information. While the current edition of IHO S-57 (Edition 3.1) contains an ENC Product Specification, it does not specify the content or format for supplemental information (e.g., MIOs). Similarly, both the current IHO Colours and Symbols Specifications for neither ECDIS (IHO S-52, Appendix 2) nor IEC Publication 61174 (*ECDIS - Operational and Performance Requirements, Method of Testing and Required Test Results)* describe how this supplemental information should be displayed.

2. HGMIO

In order to facilitate the development and implementation of MIOs, IHO and IEC agreed to establish a Harmonization Group on Marine Information Objects (HGMIO) in May 2002. HGMIO ensures the coordination of the relevant IHO and IEC bodies, and the liaison with other competent organizations interested in MIO development and implementation. Additionally, HGMIO may conduct technical exchange on MIOs with type-approval authorities, ECDIS manufacturers, and ECDIS user community. It may also recommend changes to the relevant IHO and IEC standards, because of HGMIO work.

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[1] Approved by IHO CHRIS17, September 2005.
[2] System ENC is the data held in the ECDIS system resulting from the transformation of the ENC for appropriate use.

The current chairperson of HGMIO is Dr Lee Alexander, University of New Hampshire, Durham, NH, USA (lee.alexander@unh.edu).

To date, MIO objects and attributes have been developed, based on S-57, for the following categories of MIOs:

- Ice Coverage
- Meteorological
- Oceanographic

These are currently registered on the Open ECDIS Forum (www.openecdis.org) and available for use.

3. Competent Organizations

In most cases, development or regulation of MIO data standards is not an IHO responsibility. Examples of other competent organizations that may wish to develop or administer standards for MIOs include:

International Association of Lighthouse Authorities (IALA)
World Meteorological Organization (WMO)
North Atlantic Treaty Organization (NATO)

In particular, such organizations would:

a. Clarify / define the need for a particular category of MIO.
b. Participate in the development of suitable MIO objects and attributes (if based on IHO S-57).
c. Take responsibility for the maintenance of those S-57 objects and attributes.
d. Participate in the development of appropriate colours and symbols for the display of those MIOs.
e. Participate in any MIO testing and evaluation by ECDIS manufacturers, or during at-sea trials with mariners.
f. Play an active role in the production and dissemination of MIO data.
g. Lead any initiative aimed at regulating the use of MIOs with ECDIS (e.g., to IMO and/or IEC).

4. MIO Development Procedure

IHO S-57 has proved to be an effective means to encode chart and navigation-related information for use with ECDIS. As such, competent organizations involved in MIO development are encouraged to develop any new applications using IHO S-57 as the basis. Development should proceed as follows:

1. Define the need for a particular category of MIO. The competent organization (e.g., IALA for Aids to Navigation Status) should identify the requirement and produce a detailed description of the various elements to be considered for encoding, transfer and display in ECDIS. The International Hydrographic Bureau (IHB) may act as interface or facilitator between the competent organization and HGMIO. HGMIO would then inform its parent committees at IHO[3] and IEC[4] of the perceived requirement and request approval to initiate a development process.

2. Develop Objects and Attributes. From the specifications received from the competent organization, HGMIO provides recommendations for the development of appropriate S-57 objects and attributes in liaison with the IHO body responsible for the maintenance of S-57[5], the competent organization and with ECDIS manufacturers. This may be carried out via e-

[3] Committee on Hydrographic Requirements for Information Systems (CHRIS)
[4] Technical Committee No. 80 - Maritime Navigation and Radio-communications Equipment and Systems (TC80)
[5] Transfer Standard Maintenance and Applications Development Working Group (TSMAD)

mail and/or during ad hoc workshops. The new S-57 objects and attributes would initially be registered on the Open ECDIS Forum. If formally approved by the parent IHO and IEC committees, as well as the competent organization, these new MIO-related objects and attributes will beincorporated into the IHO Registry for S-57 Edition 4. Potentially, this may involve the creation of a separate register for MIOs or several registers for various MIO categories. It is expected that the competent organization that developed these new objects/attributes would also be willing to assume the responsibility for overseeing their maintenance or future refinement.

3. Develop Colours and Symbols. From the set of objects and attributes, which are developed for the relevant MIO category, HGMIO helps facilitate the development of appropriate colours and symbols. This will be done in liaison with the IHO body responsible for the maintenance of C&S specifications in S-52[6], the competent organization, and ECDIS manufacturers. This may be carried out via e-mail or during ad hoc workshops. During this process, the existing S-52 chart colours and symbols, and those used to display the navigational elements and parameters listed in IEC 61174 or the draft IMO Performance Standards for the Presentation of Navigation-related Information on a Shipborne Navigational Display would be taken into account. After approval by the parent IHO and IEC committees, and the competent organization, the resulting new colours and symbols would be registered on the OEF. In the same manner as for new S-57 objects and attributes, it is expected that the competent organization would be willing to take responsibility for the maintenance of these specially developed colours and symbols.

4. MIO Test and Evaluation. Before a new category of MIOs can be operated on ECDIS, there would be a suitable period of test and evaluation performed by ECDIS manufacturers or during at-sea trials with mariners. HGMIO, as required, can act as coordinator to help organize this testing / evaluation, in liaison with the competent organization, ECDIS manufacturers, and maritime user groups.

5. Production and Dissemination of MIO Data. The competent organization would be responsible for the production and dissemination / distribution of its relevant MIO data. Some examples include production and issuing of ice coverage information, weather maps, and oceanographic information affecting ships routing (current flow, wave heights, etc.). This type of service could be performed on a daily or other periodic basis via internet, digital cell phone, satellite communications, or as part of an AIS broadcast service.

6. Address Regulatory Requirements. It may be necessary that the use of MIOs on ECDIS be reflected in the relevant IMO and IEC standards. For IMO, this includes the existing Performance Standards for ECDIS and the new Performance Standards for the Presentation of Navigation-related Information on Shipborne Navigational Displays. In either case, the competent organization would lead any initiative on the matter, possibly in association with the IHO. Future editions of IEC 61174 (ECDIS) and/or the new IEC 62288 (Presentation of Navigation-related Information) may require the development of a test data set for the particular MIOs by the competent organization.

[6] Colours and Symbols Maintenance Working Group (C&SMWG)

Annex IX

TERMS OF REFERENCE OF THE TASK GROUP ON ELECTRONIC NAVIGATIONAL CHART ICE OBJECTS (TG ENCIO)

1. Objective

To develop and to maintain an international standard for Ice Objects as a class of Marine Information Objects (MIO) that is based on the standards of the International Hydrographic Organisation (IHO) for Electronic Navigational Charts (ENC).

2. Guiding Principles

The framework for the Ice Objects standard includes:

- Use of **IHO S-57** including:
  - Object Catalogue;
  - MIO Product Specification;
  - MIO Encoding Guide.
- Establishment of an **Ice Objects Register** for additional real-world, ice features, attributes, and enumerations that are not already contained in IHO S-57 Edition 3.1 Object Catalogue.
- Use of the ***Open ECDIS Forum*** (OEF) as a means of communication and discussion for continuing development and maintenance of the Ice Objects Register.
- Alignment with the future **IHO S-100** Standard for Geospatial Data.

3. Authority

JCOMM ETSI is recognized as the competent international technical group on sea ice and icebergs by:

- World Meteorological Organization;
- Intergovernmental Oceanographic Commission;
- International Hydrographic Organization (IHO) – Committee on Hydrographic Requirements and Information Systems (CHRIS).

4. Participants

Register Owner:	WMO Secretariat
Register Manager:	WMO Secretariat
Register Users:	anyone interested in sea ice or iceberg MIOs
Control Body:	ETSI ENC Ice Objects Task Group
Submitting Organization:	WMO
Proposers:	ETSI Members from Canada, Germany, Russian Federation and USA

5. Composition

The Ice Objects Task Group will be composed of at least three standing ETSI Members appointed by the ETSI, in addition to the Register Manager. The Task Group Members shall serve until the subsequent intersessional meeting of the ETSI, at which time they may be re-appointed or replaced. The Task Group will elect a Chairperson from among them.

6. Meeting Schedule

The Task Group will meet on an as-required, as-agreed basis. Members will fund their own attendance at meetings. Much of the business of the Task Group will be conducted by e-mail and telephone.

7. Management of the Ice Objects Register

Any Member of the ETSI can submit a proposal to the Ice Objects Register but the proposal must:

- be in a format established by ETSI;
- describe how the new object (or feature) will be accommodated in the Ice Objects Encoding Guide.

The **Ice Objects Register Manager**:

- reviews the submitted proposal for completeness, and may request additional information/clarification from the Proposer. The proposal is also distributed to Ice Objects Task Group (Control Body) and other Register Managers for review/comment.
- officially posts the proposal on the Ice Objects ENC Register. It is initially flagged as **NOT-VALID**.
- places the proposal on the Ice Objects Discussion Forum (OEF website) for discussion.

Eight weeks after the proposal is placed on the Ice Objects Register:

- if a consensus is reached to accept, the proposal is then flagged as **VALID**.
- if no consensus is achieved, it remains flagged as **NOT-VALID**. In this case:
  - the submitter can decide to withdraw the proposal;
  - the proposal can be revised and re-submitted;
  - any participant of the ETSI can ask that the proposal be considered at the next meeting of the ETSI.
- the Register Manager announces the outcome on the Ice Objects Discussion Forum.

8. Regular ETSI Review

As owner of the Ice Objects Register, ETSI will carry as a standing agenda item on its meetings, a review of any outstanding recommendations from the Task Group.

Annex X

TERMS OF REFERENCE OF AN EXPERT ON MET-OCEAN INFORMATION IN GRAPHICAL FORM

The Expert, jointly with ET Experts (Membership), shall:

- With the ETMSS and SCG, specify the need for a basic set of graphical and digital information for MSI;
- Keep under review existing and planned projects/works on formats for coding and displaying met ocean information on graphical form (especially objects), within the respective WMO bodies, including the CBS, at both the international and regional levels;
- Keep under review existing and planned project(s)/work(s) on navigational system(s) for marine users, including formats, developed or approved by the IMO or IHO (i.e., Marine Information Objects (MIOs)), in particular the work undertaken by the HGMIO and other agencies/companies, especially for meteorology and oceanography aspects;
- Liaise with the WMO Secretariat, IMO, IHO or other agencies/companies to facilitate consistency between the existing or planned WMO standards and WMO Information System (WIS);
- Report the status of the project to the ETMSS Chairperson, SCG and the WMO Secretariat, as appropriate;
- Prepare a first version of a detailed report to the SCG-IV, planned for the beginning of 2009, as well as a final version to the JCOMM-III, including proposals on the formats contents and symbology and dissemination, to be used in future, including within GMDSS

The report by the Expert will be reviewed by the Members of the ETMSS, as appropriate, and be submitted to the SCG-IV. After the review by the SCG, the proposals will be submitted for approval to the JCOMM-III, if appropriate.

General Membership:

- Representative from Argentina (Commander Negri)
- Representative from Australia (to be appointed)
- Representative from France (Mr Henri Savina)
- Representative from the United Kingdom (Mr Nick Ashton)
- Representative from USA (Mr Timothy Rulon)
- Representative from Russian Federation (Mr Valery Martyschenko)
- Experts from the ETSI (TG ENCIO)
- One or more Expert(s) from the ETWS (to be appointed)
- One Expert from the ETMAES (USA – to be appointed)
- OFS Rapporteur (Dr Adrian Hines)

Annex XI

PROPOSED AMENDMENTS TO SIGRID-3 CODE

1. PROPOSAL 2007-1

Total Concentration of 9+/10

Although it has been common practice in Canada for many years to use a Total Concentration value of 9+ (meaning more than 9/10 concentration but *not* consolidated (i.e., not 10/10)). Other ice services have used code 91, with a value of 9-10, for this description, but believed to be incongruous. A 10/10 concentration is a very special case of ice that is consolidated or compacted, and is much more difficult to break through than 9+/10, which has enough movement left to permit cracks and small openings between the floes to allow a sufficiently powerful vessel to penetrate.

Proposal

It is proposed to amend the definition of code 91 in Table 4.1 "Concentration Codes for Variable Identifiers CT, CA, CB, and CC". The new definition would read: "9/10–10/10 or 9+/10".

2. PROPOSAL 2007-2

Strips and Patches Concentration of 9+/10

Although it has been common practice in Canada for many years to use a concentration of 9+/10 in the Strips and Patches Form of Ice, there is no SIGRID-3 code value to allow for this concentration. This common occurrence in Canadian waters and should be supported by the code.

Proposal

It is proposed to add code 91 to Table 4.3 "Form of Ice Codes for Variable Identifiers FA, FB, FC, and CF". The form would become "Strips and Patches". The Size/Concentration would be "Concentration 9+/10".

3. PROPOSAL 2007-3

Predominant and Secondary Forms of Ice

The SIGRID-3 code standard defines the variable CF as a 4-digit text code identifying the "predominant and secondary" forms of ice. The first two digits of the variable provide the predominant form of ice as a code taken from Table 4.3. The last two digits of the variable give the secondary form of ice, again as a code taken from Table 4.3. Combining these two identifiers into one variable is confusing and complicates the encoding and decoding process.

Proposal

It is proposed to amend Table 1 by replacing line 15:

	CF			Table 4.3		Predominant and secondary forms of ice

with 2 new lines as follows:

	FP			Table 4.3		Predominant form of ice
	FS			Table 4.3		Secondary form of ice

in addition, re-number the following lines, as necessary and/or appropriate.

4. PROPOSAL 2007-4

Brash Ice

Brash ice, particularly when compacted by winds or currents to a substantial thickness, presents a significant ice hazard in Canadian waters. It has been a long-standing Canadian practice to use a special encoding to depict this brash ice. Given the desire to adopt coding standards that can be interpreted internationally, it is proposed that a form of the Canadian practice be adopted into the SIGRID-3 coding standard.

The definition of brash ice, and additional related definitions, taken from Section 1.6.7 of the *Canadian Manual for Ice Observing and Reporting* (MANICE) is:

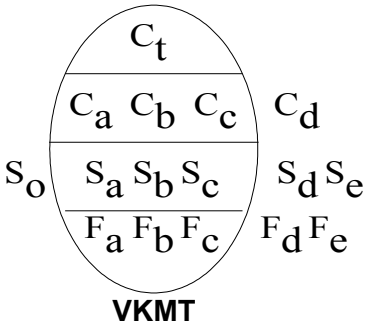
Brash Ice: Accumulation of floating ice made up of fragments no more than 2 m across; the wreckage of other forms of ice.

A particular type of Brash Ice is:

Jammed Brash Barrier: A strip or narrow belt of new, young or brash ice usually 100-5000 m wide formed at the edge of either floating or fast ice or at the shore. Heavily compacted, mostly due to wind action, may extend 2 to 20 m below the surface, and does not normally have appreciable topography. Jammed brash barriers may disperse with changing winds, but can also consolidate to form a strip of unusually thick ice in comparison to the surrounding ice.

The representation of brash on Canadian ice charts is as follows (Ref. Section 3.5.10 of MANICE):

Coding for Brash



VKMT

If brash is present, it will always be the thickest stage of development i.e. C_a.

If brash is present, S_a will always be a dash (-).

Brash is already indicated in the table as 1, therefore F_a = 1 confirms the dash (-) for S_a

Four digits (**VKMT**) shall be added below the oval to indicate the thickness concentration breakdown of the brash that is present. The table below shows the thickness categories for brash. The breakdown shall be entered going from right (T) to left (V). In the case where there is no

thickness for thin but there are entries for medium, thick and very thick a zero (0) shall be placed in the thin column. This also holds true for medium (M) and thick (K) regardless of the combination.

Table: Thickness Categories for Brash (VKMT)

Description	**Thickness**
Very Thick (V)	>4m
Thick (K)	>2-4m
Medium (M)	1-2m
Thin (T)	<1m

Note: $C_a = V + K + M + T$

Proposal

It is proposed to amend the SIGRID-3 code as follows:

1. Add a new code figure 70 to Table 4-2 “Thickness of Ice or Stage of Development Codes for Variable Identifiers SA, SB, SC, CN, and CD”. The Stage of Development for this new code figure will be “Brash Ice”. A new code table described below will determine the thickness of this type of ice.

2. Extend code table 3.3 SIGRID-3 “Variable Identifiers” to add 4 new identifiers: AV, AK, AM, AT.

3. Amend the description of code table 4.1 “Concentration Codes for Variable Identifiers CT, CA, CB, and CC” to read, “Concentration Codes for Variable Identifiers CT, CA, CB, CC, AV, AK, AM and AT”.

4. Add a note following code table 4.1 to read, “When AV, AK, AM and AT are used, the total of the concentrations represented by the values for AV, AK, AM and AT must sum to the concentration represented by the value for CA”.

———————

Appendix: 1

Appendix

Proposal for amendments to the SIGRID-3 code

Following are the SIGRID tables, as they would appear if all of the above proposals were accepted. Changes are highlighted in bold.

Table 1 Mandatory columns (fields) in the SIGRID-3 database file.

Column or Field number	Column or Field name	Data Type	Length (bytes)	Begin/End Byte	Code Table Reference	Ice Variable Description
1	AREA	Double precision binary	20	2-21		
2	PERI-METER	Double precision binary	20	22-41		
3	CT	Text	2	42-43	Table 4.1	Total concentration
4	CA	Text	2	44-45	Table 4.1	Partial concentration of thickest ice
5	SA	Text	2	46-47	Table 4.2	Stage of development of thickest ice
6	FA	Text	2	48-49	Table 4.3	Form of thickest ice
7	CB	Text	2	50-51	Table 4.1	Partial concentration of second thickest ice
8	SB	Text	2	52-53	Table 4.2	Stage of development of second thickest Ice
9	FB	Text	2	54-55	Table 4.3	Form of second thickest ice
10	CC	Text	2	56-57	Table 4.1	Partial concentration of the third thickest ice
11	SC	Text	2	58-59	Table 4.2	Stage of development of third thickest ice
12	FC	Text	2	60-61	Table 4.3	Form of third thickest ice
13	CN	Text	2	62-63	Table 4.2	Stage of development of ice thicker than SA but with concentration less then 1/10
14	CD	Text	2	64-65	Table 4.2	Stage of development of any remaining class of ice

15	**FP**	**Text**	**2**	**66-67**	**Table 4.3**	**Predominant form of ice**
16	**FS**	**Text**	**2**	**68-69**	**Table 4.3**	**Secondary form of ice**
17	Poly_type	Text	1	70	Table 4.4	
18…55	Optional fields, see Appendix 4 Table 3.3.	Text			Tables 4.5 -4.15	

Table 3.3 SIGRID-3 optional variable identifiers (from SIGRID (WMO, 1989))

Identifier	Description
Dynamic Processes	
DP	Dynamic processes
DD	Direction of dynamic processes
DR	Rate of ice drift in tenths of knots
DO	Source of information
Water Openings	
WF	Form of water openings
WN	Number of water openings
WD	Orientation (direction) of water openings
WW	Width of water openings
WO	Source of information
Topography Features	
RN	Nature of topography feature
RA	Age of topography feature
RD	Orientation of topography feature
RC	Concentration of topography feature
RF	Frequency of topography feature
RH	Height (mean) of topography feature
RO	Source of information
RX	Maximum height of topography feature
Thickness of Ice	
EM	Mean thickness of level ice in cm
EX	Maximum thickness of level ice in cm
EI	Thickness interval
EO	Source of information
Thickness of Brash Ice	
AV	**Concentration of very thick brash ice (>4 metres)**
AK	**Concentration of thick brash ice (>2 – 4 metres)**
AM	**Concentration of medium brash ice (1-2 metres)**
AT	**Concentrations of thin brash ice (<1 metre)**
Surface features and melting forms	
SC	Concentration of snow
SN	Snow depth

SD	Orientation (direction) of sastrugies
SM	Melting forms
SA	Area coverage of water on ice in tenths
SO	Source of information
Icebergs or ice of land origin	
BL	Type of iceberg
BD	Direction of drift of iceberg
BE	Rate of drift in tenths of knots
BN	Number of icebergs
BY	Day of month
BO	Source of information
Sea surface temperature	
TT	Sea surface temperature in tenths of degrees
TO	Source of information
Source of information	
OP	Primary source of information on which the chart is based
OS	Secondary source of information on which the chart is based
OT	Tertiary source of information on which the chart is based

Table 4.1 Concentration codes for variable identifiers CT, CA, CB, CC, AV, AK, AM and AT

Definition	Code Figure
Ice Free	00
Less than 1/10 (open water)	01
Bergy Water	02
1/10	10
2/10	20
3/10	30
4/10	40
5/10	50
6/10	60
7/10	70
8/10	80
9/10	90
10/10	92
Concentration intervals (lowest concentration in interval followed by highest concentration in interval)	
9/10 –10/10 or 9+/10	**91**
8/10 – 9/10	89
8/10 – 10/10	81
7/10 – 9/10	79
7/10 – 8 /10	78
6/10 – 8/10	68
6/10 – 7/10	67
5/10 – 7/10	57
5/10 – 6/10	56
4/10 – 6/10	46
4/10 – 5/10	45

3/10 – 5/10	35
3/10 – 4/10	34
2/10 – 4/10	24
2/10 – 3/10	23
1/10 – 3/10	13
1/10 – 2/10	12
Unknown	99

Note: When AV, AK, AM and AT are used, the total of the concentrations represented by the values for AV, AK, AM and AT must sum to the concentration represented by the value for CA.

Table 4.2 Thickness of ice or stage of development codes for variable identifiers SA, SB, SC, CN, and CD.

Stage of Development	Thickness	Code Figure
Ice Free		00
Brash Ice	**Given by AV, AK, AM, AT in Table 3.3**	**70**
No Stage of Development		80
New Ice		81
Nilas, Ice Rind	< 10 cm	82
Young Ice	10 - 30 cm	83
Grey Ice	10 - 15 cm	84
Grey - White Ice	15 - 30 cm	85
First Year Ice	30 - 200 cm	86
Thin First Year Ice	30 - 70 cm	87
Thin First Year Stage 1	30 - 50 cm	88
Thin First Year Stage 2	50 - 70 cm	89
For Later Use		90
Medium First Year Ice	70 - 120 cm	91
For Later Use		92
Thick First Year Ice	> 120 cm	93
For Later Use		94
Old Ice		95
Second Year Ice		96
Multi-Year Ice		97
Glacier Ice		98
Undetermined/Unknown		99

Table 4.3 Form of ice codes for variable identifiers FA, FB, FC, and CF.

Form	Size/Concentration	Code Figure
Pancake Ice	30 cm - 3 m	00
Shuga/Small Ice Cake, Brash Ice	< 2 m across	01
Ice Cake	< 20 m across	02
Small Floe	20 m - 100 m across	03
Medium Floe	100 m - 500 m across	04
Big Floe	500 m - 2 km across	05
Vast Floe	2 km - 10 km across	06
Giant Floe	> 10 km across	07
Fast Ice		08
Growlers, Floebergs or Floebiits		09
Icebergs		10
Strips and Patches	concentrations 1/10	11
Strips and Patches	concentrations 2/10	12

Strips and Patches	concentrations 3/10	13
Strips and Patches	concentrations 4/10	14
Strips and Patches	concentrations 5/10	15
Strips and Patches	concentrations 6/10	16
Strips and Patches	concentrations 7/10	17
Strips and Patches	concentrations 8/10	18
Strips and Patches	concentrations 9/10	19
Strips and Patches	concentrations 10/10	20
Level Ice		21
Strips and Patches	**Concentrations 9+/10**	**91**
Undetermined/Unknown		99

Annex XII

RECOMMENDATIONS FOR CHANGES TO ICE CODING AND MAPPING STANDARDS

During the course of the "ECDIS Ice Objects Catalogue Revision Project" carried out by the Canadian Ice Service (CIS), it became clear that full harmonization of the Ice Objects Catalogue with accepted international ice coding and mapping standards was not possible without revisions to the WMO, SIGRID-3 and Iceberg reporting standards themselves. That is because there are presently inconsistencies within and among the standards that make it impossible for the Ice Object Catalogue to be in full harmonization.

Because of this harmonization exercise, the following changes to international ice reporting, coding, and mapping standards are recommended:

1. Ice Object LACICE: WMO Symbology does not support Lake Ice Stages of Development. The values for this attribute are taken from the "Canadian Ice Service MANICE, 9th edition, June 2005". Recommend that ETSI Members discuss adding support for Lake Ice to WMO standards.

2. Ice Object BRGARE: Since a "Floeberg" is, by WMO definition, composed of sea ice and not glacial ice, floebergs have been excluded from the expected inputs of "Iceberg Area". Floebergs are not included in the associated IIP or CIS area product. Recommend informal discussions among ETSI Members to resolve this discrepancy.

3. Ice Object ICEBRG: Presently, Very Large Tabular Antarctic icebergs are not well supported by WMO Symbology. Recommend that any future changes to WMO Symbology in this regard should be reflected in subsequent changes to the Ice Objects Catalogue in order to ensure compatibility.

4. Ice Object ICEKEL: Note that there is no established WMO symbol to depict "Keel/Bummock". It is recommended that the WMO symbol for Ridges/Hummocks be inverted, so the straight line representing the water surface is at the top - and used for Keels/Bummocks. This discrepancy can be corrected in a future revised edition of the referenced WMO documents.

5. Ice Object ICEFRA: Note that there is no established WMO symbol to depict "Fracture". It is recommended that the symbol for "Crack" be used in the interim, until this discrepancy is corrected in a future revised edition of the referenced WMO documents.

6. Attribute ICEACT: The codes above are not fully in alignment with JCOMM SIGRID-3 codes. In order to achieve full alignment, it is recommended to update the JCOMM SIGRID-3 Code Table 4.1 as follows:
    - in order to avoid a "00" code value, change the code of "Ice Free" to "01"; "open water" to "02" and Bergy Water" to "03";
    - at present, neither code set supports the Canadian use of "9+". Recommended to amend the concentration definition of code "91" to include both "9/10-10/10 and "9+/10" in both code sets;
    - change the definition of code value "99" from "unknown" to "unknown/undetermined".

7. Attribute ICEAPC: The codes above are not fully in alignment with JCOMM SIGRID-3 codes. In order to achieve full alignment, it is recommended to update the JCOMM SIGRID-3 Table 4.1 as follows:
    - in order to avoid a "00" code value, change the code of "Ice Free" to "01"; "open water" to "02" and Bergy Water" to "03";
    - at present, neither code set supports the Canadian use of "9+". Recommended to amend the concentration definition of code "91" to include both "9/10-10/10 and

"9+/10" in both code sets;
- change the definition of code value "99" from "unknown" to "unknown/undetermined".

8. Attribute ICESOD: The codes above are not fully in alignment with JCOMM SIGRID-3 codes. In order to achieve full alignment, it is recommended to update the JCOMM SIGRID-3 Code Table 4.2 as follows:
    - in order to avoid a "00" code value, change the code of "ice free" to "01";
    - in order to remove ambiguities in range values, add "<" and ">" symbols as appropriate to conform to the definitions above;
    - "Brash" is not supported. Amendments to SIGRID-3 Code Proposal 2007-4 will be tabled at an upcoming ETSI meeting in Geneva. If this is accepted, recommend reviewing the above codes to ensure full alignment.

9. Attribute ICELSO: "Brash" is not supported. Amendments to SIGRID-3 Code Proposal 2007-4 will be tabled at an upcoming ETSI meting in Geneva. If this is accepted, recommend reviewing the above codes to ensure full alignment.

10. Attribute ICEFLZ: The optional use predominant (Fp) and secondary (Fs) floe size, independent from Sa, Sb, and Sc, creates coding and interpretation confusion for the user. In this context, it is recommended to review and possibly update the definitions for "Form of Ice" presently contained in: "WMO International System of Sea Ice Symbols", Suppl. No. 4, 1970.

11. Attribute ICEFLZ: The codes above are not fully in alignment with JCOMM SIGRID-3 codes. In order to achieve full alignment, it is recommended to update the JCOMM SIGRID-3 Code Table 4.3 as follows:
    - in order to avoid a "00" code value, change the code of "Pancake ice" to "01", and sequence up all the codes by 1 numeral, up to and including "Icebergs";
    - in order to remove ambiguities in range values, add "<" and ">" symbols as appropriate to conform to the definitions above.

12. Attribute ICEMLT: The codes above are not fully in alignment with JCOMM SIGRID-3 codes. In order to achieve full alignment, it is recommended to update the JCOMM SIGRID-3 codes, Table 4.11 as follows:
    - in order to avoid a "00" code value, change the code of "ice free" to "01";
    - an additional code for code "02": "many puddles" should be added.

13. Attribute ICESPC: At present, neither the code set for this attribute nor the JCOMM SIGRID-3 Code Table 4.3 supports the Canadian use of "9+". Recommended to add code "91" to SIGRID-3 Code Table 4.3. The form would be "Strips and Patches". The Size/Concentration would be "9+/10".

14. Attribute ICEBSZ: Expected inputs for this Attribute are based upon Iceberg Coding Tables 4.2 from "MANICE – Manual of Standards Procedures for Observing and Reporting Ice Conditions", 8th Edition, 1984, Canadian Ice Service (CIS), Ottawa, Canada. At present, there are minor discrepancies between the International Ice Patrol (IIP) and the CIS published height and length definitions for several iceberg categories. This is presently being addressed by the two organizations, and any subsequent changes to the CIS definitions should be reflected in the ICEBSZ code table.

15. Attribute ICEBSZ: At present, this attribute does not adequately support Very Large Tabular Antarctic icebergs. Any future changes to WMO symbology and/or code tables in this regard should be reflected in subsequent changes to this ice attribute in order to ensure compatibility.

16. Attributes ICEKCN, ICEKFQ, ICEKMD, ICEKXD: These attributes and their expected inputs

are a copied equivalent to that used for ice ridge concentration, which are supported by “WMO Sea-Ice Nomenclature”, Suppl. No. 5, 1989. WMO. It is recommended that a WMO symbol for “Keel/Bummock” be defined along with the appropriate attributes.

17. Other regional ice chart issues exist that require ETSI discussion, harmonization with international ice standards, and eventual resolution:

    - Baltic ice charts use the term “Windrow” along with the WMO symbol for “Jammed Brash Barrier”. This should be resolved in WMO Nomenclature and Symbology;
    - Isotherms of water temperatures appear on Finnish and Swedish ice charts. These are not presently supported by IHO S-57 Objects or by WMO/SIGRID-3 standards;
    - German ice charts add an “air temperature” numeric to their charts. These are not presently supported by the Ice Objects Catalogue;
    - German ice charts use a range for depicting the thickness of ice. The WMO Symbol for ice thickness presently allows only a single numeric for thickness (measured or estimated).

Annex XIII

VISION AND STRATEGY FOR THE STANDARDS FOR SEA ICE CODING AND PRESENTATIONS

Background

1. Two technical documents, the *SIGRID-3: A Vector Archive Format for Sea Ice Charts* (WMO/TD No. 1214) and the *Ice Chart Colour Code Standard* (WMO/TD No. 1215), both finalized and published in 2004 as JCOMM Technical Reports, now extend to the *WMO Sea-Ice Nomenclature* by providing standards for ice chart coding, operational and delayed-mode presentation in additional to the existing *SIGRID* (WMO, 1989) and *SIGRID-2* (WMO, 1994) formats primarily intended to support sea ice climatology. In the latter years, extensions to the S-57 format for the ENC (also discussed under Agenda Item 2.6.1) were developed on the level of several national ice services to support presentation of sea ice parameters on the bridge.

2. Further discussions regarding the formats, were carried out during the Sixth Session of the International Ice Chart Working Group (IICWG-XI, Ottawa, Canada, 24-28 October 2005) technical session and the ETSI *ad-hoc* session on Interoperable Data Formats. The primary goal of the session was to "clearly define the objective of developing common data base scheme i.e. to discuss the seamless customer support versus ice service interoperability" with a help of a technical workshop on the issue. The Agenda of the technical Workshop included thematic reports and items as follow:

- *Ice in Electronic Chart Systems* (Tim Evangelatos & Doug O'Brien - Canadian experts on ECDIS and IHO under contract to the Canadian Hydrographic Service);
- *Advances in Sea Ice Presentation for ECDIS* (Yuri Scherbakov – AARI expert on ECDIS);
- *Interoperable Data Formats in Production Systems* (Dave Denault – CIS expert on Geographic Information Systems and Brian Scarlett – ESRI contractor at CIS);
- *Plenary discussion;*
- *Breakout Groups*: 1.) Operational Ice Information Producers, and 2) Standards Enforcers; and
- *Workshop Summary.*

3. Participants of the Operational Ice Information Producers Breakout Group included the: German Ice Service (BSH), Danish Met Institute, Iceland Met Service, Qinetiq Corporation, Norwegian Met Service, USA National Ice Center, Finnish Ice Service, Canadian Coast Guard and the GIS Technical Experts and Rapporteurs. Participants of the Standards Enforcers Breakout Group included the IDON Corporation, Terraquaeous Corporation, AARI, Canadian Ice Service, Qinetiq Corporation, NOAA and the WMO Secretariat.

4. Agreements reached from the entire technical session were as follows:

- To develop standards for incorporating ice information into Electronic Chart Systems should be a role that the JCOMM ETSI should play in conjunction with the IICWG as its Technical Advisory body, and that now would be an appropriate time to be doing this;
- we are not at the bleeding edge, but are close enough to it to be effective;
- It may be a lot of work for which resources (people) are not readily available, but these factors may never change;
- The content from the carrier should be separate, as carrier issues are already resolved by others related bodies;
- It should be noted that the content model is an essential first step for interoperability between the ice services and users;
- A definition regarding how ice information is described should be more clearly defined by all respective ice services;
- IHO Ice Register (Ice Object Catalogue) should be the logical starting point for a

content model;
- The Register was developed under the ISO standards and now has a formal “home”;
- The ICE Register should reference and be completely compatible with the *WMO Sea-Ice Nomenclature*;
- The SIGRID-3 should be merged into the Register;
- The ETSI should be the “owner” of the Register and be responsible for the “control body”;
- The *Ice Object Catalogue* must incorporate standards for display of images;
- That it is not necessary for the ETSI to define the portrayal (presentation) standards, but it would be useful to define a default set;
- The current existing WMO Symbology and Colour Standards would suffice for the time being.

5. Proposed Action Plan for the next years and longer terms included:

Action plan – next years:

- Standardize the SIGRID-3 implementation among ice centers
  - ISO standard for metadata
  - Complete metadata definition for sea ice
  - Investigate relations with the MarineXML (JCOMM ETMDP)
- ISO standard for imagery
  - No need to define standards for imagery but must define what standards one shall employ at user-level
  - A possible solution is to follow the IHO standards
- Presentation content
  - Recommend default presentation in isolation
  - *WMO Nomenclature, Colour Standard for Ice Charts*

Action Plan – longer term:

- Encoding
  - Develop SIGRID-4 in alignment with ISO GML (ISO 19136)
    - S57 will serve in the interim to carry ice information in Electronic Ice Systems
- Web Services
  - Determine the level of standard web services required for interoperability among producers
    - Web Mapping Services
    - Web Feature Services
    - Web Coverage Services

Annex XIV

NEW PROPOSAL FOR THE MMSM QUESTIONNAIRE

APP/O/MSS-Q2

MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME QUESTIONNAIRE

To Masters, Deck Officers, Skippers, Sailors, icebreaking services and other marine users

In order to monitor the effectiveness of the weather and sea bulletins produced and transmitted by Meteorological Services, the World Meteorological Organization would appreciate your cooperation in completing the following questionnaire. The objective of this programme is to improve the level of meteorological support to all marine user communities.

Ship's Name & Call Sign	
Type of ship (SOLAS or non-SOLAS)	
or other marine user activity (specify)	
Activities (merchant, ferry, cruising, fishing, recreational, icebreaking)	
Country of registry	
Name of master	
Operational area(s)	
Voyage from	to
Date, time, position when the questionnaire completed	

Please complete the following questionnaire by placing a tick mark under the appropriate column heading and providing additional information or comments as appropriate.

		Good	Average	Poor	Issuing Met Service	Station
1	**Reception of GMDSS info. Please rate the quality of reception:** (should be filled at least by SOLAS vessels)					
A	via INMARSAT SafetyNET					
B	via Navtex (518 kHz)					
2	**Reception of other Safety information.** (This section should be filled at least by non-SOLAS vessels)					
A	via Navtex (490 or 4209.5 kHz)					
B	via HF Radio					
C	via VHF Radio					
D	via visual signals					
E	via e-mail					
F	via web interface					
3	**Storm and Gale warnings. Please rate the following:**					
A	Comprehension of warnings					

B	Accuracy of warnings					
C	Terminology used					
D	Usefulness (anticipation, parameters, thresholds…) Please comment in Section 9					

4	**Sea Ice and Icebergs Information (for mariners in areas with floating ice). Please rate the following:**					
A	Clarity of information					
B	Accuracy of information					
C	Timeliness					
D	Terminology used					

5	**Wave and Storm Surge Information. Please rate the following:**					
A	Clarity of information					
B	Accuracy of information					
C	Timeliness					
D	Terminology used					

6	**Weather and Sea bulletins. Please rate the following:**					
A	Comprehension of bulletins					
		Good	**Average**	**Poor**	**Issuing Met Service**	**LES/Navtex Station**
B	Accuracy of bulletins					
C	Are bulletins on time?					
D	Terminology used in bulletins?					
E	Usefulness (parameters,…) *Please comment in Section 9*					

7	**Graphic broadcasts (e.g. Facsimile). Please rate the following:**					
A	Are charts received on time?					
B	Accuracy of information on charts					
C	Comprehension of symbols					
D	Quality of reception					
E	Is this a useful service?	**Yes** ☐ **No** ☐			If Yes, please comment in Section 9 on how the service could be improved.	

8	**Please visit (http://weather.gmdss.org). Comment in Section 9 on the quality of the GMDSS website.**

9	**Land Earth Stations (LES) Inmarsat** (This section should be filled only by Voluntary Observing Ships)				
A	Rate your success in contacting a LES to send your weather observation messages (OBs)				LES: _____

B	Do you experience delays in sending your OBs?	**Yes** ☐ **No** ☐	
C	Do any LES refuse to accept your OBs?	**Yes** ☐	LES if Yes: _____

10	**Other related problems (if any) – include ship's position, date and time.**

11	**Suggested improvements**

-

Master's signature

Use additional sheets if necessary.

For each case, complete one questionnaire

After completion, please return to the following address:

Ocean Affairs Division
Applications Programme Department
World Meteorological Organization
7 bis, avenue de la Paix
Case postale No.2300
CH-1211 Geneva 2
Switzerland
Telefax: +41 22 730 8128
E-mail: oca@wmo.int

Annex XV

PROGRESS REPORT ON PREPARATION OF THE INTERNATIONAL POLAR YEAR 2007-2008

1. The IPY (2007-2008) initiated by the WMO and ICSU will be an intensive and internationally coordinated campaign of high quality research activities and observations in Polar Regions during the periods of 1 March 2007 to 1 March 2009. In April 2006, the WMO/ICSU Joint Committee (JC) for IPY had completed an evaluation of 452 full project proposals (received from nations up to 31 January 2006) for scientific or educational significance, consistency with the IPY themes, evidence of international collaboration, and evidence that activities proposed would contribute to an IPY legacy. Of these 452 project proposals, the JC endorsed 228 (170 scientific project proposals, one for data and information services, and 56 proposals for education and outreach).

2. Information on the IPY projects can be located at the following web address: www.ipy.org. Of the 170 scientific project proposals, over 100 scientific projects of these are focused on comprehensive studies of the atmosphere, ocean, cryosphere and hydrological cycle, ecosystems in Polar Regions, as well as on the study of climate change impact on socio-economic and living conditions of local population.

3. The Intercommission Task Group (ITG) on the IPY (Chaired by Professor Qin Dahe (China)) had played an active role in the process of preparation of full project proposals for the IPY. The ITG activities during 2006 were found to be going in two directions. The first direction aimed to assist technical commissions in determining of their role at the IPY implementation stage within their areas of responsibility. The second was to contribute to the development and coordination of concrete IPY projects. With regards the first direction, the sessions of the CAS, CAeM, CBS, and CIMO, which took place in 2006, have endorsed concrete proposals for the activities during the IPY. Similar actions weretaken by the sessions of the CCl and JCOMM in 2005.

4. With respect to the second approach, there are several examples of active involvement ITG Members in preparation and coordination of the IPY projects. The IPY projects dedicated to studies of atmosphere, ocean, hydrological cycle and cryosphere in polar regions such as the IPY-THORPEX, COMPASS, IASOA, IAOOS, CASO, ARCTIC-HYDRA, CRYOS and others have been, to large extent, developed thanks to leading role in their planning and coordination provided by the following ITG Members: Dr O. Hov (CAS), Dr S. Pendlebury and Dr I. Frolov (JCOMM), Dr A. Snorrason (CHy), and Dr B. Goodison (WCRP/CliC). The important contribution of the ITG Members, as well as the Presidents of some technical commissions to the overall coordination of IPY, through the participation in the established mechanisms such as IPY Joint Committee (Dr Beland, Professor Qin), Sub-Committee on Observations (Dr Snorrason and Dr Dexter), and Sub-Committee on Data Policy and Management (Dr Sterin), was well recognized by polar scientific community.

5. Proponents of all endorsed projects have applied for funding from national and international funding agencies. In July 2006, the letter signed by the WMO Secretary-General and Executive Director of the ICSU was sent to Ministers of Foreign Affairs, and of Science and Technology of all WMO and ICSU Members. The two Organizations strongly urge governments of their Members to provide financial support for the IPY implementation, in the context of their respective national research budgets, in order to allow scientists to contribute to this extraordinary international scientific collaborative effort. The reaction received was positive. Many nations (such as Brazil, Canada, China, France, Italy, Norway, Russian Federation, Netherlands, UK and other respective nations) have developed new funding to support these innovative and coordinated studies. According to information collected by the IPY International Programme Office, as of 15 January 2007 (see: www.ipy.dk), 76 of 228 endorsed projects received substantial funding, 65 projects received partial funding, 5 projects are pending funding, and information has not been received from 81 projects. One project has been withdrawn.

6. The IPY Sub-Committee on Observations (SCOBS) with participation of ITG Members had prepared the assessments of the observing systems contained within the 156 IPY scientific projects. The assessment covered all projects within the domains of Atmosphere, Ocean, Ice, Land, People, and Earth & Space (partially). The assessment results were very informative, in particular, with respect to observational data requirements, data sources, technology/institutional gaps, data management requirements and potential legacy of observing systems planned to be established during the IPY. The assessments are used to large extend to assist project in filling the gaps.

7. One of the important tasks of the IPY SCOBS is to establish an open means of communication between IPY project coordinators and Space Agencies to assist the IPY projects to meet the requirements for satellite data, products, and services. To carry out this dialog, the Space Task Group (STG) for the IPY, comprised of nominated representatives of Space Agencies, was recently established within the SCOBS. The STG was tasked with reviewing the IPY space data requirements and making data acquisition plans, processing, archiving, and the distribution of recommendations regarding contributions of the Space Agencies. Results from the first meeting (WMO Headquarters, Geneva, Switzerland, 17-19 January 2007), indicated that the STG is well on the way to developing the concept of an effective space component of the observing system for the polar regions during the IPY. This would deliver a series of “firsts”, to include:

- Pole to coast multi-frequency InSAR measurements of ice-sheet surface velocity;
- Repeat fine-resolution SAR mapping of the entire Southern Ocean sea-ice cover for sea ice motion;
- One complete high-resolution visible and thermal IR (Vis/IR) snapshot of circumpolar permafrost; and
- Pan-Arctic high and moderate-resolution Vis/IR snapshots of freshwater (lake and river) freeze-up and break-up.

8. In terms of how this will information will be delivered, the Agencies have introduced the concept of IPY data portfolios. Each Agency will determine what data will be made available to the IPY scientists as part of its portfolio. The intention of this project is to provide open and easy access to these portfolios for scientific use.

9. The content of the portfolios will evolve through the STG coordination of planning, acquisition, downlink and processing satellite data during the IPY and beyond, as a legacy. The STG noted with appreciation, the presentation of Representative of Canadian Space Agency (who), who had provided the meeting with information on IPY PolarView Services and described the planned Web Portal for one-stop shopping for operational sea-ice products derived from ice services.

10. Another important task of the SCOBS is to establish through JC, a dialog with the CBS, CAS, CHy, JCOMM, GEO, CGOS, GOOS, WCRP, as well with the Arctic Council and ATCM to secure provision for the legacy of observing systems established or rehabilitated during the IPY. The results of the SCOBS assessment, in particular related to a legacy of IPY observing systems, are of potential use by international programmes and organizations. There is an idea proposed by the GEO Secretariat to organize an IPY Legacy Workshop in 2008, when detailed information on the real implementation of the IPY projects in the field during the first year of IPY would be available. This should provide information on the status of the observing systems that have been actually established and operated during the first annual period of the IPY.

11. The IPY Sub-Committee on Data Policy and Management (SCDPM) has finalized a Policy on IPY data management (www.ipy.org), and is currently working on developing an IPY Data and Information Service (DIS), which will be based on existing systems, and will follow the successful example of the Data Information Units developed by the World Ocean Circulation Experiment (WOCE). The Joint Committee of the SCOBS and SCDPM (Beijing, China, October 2006), has started to develop a strategy for the overall data flow within the IPY. The important issue in this connection would be an establishment of an “InfoBase’’ that should contain the

following information: data sources both the IPY and non-IPY; templates for data and metadata, where data to submit to; outcomes of survey on data management requirements and plans carried out by the SCDPM and IPO among Project Coordinators.

12. The Joint Committee produced a technical document entitled, "The scope of science for International Polar Year 2007-2008" (WMO/TD-No. 1364, February 2007), that provided scientific basis and organizational structure for the IPY. The IPY was officially launched on 1 March 2007, in Palais de la Decouverte, Paris, France, in the presence of the Executive Heads of WMO, ICSU and Members of the JC. At its Fifth Session, the JC (Paris, France, from 28 February to 2 March 2007) agreed to begin planning an IPY Science Conference to be tentatively scheduled for autumn 2010, and accepted the kind offer of Norway to host the Conference in Oslo. The Science Conference is considered as a complimentary conference to many polar science meetings already scheduled or planned, and in particular, as a way to accelerate our progress on the interdisciplinary and integrating themes of the IPY.

13. Following the WMO Resolution 34 (Cg-XIV) and the recommendations of JCOMM-II, the Expert Team on Sea Ice (ETSI) agreed to support the International Polar Year 2007-2008 by: (i.) providing tailored information, including web pages dedicated to GDSIDB normals, ice records and national ice data, available on a timely basis, (ii.) encouraging national ice services to supply updates and historical documents and ice data from coastal stations to the Global Digital Sea Ice Data Bank (GDSIDB) centres, and (iii.) encouraging the ETSI Members to enhance sea ice observations and data archiving at the designated centres. In this context, the ETSI has been developing an Ice Information Portal, hosted by the PolarView project (supported by the ESA and European Commission with participation by the CSA (see: http://www.polarview.org). This issue is further developed under document 2.10(2).

14. At present, regular meteorological forecasts and warning for shipping under the GMDSS do not extend to polar regions, because of lack of data from these areas would make such information very unreliable, and also because of the lack of broadcast coverage by Inmarsat. In response to this issue, a joint IMO/IHO/WMO Correspondence Group on Maritime Safety Information Services was established to address this problem and other associated issues. This Correspondence Group includes representatives of all affected countries (Canada, Denmark, Iceland, Norway, Russian Federation, United Kingdom and USA) and other interested organizations (including the IMSO, Inmarsat and any other respective approved safety-service providers). The JCOMM Expert Team on Maritime Safety Services (ETMSS) is represented on this Group, and the work of this Group was summarized and reported at the Eleventh Session of the IMO Sub-committee on Radio Communications, Search, and Rescue (COMSAR-XI, London, United Kingdom, February 2007). This issue is further detailed under Agenda Item 2.6.2.

15. The coordination for the deployment of oceanographic and meteorological observing platforms in Polar Regions (e.g., ice buoys, ice tethered platforms and Ice Mass Balance buoys) was made possible through the IABP and WCRP-SCAR IPAB. The IPY development is being followed through these two DBCP Action Groups. Both the IABP and IPAB participants have made submissions to the IPY accordingly.

16. The Meeting invited to note this information and develop a plan of actions during the IPY implementation stage, as well as in the post-IPY era in provision of the efficient operations of the observational networks, of the sustainable exchange of the IPY data in real- and non-real time modes, and in security of a legacy of the IPY to include sea-ice observing systems and observational data sets.

Annex XVI

US ARCTIC BUOY PROGRAMME

1. The National Ice Center (NIC) and the University of Washington (UW) Polar Science Center (PSC) collaborate in the management of U.S. contributions to the International Arctic Buoy Programme (IABP) through the U.S. Interagency Arctic Buoy Program (USIABP). This program is the U.S. contribution to the broader International Arctic Buoy Program (IABP), established in 1991 as an action of the World Meteorological Organization (WMO)/Intergovernmental Oceanographic Commission (IOC) Data Buoy Cooperation Panel (DBCP).

2. This program has been the cornerstone of the International Arctic Observing System, with buoy data integrated into operational meteorological and oceanographic forecast and climate models, used to determine sea ice motion, and serving as the primary data source for validating new remotely-sensed products. Through the collective international effort, at any given time ~35 buoys are in the field. The USIABP is responsible for maintaining ~25% of the active drifting network, deploying a minimum of seven air dropped buoys and deploying at least one additional buoy by ship annually.

3. In 2006, the USIABP purchased 18 buoys: 3 Ice Mass Balance (IMB) buoys, 5 ICEXAIR air droppable meteorological buoys, and 10 Ice Beacon meteorological buoys in 2006. These were deployed using a combination of logistics coordinated with collaborators of the IABP. The USIABP also coordinated the Hercules C-130 deployment of a 12 ICEXAIR buoys by the U.S. Naval Oceanographic office (NAVO) via the White Trident Mission in August 2006.

4. The latest maps showing the locations of buoys purchased and deployed by the USIABP, as well as other IABP participants can be seen at: http://iabp.apl.washington.edu/owners.html, and: http://iabp.apl.washington.edu/logistics.html. The data from all USIABP buoys are released to the research and operational communities in near-real-time through the Global Telecommunications System. Research quality fields of ice motion, sea level pressure temperature, and surface air temperature are also analyzed and produced by the UW Applied Physics Laboratory (APL); these fields can be obtained from the IABP web server at: http://iabp.apl.washington.edu/.

Annex XVII

TERMS OF REFERENCE FOR THE CROSSCUTTING RAPPORTEUR ON SEA ICE MATTERS

Recognizing the importance of crosscutting issues related to maritime safety, sea ice climatology, sea ice observations, and sea ice data management in general, the crosscutting Rapporteur on sea ice matters shall liaise with the appropriate JCOMM and CBS panels in order to:

1. Act as focal point for ETSI within the JCOMM structure, in particular the OPA, DMPA and SPA.

2. Harmonize different ice coding tables and coding standards, in particular regarding SIGRID-3, IMMA and BUFR in collaboration with the DMPA TT on table-driven codes.

3. Investigate the interoperability of sea ice information systems, in particular ice charts, with the WMO information system and/or other ocean related data systems being developed.

4. Report back to ETSI.

Such liaison will primarily be through review of the documentation produced for meetings of the panels, with comments submitted through the WMO Secretariat.

The Rapporteur is appointed by the ETSI to work during its intersessional period.

Annex XVIII

WORKING PLAN FOR THE NEXT INTERSESSIONAL PERIOD
(decisions from ETSI-III/GDSIDB-XI)

Ref.	Action	By whom	When
2.1.4	Provide delegates to represent the ETSI on the IMMSC Scientific Steering Team	ETSI Members and Secretariat	ASAP
2.1.6	Provide content to the SPA website on ETSI sections	ETSI Chairperson and ETSI Members	Prior SCG-IV
2.1.8	Provide input to the SPA coordinator for consideration of ETSI requirements in the JCOMM Statement of Guidance	ETSI Chairperson	Mid-2007
2.2.2	Make available the electronic version of the WMO publications, in particular 558 and 471	WMO Secretariat	ASAP
2.5.7	Develop a selection of IICWG publications to be made available via the JCOMM SPA website	ETSI Members and IICWG representatives to ETSI	Prior ETSI-IV
2.5.9	Encourage the participation of countries from the South Hemisphere in ETSI activities	ETSI Chairperson and Secretariat	Continuing
2.6.1.2	Ensure that sea ice information is included in the proposed Resolution to the IMO on Met-Ocean services	ETSI Members to TT PMSI	Late 2008
2.6.2.3	Include references to potential occurrence of sea ice and links to ice services where appropriate based on the information provided in the WMO-No. 574	ETSI and ETMSS Chairpersons and Secretariat	Prior ETMSS-III
2.6.3.5	Submit the Ice Objects Catalogue to the IHO Registry of marine Information Objects	WMO Secretariat	ASAP
2.6.3.5	Develop the appropriate documents to effectively implement and maintain the Ice Objects Catalogue as an IHO Register as well as develop a testing scheme	Register Manager and TG ENCIO	Continuing
2.6.3.5	Contribute to the work Expert on Met-Ocean information in graphical form	TG ENCIO	Prior JCOMM-III
2.6.3.6	Present the result of the current ETSI session to the forthcoming HGMIO meeting	Mr John Falkingham (Canada)	May 2007
2.6.4.4	Provide a Number and publish the Ice Objects Catalogue as a WMO/TD Publication	WMO Secretariat	Late 2007
2.7.1.4	Manage the electronic version of the Sea Ice Nomenclature and its database	ETSI Chairperson	Continuing
2.7.1.4	Create a mirror of the Sea Ice Nomenclature database in the SPA website	ETSI Chairperson	Prior ETSI-IV
2.7.1.5	Make the necessary harmonization between the Sea Ice Nomenclature and the Ice Objects Catalogue	TG ENCIO	Prior ETSI-IV

Ref.	Action	By whom	When
2.7.1.6	Update the Sea Ice Nomenclature	ETSI Members with the coordination of the ETSI Chairperson	Late 2008
2.7.1.7	Provide illustrations to the ETSI Chairperson to be included in the Sea Ice Nomenclature	ETSI Members with the coordination of the ETSI Chairperson	Late 2008
2.7.2.1	Submit corrections in the WMO-No. 574 to the ETSI Chairperson and WMO Secretariat	ETSI Members	Continuing
2.7.2.1	Incorporate corrections in the electronic version of the WMO-No. 574 and make available on web the updated version	ETSI Chairperson and WMO Secretariat	Continuing
2.7.2.1	Inform the National Ice Services and sea ice community on the availability of the updated electronic version of the WMO-No. 574	WMO Secretariat	Continuing
2.7.2.1	Update the hardcopy version of the WMO-No. 574 in an annual basis	WMO Secretariat	Continuing
2.7.2.2	Make the appropriate arrangements to start each section of the WMO-No. 574 for a National Ice Service and include additional annexes	WMO Secretariat	ASAP
2.7.2.3	Establish a mechanism to publish officially the electronic versions of the WMO technical publications	WMO Secretariat	ASAP
2.7.3.2	Review the abbreviations list for NAVTEX messages related to sea ice	Mr Amund Lindberg (Sweden)	Prior ETMSS-III
2.7.4.2	Define the mandatory sea ice products to be included in WMO Guides and Manuals	ETSI Members to the TT PMSI	Prior ETMSS-III
2.7.4.6	Prepare a short report on the transmission of MSI via radio facsimile and submit it to the WMO Secretariat	ETSI Chairperson	Late 2007
2.7.4.6	Update the WMO-No. 9, Volume D based on the report on the transmission of MSI via radio facsimile prepared by the ETSI Chairperson	WMO Secretariat	Early 2008
2.8.1.1	Incorporate the proposed amendments in the electronic version of the SIGRID-3 Code and harmonize the changes with the WMO Nomenclature, supplement on symbology	ETSI Chairperson	Late 2007
2.8.1.1	Inform all relevant bodies about the amendments in SIGRID-3 Code	WMO Secretariat	Early 2008
2.8.1.2	Discuss additional recommendations for changes to ice coding and mapping standards	ETSI Members	Prior JCOMM-III
2.8.1.2	Coordinate the discussion of additional recommendations for changes to ice coding and mapping standards	Mr John Falkingham (Canada)	Continuing
2.8.1.2	Make available in English, French, Russian and Spanish the to ice coding and mapping standards definitions	ETSI Members and Secretariat	Prior JCOMM-III
2.8.2.2	Ensure that ETSI standards are compatible with the requirements of the JCOMM DMPA strategy	ETSI Members	Continuing

Ref.	Action	By whom	When
2.9.1.5	Prepare a SOG for sea ice applications	TT SIR	Mid 2007
2.9.1.5	Provide examples of the JCOMM SOG and requirements for the WMO/CEOS database	WMO Secretariat	ASAP
2.9.2.3	Provide contact details from potential users, in particular the icebreaking services, to WMO Secretariat	ETSI Members	Late 2007
2.9.2.3	Contact the Antarctic Treaty Secretariat to request to circulate the MMSM questionnaire to all ships sailing in the Antarctic region	Secretariat and Mr Manual Picasso (Argentina)	Late 2007
2.9.2.3	Disseminate the MMSM questionnaire through the radio-fax services provided by BHS Deutscher Wettwetterdienst RMC	Secretariat and Dr Jürgen Holfort (Germany)	Late 2007
2.9.2.3	Develop an on-line questionnaire for the MMSM	SPA Coordinator	Late 2007
2.10.2	Provide contributions to IPY	ETSI Members and GDSIDB Co-chairpersons	Ongoing
2.10.6	Convey to Polar View that Dr Vasily Smolyanitsky (Russian Federation), Mr John Falkingham (Canada) and Mr Jonathan Shanklin (United Kingdom) are the content advisers for the Ice Portal	Mr John Falkingham (Canada)	ASAP
2.11.2.3	Investigate the feasibility of using existing training material to create a Bilko lesson	Mr John Falkingham and Ms Marie-France Gauthier (Canada)	ASAP
2.11.2.3	Explore the feasibility of preparing a Bilko lesson on sea ice climatology	GCOS SST&SI Working Group	ASAP
2.11.2.3	Examine the possibility of preparing a Bilko lesson on sea ice climatology	GDSIDB Co-Chairperson (USA)	ASAP
3.1.8	Provide new contributions to the GDSIDB Project	ETSI Members	Continuing
3.1.8	Include new contributions to the GDSIDB Project in the database	ETSI Chairperson	Continuing
3.1.8 and 3.6.1	Assist the GDSIDB Co-chairpersons in obtaining data from China and Iceland to the GDSIDB Project	GDSIDB Co-Chairpersons and Secretariat	Continuing
3.1.9	Undertake technical actions to make more web-visibility all datasets archived within the GDSIDB project	GDSIDB Co-Chairpersons	Continuing
3.3.4	Make the necessary arrangements to convene the “Ice data Analysis and Assimilation Workshop” in Germany between April to October 2008	Secretariat and Dr Jürgen Holfort (Germany)	Prior Mid 2008

Ref.	Action	By whom	When
3.3.4	Develop detailed proposals for the “Ice data Analysis and Assimilation Workshop” agenda	ETSI Chairperson, and representatives of the GCOS SST&SI and IICWG to ETSI	Late 2007
3.3.8	Participate in the TT-MOCS	ETSI Chairperson	Ongoing
3.5.3.2	GDSIDB consider providing a Northern Hemispheric overview of ice conditions for each month of 2004	GDSIDB Co-chairpersons	Late 2007
3.5.3.4	Review the expected scenarios for the years 2020 and 2050 for plausibility	ETSI Members	When requested by Mr John Falkingham (Canada)
3.5.3.5	Review of material prepared by other bodies and the AMSA report	ETSI Members	Early 2008
3.5.3.5	Circulate material prepared by other bodies and the AMSA report	Mr John Falkingham (Canada)	Late 2007
4.4	Provide the appropriate support to continuing implementation of the USIABP	Mr Paul Seymour (USA), ETSI Chairperson and Secretariat	Continuing
5.1	Make the appropriate arrangements, including notify the Team, for convening the following ETSI and GDSIDB sessions in Norway or United Kingdom, between April to May 2009	ETSI Chairperson and Secretariat	Early 2008
6.2	Make the necessary arrangements to award a Certificate of Recognition to Mr John Falkingham (Canada) for his outstanding services	Secretariat	Ongoing

Annex XIX

GCOS SST&SEA ICE WORKING GROUP ACTIVITIES ON SEA ICE

1 Introduction

The GCOS SST & Sea Ice (SI) Working Group is tasked to monitor, recommend, and implement improvements in the homogeneity of Sea Surface Temperature (SST) and Sea Ice Time Series. The Working Group is composed of a main group working on both the SST and Sea Ice and a Sub-group working specifically with Sea Ice issues. The present document concentrates on activities of the sea ice group, intended to define the overall direction and organisation of the group's activities. This document is based on the Working Group's Terms of Reference (ToR) and the outcome of the First Meeting on Sea Ice (ETSI, Boulder, Colorado, USA, March 2006) and input from other relevant groups.

2 Working Group Terms of Reference

These Terms of Reference (ToR) define the core activities of the SST&SI Working Group, and are as follows:

1. To record and evaluate the differences among historical and near real-time SST and SST/SI analyses:
    a. Identify a standard data set for the intercomparisons of different products (e.g., COADS [*for SST*]);
    b. Select several standard difference products as a minimum comparison set (i.e., define regions and time periods; compute biases, standard deviations, and RMS differences);
    c. Oversee standards for Intercomparison.
2. To identify the sources of differences in the analyses;
3. On the basis of comparison of those differences, with the expected climate signals in the SST patterns, to recommend actions needed to ensure the quality and consistency of the SST and SST/SI analyses;
4. To establish criteria to be satisfied by the SST and SST/SI analyses to ensure the quality and consistency required by the Global Climate Observing System (GCOS);
5. Liaise with all relevant bodies, as appropriate;
6. To report annually to the AOPC and OOPC on progress and recommendations.

The focus with regard to sea ice is the creation of homogeneous multi-decadal data sets of sea ice concentration with quantified uncertainties and intercomparison is seen as an appropriate tool to help achieve these objectives. It should be noted how, from point 4, the GCOS Climate Monitoring Principles (GCMP) provide the baseline requirements to data sets [WMO, 2004]. This means that the analysis will also assess such aspects as overlap between the old and new systems, documentation of changes, etc. In addition, the building of a systematic intercomparison capability links directly to GCMP requirement for "a capacity to routinely assess the quality and homogeneity of data on extreme events".

The need to consider ice thickness is acknowledged from the perspective of its importance in monitoring and modelling the high latitude climate systems. However, an operational observing capability is in its infancy and the sparse coverage of existing measurements makes it difficult to evaluate in a systematic intercomparison framework. The recent IceSAT and the coming CryoSat-II missions should remedy this situation, and evaluations of uncertainties and compliance to climate monitoring principles will be required. The issue is being kept open within the Working Group to be considered and assessed at regular meetings.

3 Overview of approach

Intercomparison of sea ice estimates is not a new concept [e.g., Steffen et al., 1992; Comiso et al., 1997; Hanna and Bamber, 2001; Belchansky, et al., 2002; Agnew and Howell, 2003; Meier, 2005]. However, it has never been applied systematically, across both in-situ, ice charting, and satellite retrieval communities as it is intended here. Similarly, the theoretical concepts for deriving error estimates in sea ice analyses are established, but consistent standards are lacking and current operational sea ice analyses rarely contain error estimates at all. A major initial task of the sea ice subgroup is therefore to create a foundation in terms of a Membership that represents these communities sufficiently to facilitate the necessary exchange of knowledge and results. This wide engagement across communities, on the other hand, represents the risk that the working group activities loose focus. The central objectives defined in the Terms of Reference are to record differences and promote error estimates in sea ice concentration data sets. It is essential in the founding process, to concentrate on these objectives and avoid excess divergence in the group's activities. Once these central activities are established, it is a natural next step to consider deeper relations with groups of algorithm and sea ice analysis providers to determine the cause of differences and to improve algorithms and products.

The sea ice observations that will be taken into account belong to the following categories:

1. Sea ice concentration analyses from passive microwave observations, which are mostly available as daily gridded data sets. Such data sets extend back to 1972 with some gaps in the late seventies.
2. Ice charts, available in digital vector format and/or as gridded compilation data sets. Ice charts are a synthesis of observations from sources including ship and coastal observations, aerial reconnaissance and satellite data.
3. Field observations, mainly from ships. These observations are available as direct observations as well as compilations in a variety of formats and from numerous sources.
4. High-level multi-input SST & Sea Ice analyses, such as HadISST [Rayner, et al., 2003], ERSST [Smith & Reynolds, 2004], and OISST [Reynolds, et al., 2002] analyses. These datasets synthesize information from the above sources to achieve long-term homogeneous records. The sea ice fields are mainly used to simulate the SST.

The observations above have widely differing spatial and temporal characteristics, based on techniques ranging from manual/subjective assessment to inversion of satellite observed radiances. No single observation type offers an optimal combination of detail and temporal/historical coverage. Therefore, the production of a long time series requires the combination of datasets across categories, and in turn a good understanding of their differences and uncertainties. However, even within each category, sources of inconsistencies exist that must be recorded and analyzed to fully understand the differences between categories. Such differences are, for example, the increase in detail in ice charts over time or, for satellite data, instrument drift, inter-sensor/inter-satellite differences and geophysical crosstalk (changes in for example atmospheric or surface properties that mimic ice concentration changes). Yet, even without full understanding of errors in the fundamental data sets, examination of differences between high-level analyses (category 4), is useful to analyze the effects of assumptions in analysis procedures and to better understand the propagation of errors in the analysis.

Error estimates are lacking in practically all the fundamental sea ice data sets available today. It is therefore a priority to develop and standardize methods to compute consistent and comparable error estimates. In the short-term, it is particularly important for passive microwave and ice chart data sets as the meaningful combination and assessment of these data in higher-level products and studies requires realistic estimates of uncertainty. Intercomparison in this context is a useful way to evaluate the realism of the theoretical uncertainty estimates. The development of error estimates, like the analysis of differences, will naturally seek to include the input or feedback from algorithm developers and product providers.

4 Organisation

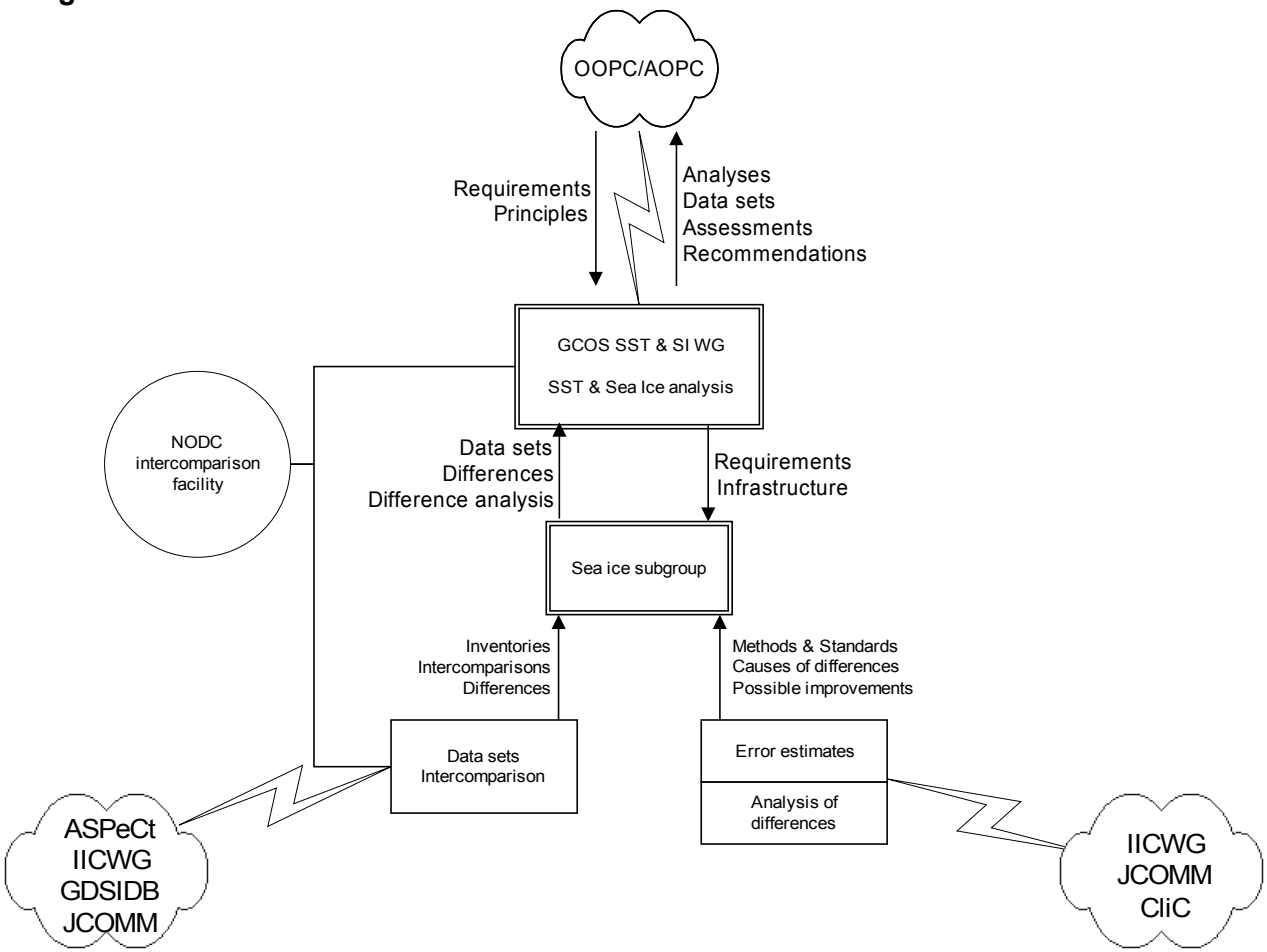


Figure 1 Proposed organisation and foreseen relationships outside the group.

The organisation of the Working Group's activities is sketched in Fig. 1. An important attribute of this organisation is the shared use of the NODC (National Oceanographic Data Center) intercomparison facility. This facility is best viewed as a data repository with a common data model that facilitates access and manipulation of a large number of gridded data sets of SST as well as sea ice. The data model is best suited to represent data sets with homogeneous increments in time and space, excluding some types of ice chart data and most field observations. While it is envisaged that this facility will be a central driver towards the initial routine production of Intercomparison, parallel activities must take place to cover the observations that fall outside the data model. The organisation further reflects the perceived commonalities of the error estimate and difference analysis activities. These both require deep theoretical knowledge of algorithms and procedures on which the sea ice records are based.

The sea ice subgroup has a mandate that responds to the needs of the larger SST&SI Working Group. Activities are primarily driven by the requirements of this Group. However, it is in the best interest of the Group to liaise and cooperate openly with other relevant groups and organisations that share similar goals and interests.

5 Proposed activities and schedule

In the following, a set of proposed activities is provided along with pertinent background information. At this stage, it is difficult to define a detailed schedule; however, the activities will be listed sequentially in order of priority. For some activities, funding is prerequisite and the first activity would therefore be to examine the possibilities and organise accordingly. Other activities depend on initiatives in external groups and are therefore fundamentally uncertain. The addition of sea ice data to the NODC intercomparison facility is a key activity and at least the initial actions are considered certain.

6 Data sets and Intercomparison

7 Gridded analyses

The activities on gridded data sets will leverage the frameworks developed in the larger SST&SI Working Group, in particular the SST intercomparison facility at the NODC. Initially, a limited selection of satellite and possibly gridded ice chart products will be ingested into the intercomparison server to facilitate the development of comparison standards and relative difference products. It is most likely efficient to form a set of derived products such as monthly sea ice extent and area.

Subsequently, a larger number of products will be included to reflect a representative cross-section of available products. It will be useful to consider the definition of one or more products that may serve as comparison standard. This is not a trivial task as, in general, all sea ice concentration observations are affected by error that is difficult to quantify. In contrast to the SST, which can be measured objectively with well-defined accuracies in the laboratory, no simple setup allows a similar concept for sea ice concentration. This leaves the examination of indirect relative evidence and be identified as a major point of discussion within the Group, as well as through cooperation with external groups and sources that may view the problem from other perspectives.

Some gridded fields, in particular those based on ice charts, exist that are too local and/or irregular in time to be imported into the NODC system. Still these data are applicable in local studies, and combined, they might sum up to represent a useful data set. Other institutions and initiatives such as the NSIDC and the CliC Data and Information Service already hold large searchable inventories of this type of data and it is not the intention to duplicate these facilities. However, it is simple to make these data sets available via a web page to ease the use of these data in subsequent analyses. A possible challenge that must be analysed in this respect, are the differences in grid geometries – it is thought that an overview of the products must be formed before this analysis can be made.

Activities

1. Initial activities:
    a. Define a limited set of products for initial ingestion into the NODC intercomparison facility;
    b. Define a set of initial intercomparison products;
    c. Make inventory of available and *useful* gridded sea ice analyses;
    d. Select a common grid and develop re-sampling methods; and
    e. Provide access to local and irregular data sets via web page.

2. Operational activities:
    a. Ingest additional sea ice products;
    b. Revise intercomparison products to support interpretation of differences.

8 Ice charts

Ice charts usually cover only a limited geographical area and, except for the global service at the NIC, where different authorities are in charge of different areas. The ice charts are produced mainly for navigational needs and areas less frequented by ships are therefore often mapped in less detail. The ice edge can be biased due to most navigators' preference for avoiding sea ice. Even if there are standards for many of the processes involved in making an ice chart, differences exist due to local practices, local customer requirements and, over time, improved mapping capabilities. Ice charts of different origin constitute the bulk of sea ice information prior to the satellite passive microwave era. They are typically stored in SIGRID formats. This format is available in 3 revisions, where the most recent (SIGRID-3) is a vector format while the preceding versions are defined on a fixed 0.25 degree resolution geographical grid. The Global Digital Sea

Ice Data Bank (GDSIDB) website at the Arctic and Antarctic Research Institute (http://www.aari.nw.ru/gdsidb) includes documentation of these formats. It is noted that ice charts are inherently vector based and the gridded SIGRID-1 and SIGRID-2 formats, therefore cannot represent the full information content of the original ice chart. There have been a few compilations into atlases or databases, such as the data sets by Walsh, EWG, ACSYS and GDSIDB.

Mainly due to uncertainties in best practice ice chart data manipulation and the complications of representing vector information in a raster based intercomparison framework, it was decided to keep ice chart information separate from the NODC data repository. However, several existing projects, such as the GDSIDB, ASPeCt, IICWG and CliC have developed systems and standards to deal with this type of observation. In the operational community, the JCOMM is in the process of defining activities to inter-calibrate and compare operational ice charts from the different ice charting agencies. Therefore, the most efficient way forward is to interact with these respective groups.

We are seeking active participation in the Working Group by the ice charting community by engaging the IICWG at its 2006 meeting in Helsinki. Activities of great importance are to identify and record changes in ice charting practice and data availability over time, as well as to promote consistent error estimates in climate data based on ice charts. In addition, planning of activities and coordination with the operational community should assure that intercomparison and calibration activities in the operational community may be leveraged. How the activities of the GDSIDB can be of use should be identified, as well as if and how the GCOS SST&SI Working Group may contribute to the GDSIDB objectives.

Activities

1. Initial activities:
    a. Determine possibilities of routine intercomparison of ice charts in liaison with the ice charting community (IICWG, JCOMM ETSI, etc.)
    b. Determine an initial set of possible intercomparison products and objectives;
    c. Analyse the compliance of available ice chart data sets with respect to GCMP's.

2. Operational activities:
    a. Take part in intercomparison activities and revise outputs to support interpretation of differences.

9 Field and ship observations

Ship observations are important as the only source of information before the period of systematic ice chart and satellite observations, and, in recent periods, as a possible reference. The objectives are mainly efficiency in terms of standards for data formats and access, as well as data rescue to extend the observations back in time. The ASPeCt Group has been successful in establishing a systematic recording of ship observations covering the entire Antarctic. In the Arctic, resources are numerous but tend to be more heterogeneous as coordination seems to have been lacking. Even though some of the ASPeCt procedures can probably not be transferred directly to Arctic conditions, the idea of adopting a standardized ice observation protocol and format is valuable. Measurements of sea ice thickness, until satellite remote sensing capability is developed, consist exclusively of field and ship observations. Therefore, it is natural that possible activities on ice thickness could arise from the discussions in this theme.

Activities

1. Analyse the availability of ship observations and their management with special regard to the GCMPs. Recommend a global standard for representation and management of ship observations.
2. Examine data gaps and provide recommendations for possible mitigation.

3. Examine the possible use of ship observations as a reference to determine absolute differences.

10 Error estimates and interpretation of differences

The activities on development of standards for error estimates in ice charts and daily gridded ice analyses share many aspects of the theoretical framework. However, the application calls for specialized knowledge of the processes and measurements on which the different sea ice observations depend. For now, this is taken as justification for dividing the activities in two themes rather than one.

11 Gridded satellite analyses

The interpretation of differences in gridded satellite analyses requires specialised knowledge of algorithms and radiative processes in the atmosphere as well as in the snow and sea ice. The activities will take input from intercomparison differences and make recommendations for new intercomparison experiments to help in making conclusions. Error models, as well as their inputs (e.g., uncertainties in tie points, atmospheric variability, etc.), should be assessed to propose a consistent standard that allows users to make more informed decisions and model the performance of their specific application. Both activities are highly related and most likely to require specific liaisons with the product developer/provider community. These activities, in particular, the development of error estimates, very likely require funding in order to achieve the momentum necessary to engage the developer community in an efficient manner.

Activities

1. Interpret intercomparison results in cooperation with product developers:
    a. Propose new intercomparison products;
    b. Recommend further investigation of selected differences and suggest methods.

2. Promote the inclusion of error information in sea ice products:
    a. Assess different error models and assumptions to recommend a consistent standard to aid in the user task of selecting a data set for a given application;
    b. Evaluate output of error models against intercomparison differences.

12 Ice charts

With ice charts, the recording of changes in analysis procedures, technical capabilities, and data availability at the analysis center is crucial to the interpretation of the derived climate data record, as well as to the estimation of errors. These activities could initially receive input from intercomparison of rasterised ice chart (e.g., such as the EWG and NIC atlas compilations available from the NSIDC) and satellite data sets to detect and quantify changes in error characteristics that may be due to changes in practice and capabilities. The NODC intercomparison facility could be a useful tool. Results from such analysis could form a valuable input to the estimation of error in ice chart analyses. We recall that regular intercomparison of ice charts of different origin should depend on activities in several existing projects. With the possible inception of routine ice chart intercomparisons, the activities could be further extended to analyse the results and provide recommendations, analogous to similar activities for gridded satellite analyses.

Activities

1. Record changes in analysis procedures, technical capabilities, and data availability. Initially, this could take input from intercomparison of rasterized ice chart time series with satellite data.

2. Promote error estimate frameworks in the analysis of ice charts:

a. Engage ice charting community via IICWG;
b. Determine possible organisation and funding for developing the actual framework.

Acronyms

ACSYS	Arctic Climate System Study	**JCOMM**	Joint WMO-IOC technical Commission on Oceanography and Marine Meteorology
AOPC	Atmospheric Observation Panel on Climate	**NIC**	National Ice Center
ASPeCt	Antarctic Sea ice Processes and Climate	**NOAA**	National Oceanic and Atmospheric Administration
CliC	Climate and Cryosphere	**NODC**	National Oceanographic Data Center
COADS	Comprehensive Ocean Atmosphere Data Set	**NSIDC**	National Snow and Ice Data Center
ETSI	Expert Team on Sea Ice	**OI**	Optimal Interpolation
EWG	Environmental Working Group	**OOPC**	Ocean Observation Panel on Climate
GCMP	GCOS Climate Monitoring Principles	**SI**	Sea Ice
GCOS	Global Climate Observing System	**SIGRID**	Sea Ice GRID
GDSIDB	Global Digital Sea Ice Data Bank	**SST**	Sea Surface Temperature
IICWG	International Ice Charting Working Group		

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Provisional intercomparison products

The NSIDC has a useful set of diagnostics products known as the sea ice index [Fetterer & Knowles, 2004; http://nsidc.org/data/seaice_index/]. Comparison of these quantities derived from different algorithms and observation types would certainly be interesting. In addition, the following products might be useful to use as comparisons:

- Linear trends on monthly mean values of sea ice extent and area results in a measure of the spread in estimated retreat or increase in the sea ice cover. Taking one product as reference can be useful.
- Maps of linear trend in concentration or sea ice persistence provide the spatial structure of differences in estimated sea ice trends.
- Per pixel range of concentration based on several products or maps of anomaly with respect to wintertime average ice concentration, provide spatial structure of single algorithm results.
- Maps of differences between algorithms on various time scales provide the spatial structure of inter-algorithm differences.

Annex XX

ARCTIC MARINE SHIPPING ASSESSMENT (AMSA) – TERMS OF REFERENCE

BACKGROUND

In November 2004, the Arctic Council released the *Arctic Climate Impact Assesment* (ACIA). One of the ten key findings of the ACIA was Finding #6:

> *Reduced sea ice is very likely to increase marine transport and access to resources.*

During the period of 2003-2004, the Arctic Council's Protection of the Arctic Marine Environment (PAME) Working Group developed the *Arctic Marine Strategic Plan* (AMSP). The AMSP follows a risk based assessment approach that addresses emerging issues, such as oil and gas and shipping activities. In an effort to provide direction to the Arctic Council, the AMSP outlined an initial list of strategic actions, including the need for an assessment of current and future Arctic shipping.

As a result of the ACIA and the AMSP, the Arctic Ministers at the fourth Arctic Council Meeting in Reykjavik (November 2004) issued the following Declaration:

> *Request PAME to conduct a comprehensive Arctic marine shipping assessment as outlined in AMSP under the guidance of Canada, Finland, and the United States as lead countries and in collaboration with the EPPR working group and other working groups of the Arctic Council and Permanent Participants as relevant.*

As a result of this action in Reykjavik, the PAME Working Group was tasked to conduct a comprehensive and integrated Arctic Marine Shipping Assessment (AMSA) at current and projected levels of shipping, taking into account the environmental, social, and economic impacts of shipping in Arctic waters. The PAME and the AMSA Team recognize a special responsibility to take into account the impacts of increased marine activity on Arctic residents, especially the Permanent Participants of the Arctic Council.

Definition of Arctic Shipping:

Arctic shipping covers a broad range of marine activities and ship types including bulk carriers, tankers, container ships, tug/barge combinations, fishing vessels, ferries, passenger vessels, cruise ships, offshore supply vessels, drilling rigs, research vessels, icebreakers (government and commercial), and all other marine vessels not mentioned.

FUNCTION

Canada, Finland, and the United States will serve as lead countries for the AMSA project. However, Denmark (Greenland and the Faroe Islands), Iceland, Norway, and Russia have significant Arctic marine interests and each will be critical contributors to the AMSA.

The lead country representatives will take responsibility for the business associated with the AMSA project, which includes defining guidelines, work plans, report chapters and monitoring risks, quality, and timelines.

Roles:

The Assessment requires a variety of players performing in various roles.

Role of the PAME Working Group: The PAME Working Group has the overall responsibility for the Assessment as organized under a 'Lead County' system. Canada, Finland and the United

States serve as joint-lead countries for the AMSA project; again, all the Arctic states are essential to the conduct of the Assessment.

The AMSA lead country representatives will engage the PAME at critical decision points. The PAME will ensure the project is progressing according to a work plan and chapter outline; provide guidance where necessary; and communicate progress and results of the Assessment back to the Senior Arctic Officials (SAO) and Ministers.

The Assessment is a significant project requiring substantial support and funding. The PAME does not normally raise funds for the conduct of the actual assessment work as this comes from the Arctic states by arranging for delivery of their data/information and support for experts participating in the project. The Working Group, through the PAME Secretariat, may however, raise funds for core activities associated with the assessment process, such as participation of indigenous peoples' representatives and report production (i.e., printing, graphical production, editing, etc.).

Role of the AMSA Leads: *The role of the lead country representatives is to have an overall coordination of the AMSA on behalf of PAME.*

- **U.S.A.:** Dr. Lawson Brigham (US Arctic Research Commission) serves as the Chairperson of the AMSA, as well as, Vice-Chairperson of the PAME;
- **Canada:** Mr Victor Santos-Pedro (Transport Canada) serves as Chairperson of the AMSA Roundtable; and
- **Finland:** Mr Kimmo Juurmaa (Deltamarine) serves as the AMSA Project Manager/Facilitator of the AMSA Work Plan.

The lead country representatives will consult with the PAME representatives at critical decision points and will provide an interim status report of progress at the respective PAME meetings.

Role of the AMSA Roundtable: The AMSA Roundtable is composed of 12-15 persons nominated by the AMSA Leads to act in the capacity as independent experts/advisors rather than country representatives. The AMSA Roundtable should have participation of, or access to, experts covering all relevant subject areas/disciplines not meant to mirror the composition of the PAME Working Group or the Arctic Council. Experts on the Roundtable will bedrawn from different countries and organizations, with the main qualification being that they can make a significant contribution to the Assessment.

The role of the AMSA Roundtable is to provide overall expertise to advise the project; author where appropriate; comment on draft reports, workplans, schedules, events, calandar; and to identify opportunities and resources. The composition of the AMSA Roundtable may change as the Assessment progresses and the need for expertise evolves.

Role of the Experts: Experts will be drawn from Arctic states, Permanent Participants, Observers, non-Arctic states, etc., with the key criteria being how they can contribute to the Assessment. Experts will be required to complete tasks of the work packages (see the Project Plan), to produce the corresponding chapter for the Assessment, and contribute to the AMSA research agenda.

A panel of experts with a lead author will be chosen for each of the work packages and chapters. The lead author/expert will coordinate the entire work package or chapter to ensure that the methodologies used in the different countries will be consistent. Each expert panel will prepare an AMSA chapter, which should include recommendations for future research. These chapters and findings will form the basis of the AMSA Final Report. This Final Report will be submitted to the PAME for consideration. The PAME will review and confirm the AMSA findings, and make recommendations to the Arctic states and the international maritime community.

All work of the expert panels (essentially the AMSA 'chapters') will be peer reviewed to the same standards as other Arctic Council assessments.

Role of the PAME Secretariat*: The PAME Secretariat serves as the main route of communication, provides practical and organizational support for the assessment work, and updates the PAME website, which provides services that can be used by the assessment groups for exchange of electronic documents and data files.*

Role of the EPPR and other Arctic Council Working Groups, Permanent Participants, and Observers: Collaboration with the AMSA Team and the PAME Working Group will be required at all stages of the project. This collaboration can take form by supporting/urging Arctic state contributions (shipping data and traditional/indigenous marine use information), nominating experts to the AMSA work packages/chapter panels of experts, assisting with the organization of Arctic town hall meetings, participating in all AMSA review stages, designating a point of contact (POC), etc.

Role of Arctic Council Member States: The responsibility for the organization and implementation of activities to deliver the data, input, and information required for the Assessment lies with the Arctic states. All Arctic states in the Council are responsible for ensuring (and funding) the participation of their nationally designated key contact person(s) in the assessment work. The key national person(s) is responsible for ensuring that relevant data and information from their country is incorporated into the Assessment.

PROJECT STRUCTURE

Purpose and Process:

The main purpose of the AMSA project is to understand how marine activities in the Arctic will develop in the future, and what affects any increased activity will have on the environment, economy, and society. The Assessment will develop findings for consideration by Member State(s) and international organizations, respecting measures in support of sustainable development of the marine activities.

Consultation:

One of the fundamental principals of the Assessment will be to engage residents of the Arctic for input. Each Arctic state is to adopt a broad range of consultation processes from facilitated discussions with groups of experts at international meetings to town hall meetings in various Arctic communities. Town hall meetings will be held in selected communities of the Permanent Participants of the Arctic Council.

Scope:

The Assessment will cover all ship-based activities and all ship types (see above definition), however, it should be emphasized that the AMSA does not include the impact of industrial activities, such as mining or fisheries management. Only the impacts of increased marine activity will be studied.

Project Plan:

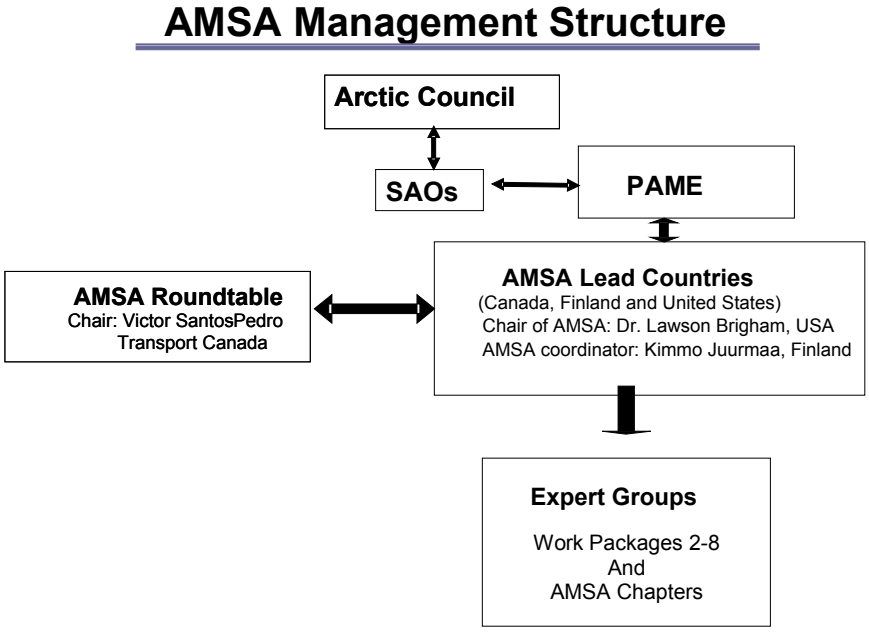
In an effort to assess Arctic marine activity and the resulting social, economic, and environmental impacts, the AMSA project is divided into work packages that require significant analysis. Each of these work packages requires specific types of expertise.

WP 1 – Project Planning & Management
WP 2 – Determination of Current Level of Arctic Marine Activity (Two tiers:

database collection and traditional marine use ~ Member States)
WP 3 – Projected levels of Arctic Marine Activity in 2020 and 2050 (Plausible Future Scenarios ~ ACIA Sea Ice Projections and Regional Economics)
WP 4 – Environmental Impact of Today's Arctic Marine Activity
WP 5 – Environmental Impact of Arctic Marine Activity in 2020 and 2050
WP 6 – Risk Analyses
WP 7 – Social and Economic Impacts
WP 8 – Analysis & Recommendations

While each work package requires specific skills and knowledge sets, consistency across all work packages and respect for the Arctic Council's principles of inclusiveness and transparency must remain at the forefront. This entails the inclusion of Permanent Participants at every step of the project and sharing of information among all Arctic Council Member States. The work packages will support the development of a set of chapters for the AMSA Final Report.

Structure:



Financing:

The AMSA project will require substantial support to ensure the completeness, comprehensiveness, and overall success of this critical initiative. Thus, all Arctic states are expected to contribute financial and in kind support (such as experts) to the Assessment.

Annex XXI

WORK PLAN OF THE STEERING GROUP FOR THE GLOBAL DIGITAL SEA ICE DATA

Work Plan for cooperation between the Members of the Steering Group for the Global Digital Sea Ice Data Bank Project for 2007 - 2009

1. Technique Development

The experts from the GDSIDB centers will continue to make available data browsers, translating and other necessary software for processing data in SIGRID 1,2 and 3, various GIS, and EASE-grid formats, and will make available software tools for working with the stated formats.

2. Data Exchange.

2.1 Data sets anticipated to be contributed by GDSIDB Members, on a schedule dictated by available resources, during the intersessional period 2007 - 2009

	Institute	Region	Time interval	Exchange date (notes)
1.	AARI	Antarctic Arctic	Prior to 1971 2007, ongoing, forward in time	SIGRID, EASE-GRID SIGRID
2	Argentine Navy Hydrographic Service	Weddell and Bellingshausen Seas	Current observations	Point coastal and ship observations in NIC-code in .db format, submitted with weekly interval to NSIDC and AARI ftp-servers
3.	BSIM (SMHI)	Baltic Sea	1980 – up to present, twice a week 2007, ongoing forward in time	In the first part of 2007, SIGRID-3, .txt SIGRID-3, .txt
4.	CIS	Canadian Arctic	Ongoing weekly charts Historical ice charts prior to 1969	SIGRID-3 SIGRID-3
5	State Oceanic Administration of China	Bohai Bay/Yellow Sea	TBD	GDSIDB co-chairs will request SOA on the details of data provision
6.	DMI	Greenland waters	2007, forward in time 1957-2007 XX century	SIGRID-3 (once a year, for the whole ice season) SIGRID-3 SIGRID-3, .txt
7.	Federal Maritime and Hydrographic Agency (BSH)	Baltic Sea (south of 56°N and to the west of 14°20’ E)	3 times a week, 1960-1996 2007, forward in time	SIGRID-3 SIGRID-3
8	Icelandic Meteorological Office	Icelandic waters	1971-1974 2002, ongoing forward and back in time	GDSIDB co-chairs will request IMO on the details of data provision

9	UK BAS	Antarctic ship and coastal stations observations	1950s forward in time	Metadata
10.	JMA	Sea of Okhotsk	Every 5 days, forward in time	Once a year in SIGRID-2 format
11.	NIC	Arctic, Antarctic Antarctic Arctic, Antarctic	Ongoing hemispheric bi-weekly charts Corrected and updated version of hemispheric 1973-2004 weekly and bi-weekly ice charts Daily ice edge from 2004 forward in time	SIGRID-3, .e00 .e00, end of 2007 .txt, SIGRID-3
12	Norway	Barents and Greenland Seas Antarctic icebergs	Weekly and daily Ice concentration charts from 1967 up to the present from ship reports, second part of XX century and forward in time	SIGRID-3 Request from the GDSIDB co-chairs and the WMO Secretariat is needed

2.2 Technical assistance

2.2.1 Experts from AARI and NSIDC centers of GDSIDB will continue to assist data contributors and data users who wish to use formats other than SIGRID (EASE-grid, Contour, etc.) if resources are available.
2.2.2 NSIDC and AARI will continue to provide guidance on preparation of metadata and other necessary documentation accompanying data submitted or to be submitted to GDSIDB.
2.2.3 NSIDC and AARI will check the web visibility of the data collections and ensure it during the intersessional period

3. Modification of formats for data exchange

3.1 The GDSIDB centers will work with the ice services to assist with the implementation of SIGRID-3.
3.2 NSIDC and AARI, with the assistance of experts from operational centers, will prepare reports on the given activity for the next IICWG-VIII & IX meetings in 2007-2008.
3.3 CIS will assist JMA in implementation of SIGRID-3 format.

4. Use, validation and intercomparison of GDSIDB data

4.1 Experts from the GDSIDB will continue joint activity on development of blended sea ice data sets, including its prolongation to 2004, and sea ice climate estimates from the GDSIDB data.
4.2 GDSIDB Members will endeavour to establish linkages with the other programs and projects concerning the development of climate estimates, validation and intercomparison of GDSIDB data, in particular GCOS, IPY, SCAR, WCRP, CliC.
4.3 The project Members together with GCOS SST & SI and IICWG experts will collaborate in organisation of the «Ice Analysis's and data intercomparison» workshop planned for 2008.
4.4 During the 2007, the GDSIDB centers will provide a blended monthly data set for 2004 for AMSA objectives, including a blended product for the stages of ice development.

5. Future activity

5.1 The GDSIDB will advertise the ASPeCT data of ice observations from Antarctica.
5.2 The GDSIDB will request Members to update contributions of ice thickness data as an IPY activity.
5.3 The GDSIDB will construct monthly series of statistics on sea ice based on GDSIDB data and submit them to the WMO Secretariat so that the WMO Secretariat can encourage the scientific community to use these data in climatological studies and reanalysis.
5.4 Within the new TT on MMS, the GDSIDB will collaborate with the ETMC on formats and sea ice climatic indices.

Annex XXII

ACRONYMS AND OTHER ABBREVIATIONS

AARI	Arctic and Antarctic Research Institute
ACIA	Arctic Climate Impact Assessment
ACSYS	Arctic Climate System Study
AIRSS	Arctic Sea Ice Regime Shipping System
AIS	Automatic Information Systems
AMSA	Arctic Marine Shipping Assessment
AMSP	Arctic Marine Strategic Plan
AMSR	Advanced Microwave Scanning Radiometer (EOS)
AOPC	Atmospheric Observation Panel on Climate
APL	UW Applied Physics Laboratory
ARCTIC-HYDRA	The Arctic Hydrological Cycle Monitoring, Modelling and Assessment Program
ASPeCT	Antarctic Sea Ice Process & Climate
ATCM	Antarctic Treaty Consultative Meeting
BAS	British Antarctic Survey
BSH	Bundesamt für Seeschiffahrt und Hydrographie (Germany)
BSIM	Baltic Sea Ice Meeting
BUFR	Binary Universal Form for the Representation of Meteorological Data
CAS	Commission for Atmospheric Sciences
CASO	Climate of Antarctica and the Southern Ocean
CB	Capacity Building
CBS	Commission for Basic Systems (WMO)
CCl	Commission for Climatology
CEOS	Committee on Earth Observation Satellites
CDMP	US NOAA Climate Database Modernization Program
CG	Correspondence Group
CGOS	Global Climate Observing System
CHRIS	Committee on Hydrographic Requirements for Information Systems (IHO)
CHy	Commission for Hydrology (WMO)
CIS	Canadian Ice Service
CLIC	Climate and Cryosphere project
CLIVAR	Climate Variability and Predictability (WCRP)
CMM	Commission for Marine Meteorology (WMO)
COADS	Comprehensive Ocean Atmosphere Data Set
COMNAP	Council of Managers of National Antarctic Programs
COMPASS	Comprehensive Meteorological dataset of active IPY Antarctic measurement phase for Scientific and applied Studies
COMSAR	Sub-Committee on Radio-communications, Search, and Rescue (IMO)
CPRNW	Commission on the Promulgation of Radio Navigational Warnings (IHO)
CRYOS	Cryosphere Observing System
CSA	Canadian Space Agency
C&SMWG	Colours and Symbols Maintenance Working Group (IHO)
DBCP	Data Buoy Cooperation Panel
DMI	Danish Meteorological Institute
DMPA	Data Management Programme Area (JCOMM)
DMVOS	Deployed-Mode VOS
DPM	Disaster Prevention and Mitigation Programme (WMO)
DSMP	Defense Meteorological Satellite Program (USA)
EASE	Equal-Area Scalable Earth
EC	WMO Executive Council
ECDIS	Electronic Chart Display Information System
ECIMO	Russian Unified System of Information on World Ocean Conditions
ECS	Electronic Navigation System

ECV	Essential Climate Variable
EGOS	Evolution of the Global Observing System
ENC	Electronic Navigational Charts
ENCIO	Electronic Navigational Chart Ice Objects
ENVISAT	Environmental Satellite
EOS	Earth Observing System (NASA)
ESA	European Space Agency
ESRI	Environmental Systems Research Institute
ET	Expert Team
ETMAES	Expert Team on Marine Accident Emergency Support (JCOMM)
ETMC	Expert Team on Marine Climatology (JCOMM)
ETMSS	Expert Team on Maritime Safety Services (JCOMM)
ETSI	Expert Team on Sea Ice (JCOMM)
ETWS	Expert Team on Wind Waves and Storm Surges (JCOMM)
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EWG	Environmental Working Group
FIMR	Finnish Institute of Marine Research
GCMP	GCOS Climate Monitoring Principles
GCOS	Global Climate Observing System
GDSIDB	Global Digital Sea Ice Data Bank
GEO	Group on Earth Observation
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GMES	Global Monitoring of Environment and Security Programme
GML	Geography Markup Language
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
HF	High Frequency
HGMIO	Harmonization Group on Marine Information Objects
HMC	Hydrometeorological Centre in Moscow
IABP	International Arctic Buoy Programme
IALA	International Association of Lighthouse Authorities
IAOOS	Integrated Arctic Ocean Observing System
IASOA	International Arctic System for Observing the Atmosphere
ICEMON	Sea Ice Monitoring in the Polar Regions
ICOADS	International Comprehensive Ocean-Atmosphere Data Set
ICS	International Chamber of Shipping
ICSU	International Council for Science
IEC	International Electro-technical Commission
IGOS	Integrated Global Observing Strategy
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IICWG	International Ice Charting Working Group
IIP	International Ice Patrol
IMB	Ice Mass Balance
IMO	International Maritime Organization
IMO	Icelandic Meteorological Office
IMMA	International Maritime Meteorological Archive
IMMSC	International Maritime Met-Ocean Services Conference
IMSO	International Mobile Satellite Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IPAB	International Programme for Antarctic Buoys
IPO	IPY International Programme Office
IPY	International Polar Year
ISO	International Standards Organization

IWICOS	Integrated Weather, Sea Ice and Ocean Service System
JC	WMO/ICSU Joint Committee (IPY)
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JEWL	Cross-JCOMM Pilot Project on Extreme Water Level
JMA	Japan Meteorological Agency
KSAT	Kongsberg Satellite Services
LDC	Least Developed Countries
MACICE	Manual of Standards Procedures for Observing and Reporting Ice Conditions (Canada)
MAES	Marine Accident Emergency Support
MAN	Management Committee (JCOMM)
MCSS	Marine Climatological Summaries Scheme
MDA	Macdonald, Dettwiler and Associates
MIO	Marine Information Object
MIZ	Marginal Ice Zone
MMSM	Marine Meteorological Services Monitoring
MOCS	Marine and Oceanographic Climatological Summaries
MODIS	Moderate Resolution Imaging Spectrometer
MoU	Memorandum of Understanding
MSC	MCSS Summaries
MSI	Maritime safety Information
MSS	Maritime Safety Services
MySQL	Structured Query Language
NAIS	North American Ice Service
NASA	National Aeronautics and Space Administration (USA)
NATO	North Atlantic Treaty Organization
NAVO	US Naval Oceanographic Office
NCOM	Navy Coastal Ocean Model
NEARGOOS	North-East Asian Regional GOOS
NIC	National Ice Center (USA)
NMEFC	National Marine Environment Forecast Centre (China)
NMS	National Meteorological Service
NOAA	National Oceanographic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Center
NOGAPS	Navy's Operational Global Atmospheric Prediction System (USA)
NSIDC	National Snow and Ice Data Center (USA)
NSF	National Science Foundation
NSR	Northern Sea Route
NWP	Numerical Weather Prediction
OFS	Ocean Forecasting System
OI	Optimal Interpolation
OOPC	Ocean Observation Panel on Climate
OPA	Observations Programme Area
OPAG	Open Programme Area Group
OSL	Russian Otto Schmidt Laboratory
PAME	Arctic Council's Protection of the Arctic Marine Environment
PANC	Naval Combined Antarctic Patrol (Argentina)
PIPS	Polar Ice Prediction System
PMSI	Polar Maritime Safety Information
POC	Point of Contact
PSC	Polar Science Center (USA)
QC	Quality Control
QMFO	Qingdao Marine Forecasting Observatory
RADARSAT	Satellite from Canada
RAE	Russian Antarctic Expedition
RECLAIM	ICOADS-related Recovery of Logbooks and International Marine Data

RMC	Regional Meteorological Center (WMO)
SAF	Satellite Application Facility
SAO	Senior Arctic Officials
SAR	Synthetic Aperture Radar
SCAR	Scientific Committee on Antarctic Research
SCDPM	IPY Sub-Committee on Data Policy and Management
SCOBS	IPY Sub-Committee on Observations
SCG	Services Programme Area (SPA) Coordination Group (JCOMM)
SENC	System ENC
SG	Steering Group
SI	Sea Ice
SIGRID	Format for the archival and exchange of sea-ice data in digital form
SIR	Sea Ice Requirements
SHN	Naval Hydrographic Service (Argentina)
SIMS	Sea Ice Mapping System
SMARA	Argentine Navy Meteorological Service
SMHI	Swedish Meteorological and Hydrological Institute
SMN	Argentine National Meteorological Service
SOA	State Ocean Administration (China)
SOG	Statement of Guidance
SOLAS	International Convention for the Safety of Life at Sea
SPA	Services Programme Area (JCOMM)
SSM/I	Special Sensor microwave Imager
SST	Sea Surface Temperature
STG	Space Task Group
TC	Technical Committee
TD	Technical Document
TG	Task Group
THORPEX	Observing System Research and Predictability Experiment (WMO)
TLO	Top Level Objectives
ToR	Terms of Reference
TSMAD	Transfer Standard Maintenance and Application Development (IHO)
TT	Task Team
ULS	Upward Looking Sonar
UNESCO	United Nations Educational, Scientific and Cultural Organization
URD	User Requirement Document
USIABP	US Interagency Arctic Buoy Programme
UW	University of Washington (USA)
VOS	Voluntary Observing Ship
WCP	World Climate Programme (WMO)
WCRP	World Climate Research Programme
WG	Working Group
WGAM	Working Group on Antarctic Meteorology
WIS	WMO Information System
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experimentation
WS	Wind Waves and Storm Surges
WWNWS	Worldwide Navigational Warning Service (IHO/IMO)
WWW	World Weather Watch (WMO)
XML	Extensible Markup Language