The Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) International Planning Meeting

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I. BACKGROUND

Despite numerous technological advances over the last several decades, ship-based hydrography remains the only method for obtaining high-quality, high spatial and vertical resolution measurements of a suite of physical, chemical, and biological parameters over the full water column. Ship-based hydrography is essential for documenting ocean changes throughout the water column, especially for the deep ocean below 2 km (52% of global ocean volume).

Global hydrographic surveys have been carried out approximately every decade since the 1970s through research programs such as GEOSECS, TTO/SAVE, WOCE / JGOFS, and CLIVAR. Formal organization of hydrography, however, has been absent since the end of WOCE. Because of the integrated climate focus of CLIVAR, repeat hydrography did not continue as a distinct coordinated activity of the program, and it was thought that many hydrographic sections would simply be sustained without formal agreements. While hydrography has continued during CLIVAR, the lack of formal organization has led to a lack of visibility in the global observing system as well as a significant decrease of sections carried out by some countries. More importantly, the lack of international agreements for implementation of hydrographic sections has led to disparate data-sharing policies and both gaps and duplications in sections.

The IOCCP-CLIVAR Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP) has recently developed scientific justification and guidelines for the development of a regular and coordinated global survey. Two types of surveys are required to meet scientific objectives: (1) a global decadal survey conducted such that each full ocean basin is observed over an approximately synoptic time-period (< 3 years), and (2) a sub-set of the decadal survey lines sampled at high-frequency (repeats at least every 2-3 years). This strategy, developed by 46 co-authors from 9 countries, was presented as a community white paper at the OceanObs09 conference (Venice, 21-25 September 2009). The paper was highlighted by several plenary speakers and the authors were particularly congratulated for the report's core variables approach and for recommending rapid data release.

During OceanObs, the GO-SHIP Panel met to discuss the way forward and agreed that developing a sustained activity was necessary, noting that repeat hydrography will be increasingly important to the global observing system as more biogeochemical variables are added to the system. It is time to consider how future surveys can build on the foundations of WOCE and CLIVAR to create a coordinated network of sustained ship-based hydrographic sections that will become an integral component of the ocean observing system.

The Panel recommended holding a 1 day international planning meeting in conjunction with the AGU / ASLO / TOS Ocean Sciences Meeting in Portland, Oregon (22-26 February 2010), to:

1. inform the wider community about the initiative to develop a sustained coordination activity for hydrography,
2. highlight the revised hydrography program manual,
3. review existing national plans and proposals for repeat hydrography,
4. identify potential areas of duplication or sections that do not include the full suite of core variables,
5. review on-going and planned ocean interior synthesis activities, and
6. discuss data assembly / management of recent and near-future cruises.

This meeting gathered new input and guidance for the development of an international activity with a view to seeking endorsement for GO-SHIP from the UNESCO Intergovernmental Oceanographic Commission as part of the Global Ocean/Climate Observing Systems at the next session of the IOC Executive Council (June 2010).

II. INTRODUCTION TO GO-SHIP

1. Welcome and status report on the hydrography manual

Maria Hood, project coordinator of GO-SHIP, welcomed the participants and reviewed the goals of the meeting. She reminded participants that GO-SHIP is being developed as a fully interdisciplinary program that brings together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and other users and collectors of hydrographic data to develop a globally coordinated network of sustained hydrographic sections as part of the global ocean / climate observing system. As part of the observing system, a hydrography program must be developed in close collaboration with other observing system platforms, such as the Argo program, XBT program, surface ships, time series, and other sustained monitoring activities.

Hood noted that GO-SHIP was started in late 2007 as a Panel, co-sponsored by IOCCP and CLIVAR, with two major goals: to develop a community white paper for the OceanObs '09 conference outlining a strategy for a sustained network of hydrographic sections, and to coordinate a revision of the 1994 WOCE hydrography program manual. The strategy was presented in September at the OceanObs '09 Conference, where feedback from the community and recommendations of the Panel were to move forward with the development of a sustained coordination program for repeat hydrography.

Hood presented a status report on the revision of the hydrographic program manual. She informed participants that 14 of 16 chapters had been finalized or were in final revision, and two chapters were still in preparation, but that the authors agreed to submit reviewable drafts before the end of March. She thanked the authors of the chapters, noting that this was a 100% volunteer effort, and reported that the electronic publication of the first version of the manual was scheduled for late March 2010.

2. Overview of GO-SHIP Strategy

Co-chair Bernadette Sloyan (CSIRO, Australia) presented a review of the GO-SHIP strategy. She noted that the strategy considers the timescales of phenomenon the program will observe and the capacity of the international community to measure the full suite of core variables. The program has two sampling timescales: decadal surveys and a sub-set of the decadal survey lines sampled at high frequency (repeats every 2-3 years); ideally, repeats of lines sampled in the past decade. To capture the change within a quarter or shorter period of the decadal time scale, the decadal repeat survey aims to achieve full basin synopticity over a < 3 year period. The reference sections identified in the strategy (Figure 1) closely follow existing lines in order to build the full depth time-series.

For sampling resolution, sections should extend from coast to coast, or coast to ice, with:

- nominal 30 nautical mile spacing for physical measurements with higher resolution in regions of steep topography and boundary currents,
- carbon and tracers at 60 nautical mile resolution or better, and
- full water column vertical resolution.

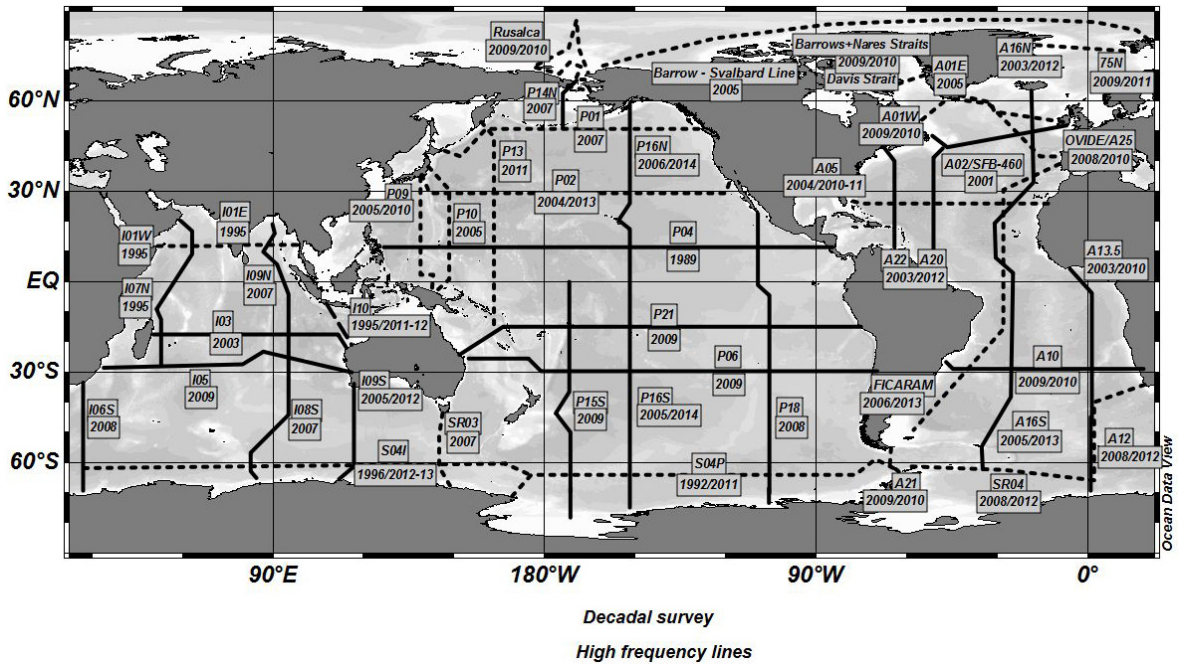

Figure 1. GO-SHIP reference lines (solid lines = decadal repeats; dashed lines = high frequency repeats).

For the decadal survey, the core program lines should measure

- temperature, salinity, and pressure,
- oxygen, phosphate, silicate, and separate measurements of NO_2 and NO_3 if possible; otherwise, $NO_2 + NO_3$ (with clear reporting of what was measured),
- at least 2 carbon parameters (e.g., DIC, Alkalinity, pCO_2, pH), where DIC and Alkalinity are the preferred pair, but spectrophotometric pH is a useful 3rd parameter because of high measurement precision and growing interest in ocean acidification,
- carbon isotopes (^{13}C, ^{14}C), chlorofluorocarbon tracers (CFC-11 and/or 12) and SF_6; tritium and helium-3 should also be measured on key sections, including meridional sections P10, P16, P18, I06S, I08, I10, A16, A22, A20, and zonal sections I05, P06, P04, and A24), and
- Horizontal velocity (by shipboard and lowered ADCP).

Salinity and oxygen should also be measured on every bottle. Also recommended are organic carbon parameters (POC, DOC) and underway surface measurements (including pCO_2, pigments, and related biological parameters at the surface). By 2012, microstructure measurements from profilers may also be considered for routine application during the next decade of hydrography. A certain subset of trace elements and isotopes should be included in future high-frequency repeat sections, particularly for parameters to deduce atmospheric mineral dust deposition to the surface ocean in key areas.

For bio-opical measurements, GO-SHIP endorses the recommendations of the International Ocean-Colour Coordination Group, including the following parameters:

Instruments to be added to a profiling CTD:

- Fluorometer to measure chlorophyll fluorescence
- Transmissometers and/or light-scattering sensors and nephelometers to measure particle beam attenuation coefficient
- PAR sensor (where possible)

Water samples collected for the following measurements:

- Chlorophyll-*a* (Turner Fluorometer)
- HPLC pigments
- Phytoplankton absorption
- CDOM (desirable measurement)
- Flow cytometry

Many of the above samples can be stored in liquid nitrogen for later analysis back in the laboratory.

On deck measurements:

- Continuous recording of incoming photosynthetically-active radiation (PAR), using a PAR sensor with a data logger (automatic).
- Measurements of spectral reflectance using a hyperspectral hand-held radiometer.

Sloyan stressed that, where national capacity does not exist for collection of all core variables, GO-SHIP community collaboration is essential to ensure the complete collection of core variables for each section.

For data sharing, the GO-SHIP panel recommends the following data-release guidelines:

- Preliminary dataset released within 6 weeks (e.g., all data measured on the ship)
- 6 months for final physical data
- 1 year for final data of all other variables (except for isotopes or tracers with shore-side analysis where 1 year is difficult).

The relatively rapid release of data is motivated by their usefulness for climate studies and increasing their use by a wide range of users. To facilitate rapid release of data by all participants, a system should be developed to appropriately recognize the efforts of data contributors. Sloyan noted that adherence to the data policy will be a determining factor of the program's success and discussions of data release and sharing should not be taken lightly.

Sloyan outlined the timeline for transition from the CLIVAR survey to the next decadal occupations of each section:

Atlantic

- 2003/5 Completed
- 2010/12 Planned next reoccupation of sections

Pacific

- 2005/2009 Completed
- 2013/2016 Planned next reoccupation of sections

Indian

- 2007/2009 Completed
- Next reoccupation – too far out to plan at present

3. Overview of the way forward

Co-chair Chris Sabine (NOAA / PMEL, USA) presented an overview of the way forward. He reminded the participants that the Community White Paper, *Ship-based Repeat Hydrography: A Strategy for a Sustained Global Program*, with contributions from 46 coauthors from 9 countries, was submitted to the OceanObs09 conference on 9 September 2009 and that the response to the CWP and a poster presented at the meeting was very positive and GO-SHIP was encouraged to continue developing the strategy for a

sustained observing program. Sabine outlined other community white papers presented at the conference that highlighted the importance of repeat hydrography as part of the observing system.

Guidelines towards an integrated ocean observation system for ecosystems and biogeochemical cycles (Herve Claustre & Co-Authors): The next 10 years of the observing system will see an increase in biogeochemical sensors, and hydrography is currently the only method for measurement of most of these variables. Hydrography is also needed for development and ground-truthing of autonomous sensors and float deployments.

Warming up, turning sour, losing Breath: An integrated observing system for ocean biogeochemistry at a time of change (Gruber & Co-Authors): Long-term changes in the ocean's interior biogeochemistry are only measurable by ship-based hydrography; this is particularly true for carbon and biogeochemistry for which there are currently no suitable sensors for long-term deployment on floats. This shipboard-based approach for determining long-term changes in the ocean's biogeochemistry benefits strongly from the many synergies that can be realized with the wealth of additional parameters that can be measured from a ship, especially the large suite of physical and biogeochemical tracers.

An International Observational Network For Ocean Acidification (Feely & Co-Authors): The combination of available autonomous pCO_2 and pH sensors does not allow for the most accurate and precise measurement of $CaCO_3$ saturation state. With repeat hydrography cruises, DIC, pCO_2, TA and pH can be measured with very high accuracy and precision. The Repeat Hydrography Program could effectively provide the required long timescale information for an ocean acidification observation network.

Integrating the ocean observing system: mobile platforms (Roemmich & Co-Authors): Besides its value as a stand-alone program, repeat hydrography is an important component to integrate with other elements of the observing system: data needed for accuracy of Argo float and XBT profile data; measurement of a large suite of core variables common to floats, gliders, and moorings; observation of deep ocean changes in heat, freshwater, and steric sea level; validation and correction for gliders and deep-ocean floats (as developed); boundary current measurements and validation of glider data; data policy and release of hydrographic data in a timely fashion for use by other parts of the observing system.

Deep circulation and meridional overturning: recent progress and a strategy for sustained observations (Rintoul & Co-Authors): Repeat hydrography will remain the backbone of the broad-scale deep ocean observing system.
Sabine noted that hydrographic sections continued after the end of WOCE/ JGOFs as part of the CLIVAR program, but because of the integrated climate focus of CLIVAR, repeat hydrography did not continue as a distinct coordinated activity of the program. The IOCCP has been working to promote communication among scientists making carbon measurements on hydrographic sections, but the lack of formal organization for a comprehensive hydrography program has led to a lack of visibility in the global observing system as well as a significant decrease of sections carried out by some countries. The lack of international agreements for implementation of hydrographic sections has led to differing coverage, disparate data-sharing policies and an inefficient distribution of sections.

Figure 2 shows the number of annual ocean interior carbon observations as a function of time with labels for the scientific program under which hydrographic sections were carried out. It shows that the WOCE/JGOFS period provided an unprecedented number of observations. At the end of the field season for those programs there was a precipitous drop in the number of observations. Over the past few years the number of observations has increased through the CLIVAR repeat hydrography program with IMBER and SOLAS providing scientific objectives for the carbon survey, but a longer term vision is needed to prevent another collapse in observations at the end of CLIVAR.

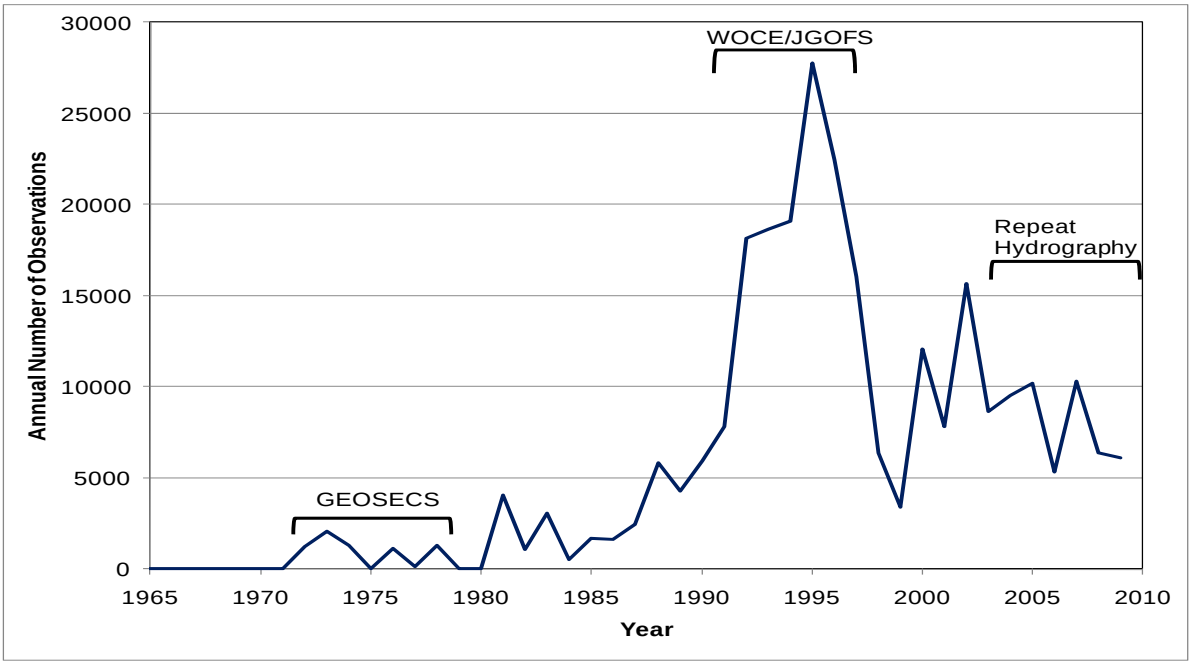

Figure 2. Number of annual ocean interior carbon observations as a function of time.

To address the issues raised by the community white paper at the OceanObs 09 conference, the GO-SHIP panel recommended the establishment of an international scientific steering committee to:

- develop formal international agreements for a sustained international repeat ship-based hydrography program, including an internationally agreed strategy and implementation plan building on the guidelines in the Community White Paper;
- advocate for national contributions to this strategy and participation in the global program;
- provide a central forum for communication and coordination; and
- develop syntheses of hydrographic data, in partnership with national, regional, and global research programs.

During this initial development period, the IOCCP and CLIVAR International Project Offices are providing part-time project office support, but as the program develops it will eventually need to become an independent standing program with its own project office and program funding.

Sabine noted that the next step is to promote the implementation of the GO-SHIP strategy, and referred to Figure 3, which shows the GO-SHIP reference sections color-coded for country commitments to each section.

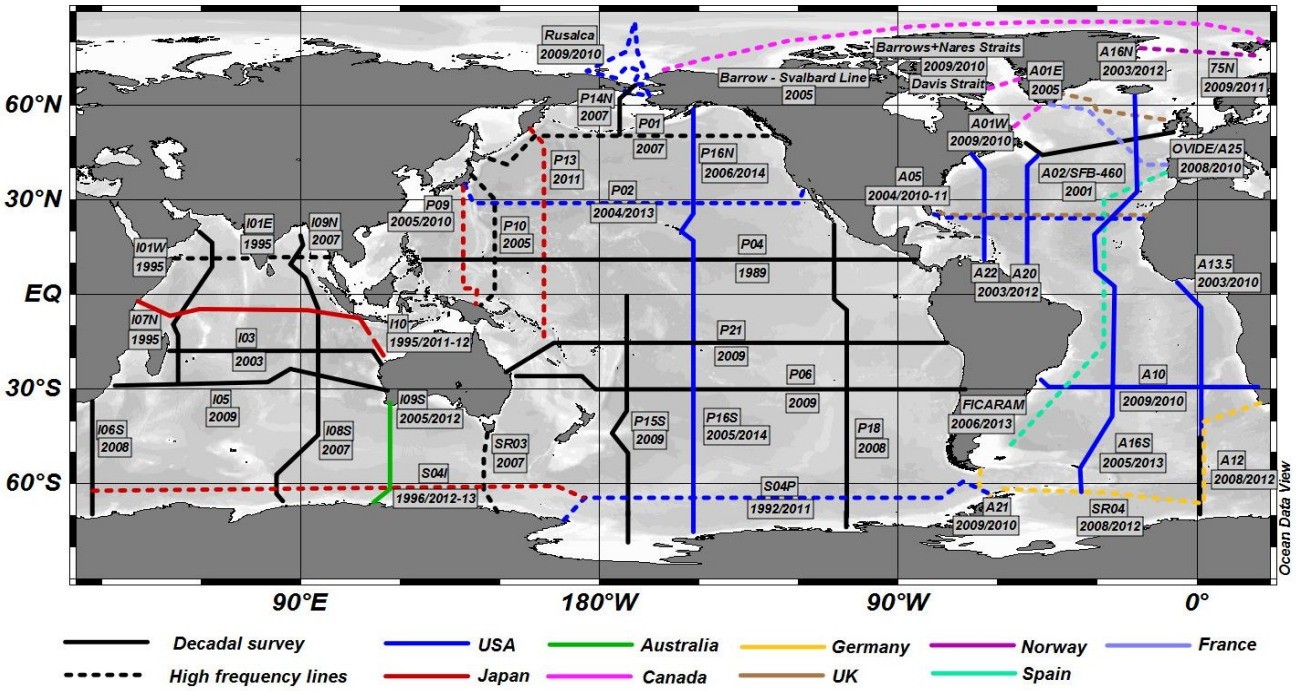

Figure 3. GO-SHIP reference sections by country.

Sabine reviewed text adopted at the 3rd session (November 2009) of the IOC-WMO Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM):

> *6.1.12.7 The Commission welcomed the progress made by the IOCCP-CLIVAR Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP), which brought together interests from physical hydrography, carbon, biogeochemistry, Argo, OceanSITES, and other users and collectors of hydrographic data to develop guidelines and advice for the development of a globally coordinated network of sustained ship-based hydrographic sections that would become an integral component of the ocean observing system. These guidelines, including a strategy for the next global survey, were presented at the OceanObs'09 conference and the community consensus was to move forward with the development of a sustained coordination effort for repeat hydrography. The Commission supported this initiative and noted that IOCCP and CLIVAR have developed an oversight committee to move this forward with the goal of presenting a plan for a sustained coordination effort to the next session of the UNESCO/IOC Executive Council for endorsement. The Commission also welcomed the GO-SHIP revision of the 1994 WOCE Hydrographic Programme Manual, which would be published electronically in January 2010.*

Sabine noted that, while we are just starting the process of developing the program, the first national committee to implement the GO-SHIP strategy has already been established in Japan. In January 2010, the Japan Repeat hydrography Implementation Group (JRIG) developed tentative Terms of Reference to:

1. exchange information of plans and results of (long) hydrographic observation among oceanographers in Japan
2. to work as a technical forum toward implementation of observation along GO-SHIP Repeat Hydrography concept
3. to work as an international (or at least GO-SHIP) contact point in Japan.

Sabine ended by stating that this meeting is also an important step in program development because it is meant to be a bottom-up program developed by community input and consensus. He then opened the meeting for discussions about the program and the way forward.

Discussions: Participants discussed the development of GO-SHIP and noted that it is more similar to the Argo or OceanSITES programs than to a global research program, since it is meant to be a sustained activity with no sunset clause and it is focused on the network of observations and data management rather than on achieving a handful of specific scientific goals. Participants noted that this makes the program a useful partner to research programs that use hydrographic data to achieve their goals, since many programs with different sunset clauses and different scientific goals use hydrographic data and international coordination of these activities would represent a significant burden to resources that could otherwise be used for the science. One participant specifically noted that the repeat hydrography program could fulfill many of the requirements of an ocean acidification observing network, and requested that GO-SHIP work closely with the new SOLAS-IMBER working group on Ocean Acidification to ensure that those needs are fully included in the development of the GO-SHIP activity. Some participants questioned why such a hydrography activity could not continue as a project under the IOCCP and CLIVAR. The co-chairs responded that an internationally sanctioned hydrography program is needed to increase national commitments for hydrographic sections and to facilitate data exchange. The IOCCP and CLIVAR have been working together since 2004 to try to improve coordination of hydrography, and experience has shown that the type of comprehensive international coordination and national buy-in that is needed cannot be achieved as a panel activity or a sub-project of two sponsor programs. Participants also noted that the data release policy of 6 months may be difficult for some groups and that one way to facilitate data release would be to strongly endorse the use of data journals as part of the strategy. Participants also noted that there is a growing need for new global-class research ships and wondered if GO-SHIP could provide any assistance or advocacy for this. The co-chairs noted that GO-SHIP would clearly highlight these needs. One participant also noted that shipboard ADCP needed to be highlighted more strongly as a core variable, especially when discussing building or acquiring new ships. Another participant noted that the water intake on their ship is not good enough to do much underway work and that an endorsement and / or guidelines from GO-SHIP might help argue for improvements or new ships.

Action item 1. Contact the chair of the SOLAS-IMBER working group on ocean acidification to ensure that the GO-SHIP strategy will meet their needs for establishing an observing network and investigate other opportunities for collaboration. [*Responsible: project coordinator. Timeframe: immediate. Financial implications: none*.]

Action item 2. Strengthen the data sharing and exchange policy to strongly encourage and assist data contributors to use data journals for appropriate acknowledgement of their contributions. [*Responsible: project coordinator. Timeframe: immediate. Financial implications: none.*]

Action item 3. Investigate the interest and feasibility of developing a brief technical report on the global class research fleet. [*Responsible: project coordinator. Timeframe: late 2010. Financial implications: low*.]

III. NATIONAL REPORTS

Participants were asked to present brief overviews of national priorities and information about on-going or planned hydrographic sections. The emphasis was on GO-SHIP reference sections, but information about other hydrographic sections was also gathered to include in the GO-SHIP compilation of sections that do not meet GO-SHIP criteria but are still useful for planning and synthesis activities. Presentations included:

- Australia - Berndette Sloyan (CSIRO)
- Brazil - Edmo Campos (Uni. Sao Paulo)
- Canada - Kumiko Azetsu-Scott (DFO / Bedford Institute of Oceanography)
- France - Herlé Mercier (IFREMER)
- Germany - Toste Tanhua (IFM-GEOMAR)
- Japan - Masao Fukasawa (JAMSTEC)
- Netherlands - Hein de Baar (NIOZ)
- Norway - Are Olsen (Uni. Bergen) *(presented by Maria Hood)*
- Spain - Pedro Velez (IEO) and Fiz Perez (IIM-CSIC) *(presented by Maria Hood)*
- Sweden - Leif Anderson (Göteborgs Uni.) *(presented by Toste Tanhua)*
- UK - Brian King (NOCS)
- USA - Dick Feely (NOAA PMEL)

Much useful information was gathered from these presentations that will be used to update the GO-SHIP maps and tables. Several new programs were highlighted, such as the Brazilian transatlantic cruises covering 20° S and 30° S, that should be worked into the strategy and studied more carefully for possible collaborations. The presentations will be made available on the GO-SHIP Web site (www.go-ship.org) on the Cruise Plans page.

Discussions: Participants noted that several of the decadal section cruises did not include the full suite of recommended core variables and that these sections should be highlighted to encourage collaboration. The idea of establishing a bulletin board for this type of information was discussed, but some participants were hesitant to advertise the fact that their program was not fully utilizing the ship's resources (free berths, etc.). It was agreed that the best solution would be to include a column on the GO-SHIP reference section tables listing the measurements that each cruise plans to make so that the community can organize collaborations for any missing variables.

Action item 4. Update maps and tables based on gathered information, and highlight new sections for potential collaboration.
[*Responsible: project coordinator. Timeframe: immediate. Financial implications: none.*]

Action item 5. Add a column on the GO-SHIP reference section tables listing the measurements that each cruise plans to make so that the community can organize collaborations for any missing variables.
[*Responsible: project coordinator. Timeframe: immediate. Financial implications: none.*]

IV. POTENTIAL GAPS AND DUPLICATIONS OF SECTIONS

Co-chair Bernadette Sloyan provided an overview of the GO-SHIP reference sections and highlighted potential gaps and duplications. The following issues were noted:

AR7W/E – This high frequency line is frequently occupied by many different groups (Netherlands, Canada, Germany, and UK in the last few years). It was suggested to add last/next occupation information for each country occupying the section to determine if there is a long-standing commitment or if these are one-off cruises. It was also noted that a list of variables measured on each occupation should be listed.

A02 – Germany has been occupying this decadal section with a modified cruise track regularly (2003, 2009, 2010/11 plans). Update the maps and tables.

A05 – This high frequency section is scheduled for occupation by three countries (UK, Spain, USA) over a period of < 2 years (UK = completed early 2010; Spain for December 2010; USA for 2011). This section is part of the UK RAPID program, which occupies the section every 5 years for the duration of the program but also part of the USA decadal repeat program, which occupies the section only once every 10 years. No Spanish representatives were present to provide information on their strategy. The UK noted that it plans to reoccupy the section in 2014, but that it would carry out one other transatlantic section that could be flexible depending on what other countries are doing. The UK noted that their cruise would include all core variables except carbon isotopes and asked if the USA would be willing to collaborate on these and consider reprogramming the USA A05 occupation. The UK representative also noted that the recently completed A05 section (mid-February, 2010) data were already submitted to CCHDO for distribution to the community.

A10 – This decadal line is scheduled for occupation by 2 countries (UK, USA) in 2009 and 2010. The UK noted that their section should really be called A "9 ½" since the track runs along 24° S and not 30° S, and participants noted that it is useful to have these two separate lines measured close together in time. The new Brazilian program with two tracks along 20°S and 30° S also needs to be included in planning to determine how best to collaborate in this area. One suggestion was that the UK and USA occupy this section decadally and then the Brazilians can occupy it more frequently. In this case, the section will need to be converted in the strategy to a high frequency line.

A16 N and S – The USA occupation of these decadal sections has been pushed back to 2013 and 2014.

A13.5 – The USA section only extends down to where the German line A12 / ZeroMer begins. This should be changed on the map.

FICARAM – A question was raised about the station spacing and sampling on this line and whether it met GO-SHIP specifications. Spanish colleagues provided information that they have submitted a proposal for reoccupation of this section in 2014 but that funding was uncertain.

A21 – The French have reoccupied this section recently over the last few years. Contact this group to determine what measurements were made and plans for any future occupations.

P01 – There are currently no plans for reoccupation of this high frequency line (last occupied in 2007). The Japanese would like to reoccupy this before 2013, but plans have not yet been made.

P04 – This section was marked in the strategy as a decadal section, but has not been occupied since 1989. The section is very long and expensive to carry out, and participants questioned whether this line should be removed from the strategy and replaced with P03 (24N), which was occupied in 2005. The GO-SHIP committee agreed to study this. The committee must also consider whether it is feasible to leave P01 and P02 as high frequency repeats.

P10 – Japan has agreed to repeat this on a decadal timescale.

P15S – The southern extension of this decadal section has always been limited by the ice edge, but the Australians report that they will acquire a new ice-strength ship in the coming years that will make the extension possible.

P16S – The coordinates of this section need to be corrected.

S04P – The USA will be occupying this line next year, which will tie in very nicely with the Japanese occupations of S04I in 2012-13. Participants noted that the S04 lines are marked as high frequency, but the difficulty and expense of carrying out these sections make it unrealistic to expect that they will ever be re-occupied with a frequency of < 3years. Participants felt, however, that there was strong scientific motivation to carry out these sections frequently and that they should remain as high frequency in the strategy to indicate this. It was also noted that this provides an excellent example of the need to integrate ship-based repeat hydrography with other platforms that may be able to measure some variables at higher frequency.

SR03 – The Australians will occupy this section in 2010. Owing to funding constraints, this high frequency section will only have 30nm station resolution at the southern end and at fronts, with coarser resolution in the northern part of the section. The cruise will measure CTD/O2, nutrients, L-ADCP, and carbon, but no CFCs or tracers are planned.

Indian ocean sections – Participants questioned whether it was meaningful to keep sections on the strategy that are not possible owing to security or political issues (for example, I01 E and W and I07). At the same time, the Japanese have been occupying I02, which was not included in the original strategy. Participants felt that it may still be possible to occupy I07 in the future and that it should remain as part of the strategy. More effort needs to be made to contact Indian colleagues to determine the feasibility of occupying some part of I01E and W. Participants suggested replacing I03 with I02.

Action item 6. Update maps and tables based on information gathered during this session.
[*Responsible: project coordinator. Timeframe: immediate. Financial implications: none.*]

V. ON-GOING AND PLANNED SYNTHESIS ACTIVITIES

Presentations were provided on the following activities:

- Pacific Carbon Data Synthesis Activity (PACIFICA) - Masao Ishii (MRI, Japan)
- Southern Ocean Deep Ocean Change Workshop – Bernadette Sloyan (CSIRO, Australia)
- North Atlantic sub-polar hydrography synthesis project - Igor Yashayaev (DFO-MPO, Canada)

The presentations will be made available on the GO-SHIP Web site (www.go-ship.org) on the Cruise Plans page along with the national reports.

Discussion: Co-chair Chris Sabine led a discussion about what GO-SHIP's role should be in synthesis activities. Participants noted that synthesis means different things to different groups, where many projects are actually data assembly activities rather than interpretation projects. The consensus was that GO-SHIP was needed to facilitate data release and data assembly, as well as providing information about cruises, but that scientific interpretation tends to happen in a more ad hoc manner depending on interests of a group of scientists, or as part of global research programs, and did not need facilitation by GO-SHIP. It was also noted that many GO-SHIP variables, especially the physical variables, are collected by other platforms (e.g., Argo, XBTs, satellites, etc.) and that some other organization or group should take the lead in any data assembly exercise that extends beyond hydrography.

VI. OVERVIEW OF DATA ASSEMBLY AND MANAGEMENT ISSUES

Presentations were provided by the following hydrography data assembly and/or management projects, and will be made available on the GO-SHIP Web site (www.go-ship.org) on the Cruise Plans page along with the national reports:

- Shipboard Automated Meteorological and Oceanographic System (SAMOS) – Shawn Smith (FSU, USA)
- CLIVAR and Carbon Hydrographic Data Office (CCHDO) – Jim Swift (SIO, USA)
- Carbon Dioxide Information and Analysis Center (CDIAC) – Maria Hood for Alex Kozyr (CDIAC, USA)
- Shipboard and lowered Acoustic Doppler Current Profiler Data Assembly Center Status – Jules Hummon (UH, USA)

Co-chair Chris Sabine led a general discussion about data management issues raised by the presentations. He noted that the presentations provided examples of national data assembly efforts and asked participants for ideas on how to make a coordinated global network that builds on existing activities. SAMOS and CCHDO both agreed that GO-SHIP could provide a useful service to other projects by compiling cruise plans that could be used to plan instrument deployment and collaboration or to identify data collectors. Participants stated that having a global data assembly center for different types of hydrography data was difficult because of funding issues and the necessity of soliciting national contributions to an international project. A distributed but coordinated network seemed more feasible, but coordination and agreements would be challenging. It was suggested that a Data Assembly Committee should be developed to address coordination issues and that several data management and coordination models should be proposed and discussed by the community and national programs.

The CCHDO group stated that their goal was to compile and maintain a complete data set for all hydrography variables and that they could act as a global center or clearinghouse for hydrography, stressing that the data assembly centers for individual variables would still be needed to quality control the data before sending it to CCHDO. The CCHDO program is already meant to be international and does manage some international data, but a large influx of new data from GO-SHIP would require additional resources. Participants also noted that GO-SHIP should not over-extend itself and should concentrate on assembly and serving data from GO-SHIP reference lines only since resources are limited. Several participants noted that there has never been consensus on how to process L-ADCP data, and that a concerted effort is needed to resolve this issue as part of the establishment of an ADCP data assembly activity for GO-SHIP.

Action item 7. Establish an oversight committee for data issues to develop models for data assembly and management coordination for consideration by the community.
[*Responsible: Committee and project coordinator. Timeframe: late 2010. Financial implications: medium to high.*]

VII. PRESENTATION OF THE JCOMM OBSERVING PROGRAM SUPPORT CENTER

Yves Desaubies, scientific coordinator of the WMO / IOC Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM) Observing Program Support Center, provided an overview of the center and its products, services, and programs (available on the GO-SHIP Web site at www.go-ship.org). JCOMMOPS is a major support facility for the implementation of the in situ elements of the global ocean observing system, with a mission to:

- monitor and evaluate the performance of the networks,

- act as a clearing house and focal point on all programme aspects,
- provide up to date, comprehensive information on status of observing system,
- assist in data distribution on the Internet and GTS,
- encourage cooperation between communities and member states,
- relay user feedback on data quality to platform operators,
- provide technical assistance and user support worldwide ,
- develop synergies between observing systems, and
- assist in the planning, implementation and operations of the observing systems.

The JCOMMOPS center was established in 2001 and provides services for the operational components of the observing system including the data buoy cooperation panel (drifting and moored buoys in the high seas and tropical moorings), the ship observations team (XBTs, TSGs, atmospheric soundings, meteorological observations) the Argo profiling float program, and the OceanSITES time series station program.

The center is hosted jointly by France's Collecte Localisation Satellites (CLS) Center and Institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER) in Toulouse, France, and is staffed by 2 full time technical coordinators and a part-time scientific coordinator, with full time I.T. staff and resources offered by the host center. Work plans and overall scientific guidance is provided by the chairs and steering committee of each programme, and the technical coordinators and chairs of all the programs meet annually in the JCOMM Observations Program Area panel to exchange information and coordinate activities across programs.

One of the most important aspects of the center is the synergy offered through collocation of the observing system elements. International programs benefit from centralized information and communication services, shared databases (platforms, people, data directories, calendars of events, map projections of the observing system, etc.), and shared database and GIS technologies to manage information from different elements to create a coordinated global network. The collocation of these international projects in a single center under intergovernmental sponsorship allows for maximum optimization of resources and implementation coordination. The center also offers long-term stability for sustained programs and funding support for the center is provided by multiple sources.

Desaubies noted that GO-SHIP would have many advantageous links to existing observing system elements already managed by the center, and suggested that the GO-SHIP community develop a clear scope and terms of reference for its program management so that the JCOMMOPS center can better understand the program's requirements and propose appropriate services.

Discussions: The participants agreed that hosting the project office at the JCOMMOPS center might have significant advantages and synergies, but also noted that the needs for the office, including staffing and budget, have not yet been clearly defined. The chairs noted that the plan was to seek international / intergovernmental endorsement from the IOC EC in the coming months, and that part of this process would involve defining the precise needs for a project office and program budget. Some participants questioned whether it might be easier to fund a project office at a national center or university rather than requesting funding support to establish a post at the JCOMMOPS center. The chairs suggested that perhaps the best way forward would be to define the scope and needs for staff and budget and then circulate a request to potential hosts or funding sources to see what support might be available.

Action item 8. Define needs and terms of reference for a GO-SHIP project office, including staff and program budget, and circulate this information to perspective host institutes and funding sources to determine the most appropriate location and conditions for establishing a project office.

[*Responsible: Committee and project coordinator. Timeframe: immediate. Financial implications: low*.]

VIII. SUMMARY AND NEXT STEPS

Co-chair Chris Sabine briefly reviewed the actions developed during the meeting and the way forward. He reminded participants that JCOMM supported the initiative to develop a sustained coordination activity for hydrography at its 3rd session in November 2009, and that GO-SHIP was planning to seek endorsement from the IOC Executive Council in June 2010, which would make it easier for some countries to participate fully in the program. Once the program has been officially endorsed, a more comprehensive scientific steering committee (15-20 members) will be developed that will take into consideration national and regional representation as well as disciplinary expertise. While IOCCP and CLIVAR can continue to provide part-time project office support during this transition period, GO-SHIP needs to become a standing program as soon as possible and seek financial support for establishment of a project office, including staff and program budget. The input gathered at this meeting will be included in the GO-SHIP program development and all members of the hydrography community are welcomed to join in program planning by joining the GO-SHIP email list (see www.goship.org) and participating in open discussions and meetings. Finally, the co-chairs thanked the participants and speakers for their input and noted that a report of the meeting, including presentations, would be published shortly.