



SOOS

SOUTHERN OCEAN
OBSERVING SYSTEM

**MINUTES FROM THE
2ND SCIENTIFIC STEERING COMMITTEE MEETING**

**20-22 May 2013
Shanghai, China**

SESSION 1: GENERAL SOOS BUSINESS

1. Introductory Items

1.1 Welcome and Introductions

Schofield welcome all participants, thanked the meeting hosts and sponsors, and invited introductions from all (list of attendees below).

SCIENTIFIC STEERING COMMITTEE MEMBERS	
Name	Affiliation
Ackley, Stephen	University of Texas at San Antonio, USA
Bhaskar, Parli Venkateswaran	National Centre for Antarctic & Ocean Research, India
Brandt, Angelika	University of Hamburg, Germany
Costa, Dan	University of California, USA
Finney, Kim	Australian Antarctic Division, Australia
Garabato, Alberto Naveira	National Oceanographic Centre, UK
Liu, Jiping	Chinese Academy of Sciences, China
Mata, Mauricio	Federal University of Rio Grande, Brazil
Meredith, Michael	SOOS Co-Chair, British Antarctic Survey, UK
Schofield, Oscar	SOOS Co-Chair, Rutgers University, USA
Swart, Sebastiaan	University of Cape Town, S. Africa
Tilbrook, Bronte	CSIRO, Australia
Wåhlin, Anna	University of Gothenburg, Sweden

EX-OFFICIO MEMBERS	
Ballerini, Tosca	APECS Ex-officio, Mediterranean Institute of Oceanography, France
Constable, Andrew	ICED Ex-officio, Australian Antarctic Division

SOOS INTERNATIONAL PROJECT OFFICE	
Newman, Louise	SOOS IPO, Australia

INVITED OBSERVERS	
Butler, Ed	Antarctica New Zealand, New Zealand
Klepikov, Alexander	CIIC Representative, Russia
Hyoung Chul Shin	COMNAP, Korea
Yunlong Sun	COMNAP, China
Wooding, Rob	COMNAP, Australia
Payne, Bridget	COMNAP, Australia

SSC MEMBER APOLOGIES	
Rintoul, Steve	SOOS SSC Member, Australia

1.2 Overview and Goals of Meeting

Newman provided a general overview of the goals of the three-day SSC Meeting.

1.3 Report on 2012 Activities

Newman provided an overview of SOOS activities since the last SSC meeting (Feb 2012).

2. SOOS Funding Overview and 2013 Budget

2.1 International Project Office Sponsorship and Support

Newman provided an overview of the sponsorship structure of SOOS and the SOOS IPO.

2.2 IPO Operating Budget: 2012/2013 Overview

Newman outlined the 2013 operating budget for the IPO.

Decision – The SSC approved the 2013 budget.

3. Endorsement and Sponsorship of SOOS and the SOOS IPO

3.1 SOOS Endorsement and Sponsorship Policy

Newman outlined the background and structure of the *SOOS Endorsement and Sponsorship Policy*. The SSC discussed the need for the policy, and many suggested that it gave a negative feeling towards sponsorship.

Decision – SSC decided that the Sponsorship Policy does not need to be developed any further and that the document as it stands can be used as a point of reference for discussions if needed. It could be readdressed if issues arose in the future. Some details from the policy should be included in the Sponsorship Package.

3.2 SOOS IPO Sponsorship

The SSC discussed the structure and content of the Sponsorship package, and gave input on the best way to invite institutions to contribute support to SOOS. It was considered that many institutions would respond positively towards funding specific activities or products, rather than providing general support for IPO running costs. The SSC suggested a number of changes to the draft document, including providing recognition for institutes or nations that dedicate resources to specific field efforts and logistics of SOOS, and the suggestion of a small membership fee for interested countries.

Action – Schofield and Swart to help the IPO to develop the package following suggestions by the SSC. SSC to provide feedback on final draft.

4. Programmatic, National & Disciplinary Links

4.1 New Programmatic Connections

4.1.1 Committee Of Managers of National Antarctic Programmes (COMNAP)

Wooding presented an overview of the upcoming COMNAP/SOOS Workshop. The SOOS SSC members were very excited by the potential power of this collaboration to greatly enhance output from current efforts through better leveraging of resources and communication of measurement standards and data. It was agreed by all that small increments in coordination and effort could make a big difference in the quality of data currently being collected.

The SSC highlighted a number of ways that COMNAP could help SOOS achieve its objectives:

- It would help SOOS Data Management objectives if COMNAP could consider data management centres as logistical capabilities and aid in the communication of data requirements to the National Antarctic Programmes (NAPs).
- COMNAP could provide information on the current measurements that are routinely taken by all ships and stations (and the location of this data), to better coordinate and enhance existing capabilities.
- COMNAP could provide information on annual shipping plans and schedules (e.g., through modified POGO research cruise database), including information on where the ship will go, what equipment it will carry, who to contact for more information, and information on available births. It is suggested that the logistics or shipping managers of the NAPs could submit this information annually following development of their schedules. This information would help leverage resources and also enable researchers to tailor proposals to fit with logistical capabilities.
- COMNAP could help communicate SOOS requirements of satellite data to the satellite community, including the need for better validation of satellite data.
- COMNAP could help communicate to the meteorology community that there are a great deal of meteorological data collected that would be of considerable use to the oceanography community but the data is not currently available/shared.

The SSC agreed to provide COMNAP with the following:

- A list of measurements that can be taken by ships and stations on a routine basis, including the requirements for calibration of equipment.
- Internationally agreed standard methodologies and protocols for sample collection and required metadata information.
- A list of equipment that can be relatively easily/cheaply added to ships for increased underway measurements.

Further discussion is required to clarify the mechanism for coordination between COMNAP and SOOS. It was also highlighted by COMNAP delegates that positive feedback to NAPs will be very important, to provide NAPs with recognition for their efforts, which would enable them to justify to their respective governments for continued support of SOOS-related science.

A task group was formed to develop a document that provides a simple message to the COMNAP delegates – outlining SOOS objectives, priorities, and how COMNAP can contribute. The document is to be prepared for background information for COMNAP delegates attending the SOOS/COMNAP workshop (7 July).

Action – SOOS representatives at the COMNAP workshop to present request for aforementioned products.

Action – SSC/COMNAP task group to prepare COMNAP workshop documentation highlighting SOOS requirements. Task Group members include: Schofield, Costa, Constable, Wooding, Wahlin and Tilbrook.

Action – Task Group to draft a list of measurements that can be taken by ships and stations on a routine basis, including any requirements for calibration of equipment. Ackley, Meredith, Schofield, Tilbrook and Constable all volunteered to be involved in this Task Group.

Action – Task Group to draft a list of equipment that can be relatively easily/cheaply added to ships for increased underway measurements. Task Group members still to be identified.

Action – Task Group to develop a document of internationally agreed standard methodologies and protocols for sample collection and required metadata information (in collaboration with Constable and SOKI). Task Group members still to be identified.

Action – IPO and EXCOM to develop skeleton of Satellite Task Group to progress satellite coordination, identify current, planned and required satellite products and activities.

4.1.2 Group on Earth Observations (GEO)

Newman notified the SSC of the invitation by GEO to contribute to their Cold Regions Working Group, and it was agreed that this would be discussed further once more information was available. It was generally agreed by the SSC that the IPO does not currently have the capacity for a significant level of contribution to GEO.

Action – IPO to get further details on how GEO envision collaboration with SOOS.

[NOTE – Newman has since attended a Cold Regions videoconference to find out more information on the objectives and requirements of the initiative. Newman noted that many of the programmes involved were very different to SOOS, and that there would be no value added by SOOS contributing to this task group at present. This has been communicated to GEO. Further information is available from Newman if required]

4.1.3 International Association of Antarctic Tourism Operators (IAATO)

Newman outlined the status of communication with IAATO. The SSC agreed that this was an important potential avenue to enhance observations of the Southern Ocean, particularly through deployment of modular equipment. Wooding suggested that collaboration with IAATO could be supported through COMNAP. The SSC discussed the potential for science lectures to be given on the tourist vessels, as incentive for deployment of equipment. Costa volunteered to help establish communication with IAATO, and coordinate the development of collaborative ventures.

Action – Costa to help coordinate collaboration with IAATO. Newman to initiate communication.

4.1.4 Polar Space Task Group (PSTG)

Newman notified the SSC of the request for information on SOOS Satellite data requirements by the PSTG. The SSC all agreed that satellite data is very important for all aspects of SOOS science, but that the rights to satellite data is very difficult to obtain. The SSC were interested to know whether there was a list of products that PSTG were currently pursuing, so that they could then identify the gaps. The SSC also highlighted the activities of the International Ice Chart Working Group (IICWG) and the broad utility of their maps.

The SSC agreed that specific requirements of satellite data would need to be identified by each SOOS Science Theme and this information would then be relayed back to PSTG. Ackley volunteered to help coordinate discussions with PSTG and the satellite community.

Action – SSC to highlight satellite data requirements in Theme Workplans, and Newman and Ackley to communicate requirements to PSTG – through SOOS Satellite Task Group.

Action – IPO to contact PSTG to find out if they have a list of products that they will be pursuing, so that the SSC can identify key gaps.

4.1.5 Center for Southern Ocean Biogeochemical Observations and Modelling (SOBOM)

Schofield provided information on the U.S.-led proposal for SOBOM, highlighting that the proposed centre would 1) focus efforts on the ACC, 2) contribute to the BIO-ARGO network and reanalysis of the Biochemical GCM, 3) provide online educational and data resources, 4) develop a data portal, and 5) hold summer schools. Schofield emphasised that, if supported, SOBOM would constitute a significant U.S. contribution to SOOS, and would be interested to work with SOOS, particularly with regard to data sharing and leveraging of resources.

[NOTE – Schofield has since notified that SOBOM was not funded.]

4.1.6 International Council for Science (ICSU) Biology workshop proposal

Constable provided the SSC with an outline of the successful proposal from SCOR and SCAR to ICSU. He highlighted that the planned workshop and associated group would develop four reviews:
- Recommendations for ecosystem Essential Ocean Variables (eEOVs)

- Available information on each eEOV
- Tools and methodologies to assess (evaluate usefulness) each eEOV
- Methods to communicate the selected eEOVs to the community

Likely outputs of the workshop include:

- State-of-the-art publication
- Identification of required follow-on activities
- Publication for marine policy
- Publically available information

The workshop will likely be held in March/April 2014.

4.1.7 Korean Amundsen Sea project and workshop

Shin provided an overview of the Antarctic Oceanography workshop held in Incheon, Korea (14-16 May 2013), which reviewed the ongoing ocean and climate studies in the Amundsen Sea, and discussed future collaborations in the context of SOOS. Shin highlighted that a correspondence group had been formed to develop an Amundsen Sea Regional Study, under the umbrella of SOOS. The SSC were very supportive of this initiative and agreed that inclusion of this initiative within SOOS would be greatly beneficial to both parties.

Action – Shin to provide IPO with finalised workshop report for inclusion in SOOS newsletter. IPO and SOOS EXCOM to invite discussion with Amundsen Sea correspondence group regarding future activities.

4.2 Continued Connections

4.2.1 Partnership for Observation of the Global Oceans (POGO)

No report given.

4.2.2 Global Ocean Observing System (GOOS)

Schofield provided an update on recent GOOS RA activities, as discussed at the GRA Forum (Honolulu, 14-16 May), which he attended as a SOOS observer. He mentioned that the GRAs are currently developing an inventory of assets, or Asset Map, which will feed into GOOS. The SSC suggested it could be useful for SOOS to also develop an Asset Map.

Action – IPO to consider preparation of a SOOS Asset Map and discuss with EXCOM.

4.2.3 World Meteorology Organisation's Executive Council Panel of Experts – Polar Observations Research and Services (WMO EC-PORS)

Newman provided the SSC with an overview of EC-PORS and their recent activities, as outlined in the EC-PORS presentation (Appendix 5).

4.2.4 Climate and the Cryosphere (CliC)

Klepikov gave a brief presentation on new CliC activities. He highlighted a number of CliC-funded priority projects that were relevant to SOOS, including Antarctic Ice Sheet and Ocean coupled model (D. Holland), Understanding linkages between cryosphere elements (R. Massom), Coordination of cryosphere for model evaluation and prediction (D. Dahl-Jensen), and the WCRP grand Challenge “Cryosphere in a Changing Climate”, which will have a workshop in October.

4.2.5 CLIVAR

No report given.

4.3 SOOS Endorsed Programmes

Newman reminded the SSC of the role that SOOS can play in providing endorsement to research projects and programmes. The SSC agreed that this was an important community-building activity and that they would continue to encourage researchers to apply for endorsement.

The SSC also discussed the merits of a recent request for endorsement by POLAR POD, but requested further information before a final decision. It was agreed that if further information was not available at present, a Proof of Concept could be endorsed.

Action – Swart to request additional information from POLAR POD.

[NOTE – Swart has since contacted POLAR POD with a request for more information. Jean-Louis Etienne has stated that the scientific programme and data policy is not yet developed and is being discussed in the coming months. Jean-Louis will re-contact SOOS for endorsement once these issues are resolved]

5. SOOS’ Stance on Intergovernmental Issues

The SSC discussed the role of SOOS in providing expert advice and comments on international intergovernmental issues. The SSC agreed that it would not comment on intergovernmental issues.

6. Data Management

6.1 SOOS Data Management

Finney provided an overview of SOOS Data Management and the SOOS Data Portal. She outlined the concept of Data Aggregating Nodes and informed the SSC of the resources required to provide the data and data infrastructure they need. Finney also requested that within the Thematic Workplans, the SSC identify the key sources of data that are currently being used to meet science needs, so that the DMSC can prioritise its targeting of these data sources/providers in terms of their potential contribution to the SOOS Portal.

The SSC also discussed the role of COMNAP in encouraging NAPs to submit all ship data to data centres. Finney highlighted that SOOS would benefit from this if data centres of the NAPs also agreed to make their data discoverable by the SOOS portal.

Action – SSC to include current and key sources of data in the Thematic workplans, so that the DMSC can prioritise its targeting of data providers for the Portal.

6.2 Southern Ocean Knowledge and Information - SOKI

Constable gave the SSC a summary of SOKI. The SSC agreed that SOKI could be a powerful tool in providing a forum for exchange and review of material. Constable enabled access to SOKI for all SSC members and observers, and invited them to use and review the wiki.

Action – SSC to provide feedback to Constable on SOKI utilities.

Action – Newman, Finney and Constable to discuss connection of SOKI with SOOS website.

7. Scientific Steering Committee Membership and Activities

7.1 SSC Membership

Newman outlined the current structure of the SSC and length of membership, and invited the SSC to discuss ideas to prevent all members rotating off the committee at the same time, given that all members joined in the same year. The following decisions were made:

- Membership should be 3 years, with the option to re-new for second term on invitation by SCAR and SCOR.
- Current members will be invited for a second term of variable length – some 1 year, 2 years and 3 years – the decision on how these terms are distributed will be made by SCAR and SCOR following discussion with the SSC and EXCOM, and will try to ensure overlap of old and new members within a Theme.
- An open call for nominations will be advertised at the end of 2013 for up to two new members – the expertise of which will have to contribute to filling the knowledge gaps identified in the Thematic workplans (Discussion outlined in Session 3). Broad geographic representation will also be sought.
- Ex-officio membership can also be increased to ensure close collaboration of relevant organisations as required – with the understanding that ex-officios self-fund attendance at SOOS meetings.

Action – IPO to advertise call for nominations at the end of 2013.

8. Communications Strategy and Product Development

8.1 Website and Internet

8.1.1 Website:

Newman asked for feedback from the SSC on the website and associated databases. Wooding suggested it would be good to have a section that gives an overview on where SOOS is going and what has been achieved so far. The SSC also suggested having a page that informs the community of the gaps in observations and how they can contribute. It was also raised that the News items should be more dynamic and include information on voyages and projects.

Action – IPO to implement suggested changes to website.

8.1.2 Members Area:

Newman outlined the status of the members area and asked the SSC to subscribe to the website to ensure they get access to the members only area.

Action – SSC to ensure they are subscribed to the website.

8.2 Products and Merchandise

The SSC discussed the suggestion by Rintoul for a newsletter that informs on upcoming voyages, deployments and projects. The SSC agreed that this would be important information to disseminate, and discussed the best way to ensure this information is provided to the IPO on a regular basis. It was agreed that the newsletter would be in html format, with dot point highlights linking to the website. This would enable readers to scroll through short list of article headings and click for more detailed information. It was agreed that the newsletter should be sent out whenever there were 5 information points to publish. Initial points to include – report on the Korean Amundsen workshop, and the report on the Under Ice workshop.

Action – IPO to design new newsletter format and initiate development of first issue – including Korean W/S and Under Ice report.

8.3 Meetings

Newman went through the list of upcoming meetings of relevance to SOOS, and confirmed SSC attendance. Costa agreed to look into representing SOOS at the Latin American Antarctic Science Congress. SSC members highlighted a number of meetings missing from the list.

Action – SSC members to provide Newman with details of meetings missing from the list. Newman to follow up with Costa re: his attendance at the LASC.

[NOTE – Costa has since confirmed attendance at LASC]

8.4 National Representatives

Newman detailed the nominations received for new National Representatives. The SSC approved both nominations. The SSC also suggested that SOOS should request nominations for representatives from Chile and Argentina, as South America is not well represented in SOOS. It was noted that this could be done during participation in the Latin-American Antarctic Science Congress.

Action – IPO to notify K. Kovacs and S-H Lee of SSC decision, and initiate discussions on South American representatives.

9. 2014 SSC Meeting

Newman outlined the potential locations for the 2014 SSC meeting. The SSC agreed that it would be best to accept one of the two offers to host the meeting. It was agreed that holding the meeting in Hobart would likely be cheaper, given that a number of SSC members are from Hobart. However, it was also agreed that it could be of great benefit to accept the offer by Norway, as Norway has not yet been directly involved in SOOS activities.

It was decided that the IPO would estimate costs for both offers and ask the potential hosts to indicate their preferred timing of the meeting. This information would then be given to the SSC for final decision. If possible, the SSC would accept one offer for 2014, and defer the second offer for the 2015 meeting.

Action – IPO to estimate costs of both offers.

10. Other SOOS Matters

No other matters were raised.

SESSION 2: WORKPLANS & KNOWLEDGE GAPS

2.1 Presentation of Individual WorkPlans

2.1.1 Theme 1 and 2 – Heat and Freshwater Balance, Overturning Circulation

Garabato presented the Workplan for Themes 1 and 2. He highlighted a number of key issues:

- Need the involvement of the data assimilation community.
- Need to continue present level of observations but enhance technological developments for deep ocean (below 2000 m) and sea ice zone. These are the two blind spots in current observations.

Garabato also outlined those key objectives that are achievable now, and those that require technological innovation (specifically with regard to under ice measurements).

Achievable now:

- Extension of meridonal oceanographic sections across the Antarctic continental shelf and new short cross-shelf sections near Antarctic bases.
- Extension of the Argo network to deep ocean and inclusion of O₂ sensors (for ventilation)
- Regular measurements of freshwater tracers (e.g. $\delta^{18}\text{O}$, noble gases) on existing transects

Achievable with technological development:

- Establishment of an array of under ice (possibly acoustically tracked) Argo floats that can navigate the shelves, low-cost shelf/shelf-edge moorings, ice-tethered profilers and under-ice gliders, focussing on key shelf-ocean exchange areas (as was discussed at the SOOS Under Ice workshop 2012).
- Remote Sensing – development of techniques to estimate sea-ice thickness and under-ice sea level from satellite measurements, and continuation of satellite measurements of sea ice drift (CalVal needed!).

The SSC then discussed the workplan, with the following key points made:

- Satellite data are imperative and need developing, e.g., validation of Aquarius salinity data
- Repeat hydrography measurements across shelf regions would also be important for ecosystem research
- Identification of quantified observation targets is important – knowing how often and where measurements should be taken will help stretch resources to cover all scientific requirements
- Air/sea flux data are very sparse so any additional measurements are beneficial

2.1.2 Theme 3 – Ice Sheets and Sea Level

Wahlin presented the Workplan for Theme 3. She highlighted a number of key questions:

- Why are some continental shelves flooded by warm CDW, while others only have modified (colder) versions of it?
- What forces the warm water onto the shelf?
- How can we predict the melt rate?
- How does temperature, melt rate, and grounding line location change with climate (on decadal timescales)?

Wahlin then summarised the observations required to address these questions, and highlighted that the key gaps in knowledge were:

- Winter data (there is a strong summertime bias)
- Lack of long time series
- Some areas are very poorly known (e.g., bathymetry, CTD)
- Grounding line cannot be measured

The SSC discussed the presentation, and noted the requirement for continental shelf measurements and under ice measurements that were also highlighted in Themes 1 and 2. The requirement for sharing of technological advances was also raised, in particular with regard to defence force advances in under ice technology, which is currently unavailable for scientific use. It was also proposed that basic understanding of the bathymetry around ice shelves could be extended by relatively minor re-routing of ship tracks. The SSC also suggested forging a connection with the terrestrial glaciological community, specifically with regard to identifying grounding lines.

2.1.3 Theme 4 – Carbon

Tilbrook presented the workplan for Theme 4. He outlined the key issues of carbon research in the Southern Ocean as:

- Quantifying the uptake and storage of CO₂ by the Southern Ocean
- Obtaining the data required to determine the sensitivity of the uptake to climate change
- Identifying and measuring ocean acidification change and effects

Tilbrook highlighted a number of international initiatives, such as SOCAT, GLODAP and RECCAP, and stressed the summer bias in current measurements, which limits understanding of seasonal variability and inhibits our ability to quantify variability and trends in CO₂ uptake and release.

The key knowledge gaps were identified as:

- Interannual variability in air-sea carbon exchange and impact of the uptake efficiency on the global carbon budget
- Limited knowledge on what is going on in the seasonal sea ice zone
- Limited data from shelf regions and polynyas
- Lack of an ocean acidification observing networks, including coastal regions

Tilbrook suggested that important measurements, such as O₂ and pH, could be taken routinely by deploying sensors from Antarctic bases, and reiterated the importance of calibration, to ensure data quality. He emphasised the following points:

- All ships should already be equipped with CO₂ sensors, and at a minimum should be measuring T, S, and pCO₂, but could also easily measure TCO₂, alkalinity, pH, nutrients, O₂/Ar and bioptical parameters.
- Time-series moorings are very important, and require international cooperation for deployment, recovery and sampling.
- New sensor technology and platforms are providing a major boost to the capacity to measure biogeochemical parameters in the region.

The SSC discussed the Theme 4 presentation. It was agreed that developing a list of existing moorings would be important, and would enable identification of possibilities for adding new sensors. It was also agreed that important data could be obtained with relatively small effort if nations agree to routinely collect measurements from Antarctic bases. The SSC again noted the overlapping requirements of Theme 4 with Themes 1,2 and 3, particularly with respect to winter data, data in the ice zone, and data from shelf regions. The importance of communicating with the GEOTRACES community was also noted.

2.1.4 Theme 5 – Sea Ice

Ackley presented the workplan from Theme 5, and outlined the sea ice Essential Climate Variables that are measurable by satellite observations on a circumpolar basis (Ice cover (extent and concentration), Ice thickness, Ice types, Ice drift, and snow depth), the effectiveness of existing methodologies, and the role of SOOS in enhancing sea ice observations. Ackley indicated that SOOS could play an important role in the following:

- Sea-Ice Concentration/extent: Enhancing existing ship-based measurements and work to ensure better quantification of concentration estimates using digital cameras and Unmanned Aircraft Systems. This is key to further the use of satellite observations of ice concentration as an EOVS.
- Sea-Ice Thickness: Detailed Cal/Val experiments using ship-based Terrestrial Lidar and AUV swath mapping, with development of 2-D algorithms for conversion of elevation to ice thickness from field data.
- Sea-Ice Types: Deployment of ice mass balance buoys in different regions, cross-equipped with CTD, O₂, biology and meteorological sensors.

- Sea-Ice Drift: Comparison and Cal/Val of satellite-based estimates with buoy arrays for both drift and deformation. Meteorology and upper ocean data on pressures, winds and ocean heat flux is critical for calibration of for ice/ocean and climate models.

The importance of other international efforts, such as ICEBell, ICEBridge and SIPEXII were mentioned. Ackley also indicated that, as with the other Themes, measurements from Antarctic bases would greatly benefit this Theme. The SSC discussed the Theme 5 workplan. It was agreed that, where possible, it was important to push for the inclusion of Airborne Lidar and cameras on aircraft and helicopters, and that this should be discussed with COMNAP. The importance of observations during winter were also highlighted, in particular in polynyas.

2.1.5 Theme 6 – Ecosystems

Constable presented the workplan for Theme 6, and outlined 4 regional sections that could be used for biological assessments – East and West Pacific, Atlantic and Indian, with a delineation between polar and sub-tropical (to 30°). He then summarised existing activities (remote sensing, underway, ship/on station, land-based) and highlighted the need to integrate land-based studies with marine/ship-based studies to provide more integrated ecosystem studies.

Constable detailed the required elements of an ecosystem observation programme, including identification of Ecosystem EOVs (eEOVs) and standardisation of methods, and then outlined the development of sub-groups to manage specific tasks:

- Standardisation of methods
- Acoustic methods and algorithms
- Ocean colour methods and algorithms
- Tracking methods and algorithms (CLIOTOP)

A timeline of activities was then presented, highlighting upcoming workshops and meetings, existing action groups (e.g., ICSU proposal, ICED Action Groups), and coordination of land- and ship-based activities (e.g., through COMNAP/SOOS workshop).

The SSC discussed the presented workplan of Theme 6. It was suggested that SOOS should identify what overlap can be made between the biological transects outlined in the workplan and those of GO-SHIP. It was also agreed that where possible automated systems should be included in project plans, to cover the seasonality beyond the ability of ship-based sampling and to help with calibration of ocean colour. The benthos was also highlighted as a major knowledge gap that needs to be addressed.

2.2 Observational Gaps

The SSC then identified the top 3 gaps in observations for each Theme, that should be identified as “priority observations” for the coming years:

Theme	Priority Observations
1 and 2	Deep ocean T, S and O ₂ measurements
	Freshwater Tracer (18O, noble gases) measurements
	Shelf/slope and under ice measurements, focussing on key regions of shelf-ocean exchange and polynyas
3	Bathymetry under and near ice shelves
	Year-round, sustained measurements of T, S and O ₂ under and near ice shelves
4	Filling temporal/spatial gaps (using autonomous platforms)
	Ensure all ships are taking validated measurements of essential variables
	Develop time series measurements near coastal Antarctic stations
5	Sea-ice thickness from ships and coastal stations
	Sea-ice drift (meteorology, buoy arrays etc)
	Sea-ice extent and concentration observations
6	Standardised biological sampling
	Sampling offshore from land-based activities (e.g., integration across land to marine observations)
	Improved capability on ships (e.g., CPR, acoustics, predator tracking/diet)

2.3 General Discussions

A consistent point raised during the workplan presentations was a lack of up-to-date information on the ship-based and station-based measurements that are currently being made by all nations. It was agreed by all that this information is imperative in identifying observational gaps, accessing data, and leveraging resources. This request will be discussed with COMNAP delegates at the upcoming SOOS/COMNAP workshop in Seoul (7 July 2013) (Action item added under section 4.1.1).

Also reiterated was the need for information on the annual field plans for each nation. It was suggested that a map of planned cruise tracks with information on what research will be done, what equipment will be carried, where the data will go, and who to contact for more information, would be very useful. It was agreed that the POGO research cruise database would be a good template for this, and that it should be coordinated by COMNAP (Action item added under section 4.1.1).

As discussed previously, the need for consistency in sampling technique/methodologies, and appropriate calibration of equipment was highlighted. Wooding agreed that this information could be important to provide to NAPs, to ensure data quality and comparability. SOOS will work with active groups from Theme 6, to develop documents providing this information (Action item added under section 4.1.1).

It was also recognised that a first-order goal is to have uniformity in the basic measurements that are taken across all ships and Antarctic bases. A task group will be formed to develop a list of the baseline parameters and standard measures (“cheap and easy”) that could be made from all Antarctic bases/ships. This document should also include links to information on what stations are currently measuring (on a routine basis), so it needs to be coordinated with COMNAP. Ackley,

Meredith, Schofield, Tilbrook and Constable all volunteered to be involved in this Task Group (Action item added under section 4.1.1).

The SSC then discussed how the Thematic workplans and priority observation gaps can be used. It was agreed that the workplans need to be compiled into an overall SOOS workplan, with cross-cutting elements clearly elucidated. The overall workplan would clearly outline the priority gaps identified so that nations seeking to contribute to SOOS can identify which observations they will do. This way, nations can also clearly see where their efforts can have most impact. The map highlighted in section 3.2.2 will form the centerpiece of this document.

The document should outline the overall vision for SOOS and then identify the required actions and timelines for each theme, so that we could use it internally for planning and tracking, but also so that external communities can see what actions they might want to take to get involved in SOOS. Information on satellite data requirements, and key data repositories and requirements should also be included. Benefits to stakeholders should also be clearly stated.

The document should be revised annually, to keep it up-to-date and to keep SOOS moving in the right direction. It will be made available on the website, but SOOS will also distribute it proactively to national programmes and other bodies such as IGFA, Belmont Forum, NSF, NERC etc, so these communities can see the gaps and potentially tailor activity to address them.

Action – SSC to distil Theme workplans and develop Thematic timelines of activities for inclusion in overall SOOS Workplan. Schofield to compile first draft of document as outlined above (including general SOOS vision, and technological vision).

SESSION 3: STRATEGIC PLANNING

3.1 Achieving the SOOS 20-year Vision

Meredith outlined the recently published SOOS Vision and called for a discussion by the SSC on what the key components of this vision should be and how best to implement it.

The SSC discussed the steps required to achieve the mission and raised the following issues:

3.1.1 Technological developments: SOOS must identify what developments in technology are required. Towards this goal, SOOS will develop an Ocean Engineering Task Group that will identify requirements and determine “how and who”. This Task Group will form a cross-cutting Theme across all the other 6 Themes. It was also highlighted that an integrated and comprehensive data system is fundamental to what SOOS is trying to achieve. It was agreed that increasing SSC expertise to include 1-2 technologists for pushing the cyber and data development is imperative (hardware, software and data engineering – three levels of requirements).

Action – IPO and EXCOM to outline development of SOOS Task Group on Ocean Engineering.

3.1.2 Modelling: SOOS needs to identify the groups that are looking at modelling, data assimilation and infrastructure and bring them together to collaborate towards a common goal. This initiative should also include observationalists, to get communication across disciplines. Modelling is integral

to design of the field programme, and will help quantify the observational requirements for an optimised system.

Action – IPO and EXCOM to identify a timeline and agenda for coordination of modelling activities.

3.1.3 Funding: Funding is going to be a very important issue in achieving the long-term vision for SOOS. SOOS needs to “sell the system” by highlighting what SOOS data could be used for. To get support, SOOS must get others excited about the potential products (e.g., marine resource managers, etc.).

The SSC discussed why a Stakeholder should invest in SOOS and it was suggested that SOOS might need to update the SOOS strategy to capture current thoughts. Some examples as to why a stakeholder should sign on to SOOS:

- The IPCC Chapter on the Southern Ocean is full of gaps, and it is indisputable that the U.N. is already calling for information on the status of the Southern Ocean.
- Need to make clear that automation of observations makes things more cost effective in the long run – investment now will reduce burdens later because science voyages become secondary.
- The vision will enable fundamental science, inform management, and help to ensure sustainable use of resources.

Action – IPO to ensure information on why Stakeholders should invest in SOOS is included in the final Workplan document and is also outlined in the Sponsorship Package.

3.1.4 Regional Studies: A pilot study is an important step towards the SOOS Vision. The SSC discussed 3 potential options for a mid-vision pilot study, in recognition of the fact that observational requirements are different in different areas:

- **Flagship Projects:** Nations and organisations could collaborate to develop an integrated system that would target an area that is not well studied e.g., Amundsen Sea.

The SSC agreed that outlines of potential Flagship Projects should be developed (e.g., articulation of the capabilities required and where the geographical knowledge gaps are).

- **Enhanced Regional Study:** Development of an enhanced integrated system in a region that has an existing system of some kind e.g., Antarctic Peninsula Palmer LTER.

This option would require less initial input in infrastructure and logistics, but may have issues with regard to data accessibility. It would be important for SOOS to work with these communities now, to ensure access to the current data, so that any data collected during a SOOS Pilot Study could be seamlessly accessed by all. It was highlighted that Palmer LTER will be coming up for funding in 2014, and that a proposal from SOOS to use LTER as an Enhanced Regional Study could be developed following re-funding. It was agreed that such a proposal would develop naturally from the compiled Workplan document, which will outline data and cyberinfrastructure requirements.

- **Regional Study:** Development of an enhanced integrated system in a region that is characterised by a unique physical feature, e.g., Weddell Gyre, Kerguelen Plateau, or, in the case of SOBOM, the Antarctic Circumpolar Current.

The SSC discussed the range of options for pilot studies and agreed that a “SOOS Project Menu” of potential projects (across all three types) should be developed for nations and organisations to use for research proposal development.

Action – EXCOM to develop idea for SOOS Project Menu and pilot study and report back to SSC.

[NOTE – The EXCOM has since discussed the utility of the Project Menu and suggest that it would involve an enormous amount of work, and that many projects and initiatives are already developing in the identified areas. The EXCOM propose that these large international initiatives be developed as SOOS Regional Nodes (see section 3.3) and that the SOOS Pilot Study be a separate, SOOS-driven study in a single location.]

3.2 Required Activities in 2013/2014/2015

The SSC then outlined activities that are required within the next 2-3 years, to achieve the Theme Workplans.

3.2.1 Theme 1 and 2 (Circulation and Heat):

- 1) A workshop on air/sea fluxes.
- 2) An experiment or study focussed on the Weddell group.

Action – IPO to work with Theme 1 and 2 to draft a prospectus for an Air/Sea fluxes workshop.

3.2.2 Theme 3 (Ice Sheets):

- 1) Initiative to involve nations that do not have a ship in the science of Theme 3, for example, having them provide equipment. A day could be added to the FRISP 2014 workshop to focus on this idea.
- 2) A map showing locations of moorings and other activities could be done easily and would highlight areas where more coordination is required (e.g., formatted in similar way to the map included in the Biology Theme). The map would include the key areas / physical parameters that require sustained observations to address the science priorities for themes 1-3 (and possibly other themes too). This would be compared to what is currently happening, gaps could be identified, and SOOS could then sign up champions to address these gaps.

Action – Garabato to draft a Map.

3.2.3 Theme 4 (Carbon):

- 1) Workshop to encourage and develop observations (carbon and acidification) in the seasonal sea-ice zone and shelf waters.
- 2) SOOS workshop (involving other relevant organisations) to address the key issue of how changes in physical circulation is going to impact CO₂ fluxes and the global carbon budget in future.

Action – SOOS to draft a prospectus for both workshops.

3.2.4 Theme 5 (Sea Ice):

A number of workshops and meetings are already taking place that will contribute to implementation of Theme 5 workplan – for example, CliC Workshop on linking observations and modelling, WCRP meeting, re-development of the ASPECT Science and Implementation plan, and the Amundsen Sea workshop in 2014 (being organised by Korea). Additional requirements:

- 1) Enhancement of air/sea flux observations in the sea-ice zone (e.g., in collaboration with suggested workshop of Theme 1 and 2)
- 2) Development of the interactive map of field activities (as outlined in Theme 3 above)

Action – IPO to include Theme 5 in development of a prospectus for an Air/Sea fluxes workshop.

3.2.5 Theme 6 (Biology):

- 1) Filling in of Table 2 in Workplan
- 2) Establishment of the Theme 6 sub-groups
- 3) Identification of eEOVs (early 2014 – ICSU-funded SCOR/SCAR workshop)
- 4) Workshop to review activities-to-date and consolidate plans, to be held at the end of 2014
- 5) Identify mechanisms of communication with other biological communities, e.g., CCAMLR working group on Ecosystem Management and Monitoring.

Action – IPO to help coordinate Table 2 development.

Action – IPO to help coordinate the establishment of the sub-groups identified in Theme 6 workplan.

Action – IPO and Theme 6 leaders to draft a prospectus for a SOOS biology workshop, to be held at the end of 2014.

Other general SOOS activities that were discussed include:

- 1) A large SOOS conference that could be coordinated with other relevant observing systems (e.g., meteorological, terrestrial, ice sheet, etc.). It was suggested that this could be a suggested topic of focus for a SCAR OSM.
- 2) Development of a number of workshops that target major challenges – for example, data. These workshops could bring in expertise that is not necessarily Antarctic/Southern Ocean, as required.

Action – IPO to review workplans and vision and identify any key issues/challenges that sit across all Themes, and which may require focussed workshop or activities.

Action – Meredith to discuss the SCAR OSM idea with SCAR representatives.

3.3 New capabilities required in the SSC

The SSC then identified a number of capabilities that are required on the Steering Committee to achieve workplans, these include researchers with expertise in Ice Sheets, Technologists (e.g., hardware, cyberinfrastructure), and data assimilation. The SSC also recognised that many nations and regions are not represented on the committee (e.g., France, Japan, S. America, Korea).

The SSC discussed the possibility that coordination of plans could be discussed on a regional level through the development of SOOS Regional Nodes. The idea would be that countries in one Node would meet to discuss collaborative efforts and coordination of resources.

Action – IPO to consider these gaps in capabilities and nations when drafting the call for nominations for Steering Committee membership at the end of 2013.

Action – IPO and EXCOM to further develop the idea of SOOS Regional Nodes.