



Paper 13
SCAR Group
SG

Agenda 2.2
SOOS
PS/LS/GS

Person
Responsible:

Louise
Newman

SCAR Executive Committee Meeting 2017

Brno, Czech Republic, 31 July - 2 Aug 2017

Southern Ocean Observing System **2016-2017 Report**

Report Author(s):

Anna Wahlin (Co-Chair); Oscar Schofield (Co-Chair); Andrew Constable (Vice-Chair); Sebastiaan Swart (Vice Chair); Louise Newman (IPO)

Summary of activities from 2016-17 and any other important issues or factors (<150 words):

From 2016-17, SOOS has delivered the Database of Upcoming Expeditions to the Southern Ocean (DueSouth); identified and made discoverable a network of over 600 current and historical moorings in the Southern Ocean; rescued 20 years of data from 63 international moorings; developed 4 regional networks to coordinate Southern Ocean observational efforts; published 8 peer-reviewed strategic and/or review publications; brokered an agreement with EMODnet and JCOMMOPS for delivery of interactive map of Southern Ocean observing platforms (SOOSMap); held 11 meetings/workshops with significant international sponsorship of these events; supported the development of the CCAMLR Marine Protected Area monitoring plan; and delivered the 5-Year Implementation Plan and 5-year Business Plan.

SOOS held its annual EXCOM and Scientific Steering Committee meetings in mid-June. Several key decisions from that meeting are reported here, noting that approval from the co-sponsors SCAR and SCOR is still required before they are confirmed.

[Note – Acronym list provided at the end of this report]

Recommendations that EXCOM should consider (if any): *Please indicate if approval is necessary or if they are just asked to note information.*

- 1) SOOS requests approval of the recommended changes to the membership of the Scientific Steering Committee and Executive Committee (Appended document 2).
- 2) SOOS requests final approval of the 5-Year Implementation Plan – specifically pages 16-17, which provides the timeline of deliverables as recommended by SCAR EXCOM during previous review (Appended document 3)

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- 3) SOOS requests a videoconference between SCAR EXCOM, SCOR EXCOM and SOOS EXCOM, to discuss key strategic issues, governance, and the long-term vision for SOOS within SCAR and SCOR.
- 4) SOOS requests that SCAR EXCOM allow the annual report of SOOS to be used as the basis for this and future reports to SCAR EXCOM (Appended document 1).

Progress and Plans:

Major Activities and Significant Progress from the past year (<500 words):

See SOOS 2016 Annual Report (Appended Document 1). Updates since 2016 are shown under “New outputs and deliverables” below.

Major Future Initiatives and Actions, including rough timeline, for at least the next 2 years (<500 words):

See page 16-17 of SOOS 5-Year Implementation Plan (Appended Document 2)

Please list any new outputs and deliverables (including publications and products that your group feels are part of your achievements):

Most significant milestones for SOOS in 2016/2017:

Formation of Regional Working Groups

In 2016/2017, SOOS initiated the development of 4 of 6 Regional Working Groups (RWGs) for the Southern Ocean. Two workshops have been held (West Antarctic Peninsula; Weddell/Dronning Maud Land), and two more are planned for late 2017 (Indian Sector (August) and Ross Sea (September)).

DueSouth: Database of Upcoming Expeditions to the Southern Ocean

DueSouth is an online tool that enables the community to share information on upcoming field campaigns and voyages. It contains user-provided information on voyages and their leadership, as well as information on the projects onboard. It was developed by Data Management Sub-Committee (DMSC) member, James Cusick, from the Australian Antarctic Division, and the SOOS data officer, Pip Bricher. For upcoming voyages, you can report the voyage ship, route, dates, and names and contact details for the scientific leadership. For upcoming projects, you can report the voyage or research facility on which the project will be conducted, brief details of the project, and names and contact details for the project leadership. The database can be searched by text, dates, or geographic location.

DueSouth is currently deployed and operational at <https://data.aad.gov.au/duesouth/>. It will be moved to its own url <http://duesouth.soos.aq> in the coming months.

Mooring Data Rescue Project

Data from 63 moorings spanning nearly 20 years, have now been converted to netCDF files and had metadata applied. The mooring data comes from Italy, Sweden, New Zealand, Poland and the US, and would not have been archived and made available without SOOS' help. Data archival is not yet 100% complete for the New Zealand and US records, but once approved by the PI's, it will be archived at NOAA NCEI. This data will then be discoverable and fully accessible by the community for the first time. This project was supported by NOAA “Big Earth Data Initiative” funding, and this project will continue to rescue mooring data for the remainder of 2017, with

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identified data from New Zealand, Sweden, Italy and the US. All NCEI data is fed to the Antarctic Master Directory at NASA GCMD. Additionally, this project has prompted greater mooring data archiving efforts in China and South Korea, and has resulted in Polish benthic temperature data also being published in NCEI.

International Southern Ocean Mooring Network

SOOS is developing the first central list of all historic Southern Ocean moorings, and we have so far identified over 600 moorings that have been or are deployed in the Southern Ocean. This list is displayed through an interactive map (currently 308 moorings shown, with over 300 more identified and to be added) with links to the data record where possible. This list will continue to be updated by SOOS, and will feed into the new SOOS Map initiative. The mooring map is available here <http://soos.aq/activities/soos-at-sea/moorings>

SOOS Map

SOOSmap is a map of observing platforms in the Southern Ocean that will show the current and historical state of the Southern Ocean Observing System, providing information on gaps in sampling effort in time, space, and scientific discipline. The map will display data layers, such as Argo floats, MEOP seal tagging, regular GO-SHIP transects, moorings, gliders, drifting buoys, among others. It will be searchable by time and platform. Following a number of meetings and discussions throughout 2016/17, this tool will be delivered by EMODnET (in collaboration with JCOMMOPS), utilizing the infrastructure that they have already built for EuroGOOS and other regional observing systems (see <http://www.emodnet-physics.eu/Portal>). Delivery is planned for the end of 2017.

8 Peer-reviewed publications (all available [here](#))

1. Hendry, K., Henley, S., Schofield, O. Moving towards an integrated approach for understanding a changing West Antarctic Peninsula. EOS Transactions of American Geophysical Union. (In press)
2. Mazloff, M.R., et al., In Press: Southern Ocean. In: State of the Climate in 2016, American Meteorological Society Bulletin,
3. Saltee, J.-B., 2016: Southern Ocean. In: State of the Climate in 2015, American Meteorological Society Bulletin
4. Pope, A., Wagner, P., Johnson, R., Shutler, J.D., Baeseman, J., Newman, L., 2016: Community review of Southern Ocean satellite data needs, Antarctic Science, DOI:10.1017/S0954102016000390
5. Schofield, O., Newman, L., Bricher, P., Constable, A., Swart, S., Wåhlin, A., 2016: Moving Towards Implementation of a Southern Ocean Observing System, Marine Technology Society Journal, 50(3):63-68., DOI:10.4031/MTSJ.50.3.8
6. Newman, L., et al., 2016: Understanding the Southern Ocean through sustained observations, Bulletin of the Australian Meteorological and Oceanographic Society, Volume 28 No.6 Dec/Jan 2015/16
7. Meredith, M.P., et al., 2016: The interdisciplinary marine system of the Amundsen Sea, Southern Ocean: Recent advances and the need for sustained observations. In: Deep Sea Research Part 11: Topical Studies in Oceanography - Special Issue "International efforts to understanding of the changing Antarctic Climate: The KOPRI expedition to the Amundsen Sea. V. 123, doi:10.1016/j.dsr2.2015.12.002
8. Constable, A.J., et al., 2016: Developing priority variables ("ecosystem Essential Ocean Variables" — eEOVs) for observing dynamics and change in Southern Ocean ecosystems, Journal of Marine Systems, 161., DOI:10.1016/j.jmarsys.2016.05.003

If your Group produces data, please report any new data generated and links to inclusions to the Antarctic Master Directory, etc.

Since May 2016, the SOOS GCMD portal has increased the number of records that have a “Get Data” link by 2% to 2418 records. The SOOS portal hosts many of the same coastal Southern Ocean data as the AMD, but extends to 40°S, compared to 60°S for the AMD. The total number of records in the SOOS GCMD portal has decreased slightly in the past year, due to changes in the way NASA archives their satellite data. Negotiations on translating metadata records from other data centres into a standard that can be incorporated by the GCMD continue. Visits to the SOOS portal have increased by 80% in the past year and the SOOS portal is now the eighth most popular GCMD portal (up from 11th in 2016).

SOOS generally acts as a broker for connecting scientists and data centres, rather than publishing data ourselves. However, as stated above, 63 new mooring records have been added to NCEI, which feeds metadata to the AMD and SOOS portal on the NASA GCMD. (NB – it may take a month or more for these records to be transferred to the GCMD, due to the way the two systems interact).

Budget

Planned use of funds for 2017 and 2018

Month/Year (MM-YY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
Apr/May 2018	Support for SOOS SSC Meeting, and side event on Observing System Design Hangzhou, China	10k	Louise Newman	newman@soos.aq
TBA 2019	SOOS SSC Meeting, Wellington NZ	To be determined and requested in 2018	Louise Newman	Newman@soos.aq

Briefly describe what the funds will be used for and what the desired results are:

All funds from SCAR are used to support the travel of SOOS SSC members to attend the annual SSC meetings.

Provide an estimate on the % of the budget to be used for support of early career researchers:

Agreement at present is that funds are to be used for SOOS SSC members only. Two of the current SOOS SSC members could be classified as Early Career Researchers (Seb Swart, Jean-Baptiste Sallee), however this may change for the 2018 SSC following the open call for nominations at the end of 2017. The use of the funds by individual SSC members varies from year-to-year depending on their ability to obtain other funding in support of their SSC meeting participation. We cannot, at this stage, predict which SSC members will be requesting support for the 2018/2019 meetings.

2017:

2018:

Provide an estimate on the % of the budget to be used for support of scientists from countries with developing Antarctic programmes (as listed here: <http://www.scar.org/finances/contributions>):

In 2017, the SOOS SSC comprised 3 members from 2 “initial stages programs” and “Associate members” (Sweden, Turkey). In 2018, we will have at least 2 members from these same countries. The use of the funds by individual SSC members varies from year-to-year depending on their ability to obtain other funding in support of

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their SSC meeting participation. We cannot, at this stage, predict which SSC members will be requesting support for the 2018/2019 meetings.

2017:

2018:

Linkages

Please describe any direct support you receive for your activities beyond SCAR (eg. Funds from another organization for a workshop):

1. Scripps Institution of Oceanography: Host support for the 2016 SOOS EXCOM, SSC, Data Management Sub-Committee meetings, and joint SOOS-SOCCOM workshop (May 2016, USA)
2. Southern Ocean Carbon and Climate Observations and Modelling (SOCCOM): Joint SOOS-SOCCOM workshop (May 2016, USA)
3. University of Gothenburg: International workshop for the SOOS-Endorsed NECKLACE project (Oct 2016, Sweden)
4. Scientific Committee for Oceanic Research (SCOR) – Support for 2016 and 2017 Scientific Steering Committee meetings (jointly with SCAR)
5. Continued sponsorship of IPO by the Australian Research Council's Antarctic Gateway Partnership, Australian Antarctic Division, Antarctica New Zealand, and new IPO sponsorship by the University of Gothenburg (confirmed for 2 years) as a contribution to Data Officer salary.
6. SCAR support for West Antarctic Peninsula Workshop ice breaker (May 2017, UK)
7. British Antarctic Survey: Hosting of West Antarctic Peninsula Workshop (May 2017, UK)
8. Alfred Wegener Institute: Hosting and support for the 2017 SOOS EXCOM meeting; Scientific Steering Committee Meeting; Data Management Sub-Committee Meeting; SOOS-AWI Joint Symposium; OASIIS workshop (June 2017, Germany)
9. Ekman Foundation: Sponsorship of SOOS SSC Ice breaker (June 2017, Germany)
10. Partnership for Observation of the Global Ocean (POGO): Support for OASIIS workshop (June 2017, Germany)
11. Australian Research Council's Antarctic Gateway Partnership: Support for OASIIS workshop (June 2017, Germany)

Sponsorship of Upcoming Events

12. SOOS Southern Ocean Indian Sector workshop (Japan, 12-16 August 2017): National Institute of Polar Research (NIPR Japan); Australian Antarctic Division
13. SOOS Ross Sea Working Group workshop (Shanghai, China, 11-15 Sept 2017): Shanghai Jiao Tong University – local host; Science Office of Chinese Antarctic and Arctic Administration (Pending approval); Polar Research Institute of China; SOA First Institute of Oceanography; SOA Second Institute of Oceanography State Key Laboratory of Satellite Ocean Environment Dynamics; SOA Third Institute of

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Oceanography (Pending approval); Institute of Oceanography, Chinese Academy of Science (Pending approval); Qingdao National Laboratory in Ocean Science and Technology (Pending approval)

14. MEASO2018 (Hobart, Australia, April 2018): CAML; Australian Antarctic Division; ACE CRC; University of Tasmania; CSIRO; NIPR; ICED
15. 2018 SOOS Executive Committee and Scientific Committee meetings: Second Institute of Oceanography; State Oceanic Administration; SCAR; SCOR; other co-sponsorship TBA (Hangzhou, China, Apr/May 2018)
16. SOOS Working Group Co-Chairs and SSC meeting: Polar2018 venue provided by SCAR

Please list any major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR:

Key collaborations in 2016/2017 include:

- CCAMLR: *Quarterly meetings between SOOS IPO and CCAMLR Secretariat; SOOS reports to SC-CCAMLR and working groups (e.g., CEMP, EMM); CCAMLR representatives at all SOOS Regional Working Group workshops*
- CCAMLR Ross Sea Marine Protected Area planning efforts: *Strong collaboration between CCAMLR MPA planning efforts and the SOOS Ross Sea regional working group*
- Partnership for Observation of the Global Oceans (POGO): *Collaboration on development of OASIS working group and support for working group deliverables*
- Integrated Marine Observing System (IMOS): *Quarterly meetings with IMOS director; involvement of IMOS in Indian Sector working group; Collaboration on Global GliderDAC network*
- Global Ocean Observing System (GOOS): *Collaboration and engagement with GOOS Panels; Regular meetings with GOOS Regional Alliances Chair; SSC member involved on all GOOS videoconferences and GRA meetings; GOOS representative at SOOS SSC meeting*
- WMO Year of Polar Prediction (YOPP): *SSC member attending all YOPP meetings; Communication of YOPP requirements through SOOS newsletter; engagement with YOPP at annual SSC meeting*
- CLIVAR-CLIC-SCAR Southern Ocean Regional Panel: *Involvement of SORP rep in SOOS meetings; regular communication between SOOS IPO and SORP Chairs; Collaboration with SORP on YOPP engagement and EOVR review*
- Coalition of Legal Toothfish Operators (COLTO) and Australian Southern Ocean Fishing Interests: *Engagement of COLTO members in Indian Sector working group; engagement of SOOS in proposed COLTO data auditing efforts*
- Mesopelagic Southern ocean Prey and Predators (MESOPP): *Engagement of SOOS in MESOPP workshops and communication of MESOPP in newsletter*
- WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology in-situ Observing Programmes Support Centre (JCOMMOPS):

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Regular engagement with JCOMMOPS team for delivery of DueSouth and SOOS Map; developing engagement on registration of all mooring platforms

- Southern Ocean Carbon and Climate Observation and Modelling (SOCCOM): *Engagement with SOCCOM for float deployments; updates to community; collaboration on SOOS Map data layers*
- Association of Polar Early Career Scientists (APECS): *New decision for involvement of APECS rep in all SSC meetings, and all SOOS working groups (to be initiated by end 2017)*
- WCRP Climate of the Cryosphere (CliC): *Collaboration with CliC on delivery of Satellite data requirements review*
- WCRP Climate and Modelling (CLIVAR): *Report to CLIVAR SSG*
- European Marine Observation and Data Network (EMODnet): *Collaboration on delivery of SOOS map*
- AntClim21: *Involvement of representative at SOOS SSC meeting*
- SCAR Data Management (SCADM): *Collaboration on AMD and SOOS GCMD portal; collaboration on data vision paper*
- ICED, AntECO, AntERA, AntClim21, CLIOTOP, ACCE, EGBAMM: *Collaboration on MEASO2018 conference*

Outreach and Capacity Building

Please describe any outreach, communication and capacity building activities that your group participates in. Also provide information on activities that demonstrate effectiveness as a network. (coordinating activity for your discipline/topic, i.e. mailing list and diversity of scientists involved) (<250 words):

Refer to Annual Report

As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Professor Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. **Please list one or more people (name and email address) from your Group who would be willing to serve as reviewers for the next few years.**

TBA

Membership

Information on membership and proposed changes is provided for SCAR comment in Appended Document 3.

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End

** Please include any APECS representative / Junior Officers*

Other members

First Name	Last Name	Affiliation	County	Email

Requests to the Secretariat:

If there are specific administrative tasks you would like help with such as your webpages, mailing list, online meeting tools, etc., please include them below:

SOOS requests support for advocating to national programs and researchers, the use of DueSouth database as a planning tool. SOOS also requests continuation of support for communication of upcoming meetings and activities through the SCAR network as appropriate.

Acronyms used in this report:

ACE CRC – Antarctic Climate and Ecosystems Cooperative Research Centre
AMD – Antarctic Master Directory
CAML – Census of Antarctic Marine Life
CCAMLR – Commission for the Conservation of Antarctic Marine Living Resources
CEMP – CCAMLR Ecosystem Monitoring Program
CSIRO – Commonwealth Scientific and Industrial Research Organisation
DueSouth – Database of Upcoming Expeditions to the Southern Ocean
WG-EMM – CCAMLR Working Group on Ecosystem Monitoring and Management
EMODnet – European Marine Observation and Data Network
EuroGOOS – European Global Ocean Observing System Regional Alliance
EXCOM – Executive Committee
GO-SHIP – Global Ocean Ship-Based Hydrographic Investigations Program
ICED – Integrating Climate and Ecosystem Dynamics
JCOMMOPS – Joint Technical Commission for Oceanography and Marine Meteorology
in-situ Observing Programmes Support Centre
MEOP – Marine Mammals Exploring the Oceans Pole to Pole
MPA – Marine Protected Area
GCMD – NASA Global Change Master Directory
NECKLACE – Network for the Collection of Knowledge on melt of Antarctic ice shelves
NOAA NCEI – National Oceanic and Atmospheric Administration National Centers for
Environmental Information
OASIS – Observing the ocean beneath Antarctic sea ice and ice shelves
SCOR – Scientific Committee on Oceanic Research
SOCCOM – Southern Ocean Carbon and Climate Observations and Modeling



THE SOUTHERN OCEAN OBSERVING SYSTEM

2016 ANNUAL REPORT

SOOS Activities and Milestones for 2016

All milestones and activities herein are reported against SOOS' four key objectives as defined in the *[interim 5-Year Implementation Plan](#)*.

Milestones

Objective 1: Facilitate the design of a comprehensive and multi-disciplinary observing system for the Southern Ocean:

- ecosystem Essential Ocean Variables (eEOVs) publication (<http://soos.aq/resources/recent?view=product&pid=38>)
- Outreach with the global ocean observing community on Southern Ocean EOVs
- Coordination of Southern Ocean contribution to the Global Ocean Observing System (GOOS) Biology Panel's survey of sustained biological monitoring towards identification of global eEOVs
- Discussion of OOPC-GCOS-GOOS EOVS specification sheets for Southern Ocean requirements

Objective 2: Unify and enhance current observation efforts and leverage further resources across disciplines, and between nations and programmes

Regional Working Groups (RWG):

- **West Antarctic Peninsula Working Group ([WAP WG](#)):**
 - Leadership has been developed.
 - First workshop is organised for May 2017 (<http://soos.aq/calendar?view=event&cid=87>)
 - Workshop is hosted by BAS, sponsored by SCAR and SOOS
- **Southern Ocean Indian Sector WG ([SOIS WG](#)):**
 - WG has preliminary approval and is currently building membership.
 - First workshop is being planned for late 2017, likely to be held in Japan.

- Workshop in Japan to be sponsored by SOOS
- **Ross Sea WG ([Ross](#)):**
 - WG has preliminary approval and is currently building membership.
 - First workshop is planned for late 2017, likely to be held in China.
 - WG leaders are working with CCAMLR Ross Sea MPA planners to ensure alignment of efforts.
 - Workshop in China to be sponsored by SOOS

Capability Working Groups ([CWG](#)):

- **Southern Ocean Air-Sea Fluxes ([SO-FLUX](#)):**
 - Officially approved at the 2016 SSC meeting.
 - Leadership meeting was held alongside Ocean Science Meeting to discuss key requirements for the pilot study
 - A [workshop report](#) was published in EOS
 - 4 focussed Task Teams developed
- **Censusing Animal Populations from Space ([CAPS](#)):**
 - A [workshop](#) was held alongside SCAR OSC, producing the following [report](#).
- **Ecosystem Essential Ocean Variables ([eEOVs](#)):**
 - WG has preliminary approval and is currently building membership.
 - [Community paper](#) was published,
 - Community presentation was given (IMOS Planning, March 2016)
- **Observing and Understanding the Ocean below Antarctic Sea Ice and Ice Shelves WG ([OASIIS](#)):**
 - Successful proposal to Partnership for Observation of the Global Ocean (POGO) for workshop support of a working group.
 - Workshop to be held 14-17 June 2017, hosted by AWI and sponsored by Australian Research Council's Antarctic Gateway Partnership, POGO and SOOS.

Task Teams ([TT](#)):

- **Southern Ocean Satellite Data Task Team ([Satellite TT](#)):**
 - The community report has been [published](#) and made open access
 - Task Team now complete

Key Products:

- **Southern Ocean Community annual calendar**
 - Initial static version of calendar provided to community [here](#)
 - Scoping for automated, dynamic calendar has been initiated and will be implemented by end of Feb 2017.

- **Maps of observing system elements**
 - Initial static version of maps provided online [here](#)
 - Proposal for IMAS-UTas Professional Development award for P. Bricher (successful)
 - Completion of Penn State University course on Open Web Mapping
 - New dynamic, online maps currently in development
- **Field Projects Planning Database ([Here](#)):**
 - Information on current and planned national/international field campaigns listed in static [table](#) on website
 - Community consultation and stakeholder engagement for development of database
 - Beta version of online, interactive [Field Project Planning Database](#) developed by Australian Antarctic Division and SOOS DMSC
 - Currently being tested by community
- **Southern Ocean Mooring Network**
 - Initial static version of mooring locations provided to the community
 - Dynamic map of retrieved and currently deployed moorings developed and provided online [here](#)
 - Initial information on mooring data provided
 - Discussions ongoing with data owners to populate the map continuing
 - Mooring data rescue work continuing (David Pasquale writing code to standardise data formats and document files for global mooring data).
- **Focussed Working Group listservers**
 - Initial scoping of options to enable working group-specific email lists for two-way correspondence between working group leaders, and working group members and interested communities

Meetings/Workshops:

In 2016, SOOS held the following meetings and workshops:

- **SOOS Executive Committee meeting** (May 2016, Scripps, USA)
- **Joint SOOS-SOCCOM [Workshop](#)** (May 2016, Scripps, USA)
- **2016 SOOS Scientific Steering Committee [meeting](#)** (May 2016, Scripps, USA)
- **2016 SOOS Data Management Sub-Committee [meeting](#)** (May 2016, Scripps, USA)
- **SCAR OSC Scientific Session** (Aug 2016, Malaysia)
- **International [workshop](#) for the SOOS-endorsed [NECKLACE project](#)** (Oct 2016, Sweden)

In 2016, SOOS was presented or represented at the following 21 meetings:

- **POGO** (M. Meredith, R. Coleman; Japan, Jan 2016)
- **Ocean Sciences** (L. Newman, P. Bricher, M. Mata, M. Mazloff, O. Schofield, M. Meredith, S. Ackley, S. Diggs, A.N. Garabato, JB Saltee, A. van de Putt, R. Proctor, S. Gille; USA, Feb 2016)

- **New Zealand Sea-Ice Symposium** (M. Williams; NZ, Feb 2016)
- **IMOS Planning Meeting** (L. Newman; Aus, March 2016)
- **Joint CEP and SC-CCAMLR Workshop** (A. Constable; Chile, May 2016)
- **South African Network for Coastal and Oceanic Research** (S. Swart; S. Africa, June 2016)
- **Antarctic Treaty Consultative Meeting and CEP** (J. Baeseman; Chile, June 2016)
- **SCAR OSC** (L. Newman, P. Bricher, A. Constable, A. Wåhlin, O. Schofield, D. Costa, M. Williams; Malaysia, Aug 2016)
- **SCADM** (P. Bricher, A. Van de Putte, T. de Bruin; Malaysia, Aug 2016)
- **SCAR Delegates** (L. Newman, A. Constable; Malaysia, Aug 2016)
- **Instituto Antartico Argentino** (M. Mata; Argentina, August 2016)
- **SciDataCon** (P. Bricher; USA, Sept 2016)
- **ICSU World Data System** (P. Bricher; USA, Sept 2016)
- **Co-Data Data at Risk workshop** (P. Bricher; USA, Sept 2016)
- **SCOR EXCOM** (A. Wåhlin; Poland, Sept 2016)
- **CLIVAR OSC** (M. Mata; China, Sept 2016)
- **CLIVAR-CLiC-SCAR SORP** (M. Mata; China, Sept 2016)
- **MESOPP** (A. Constable; Aus, Sept 2016)
- **FRISP** (A. Wåhlin, R. Coleman, P. Bricher (virtual attendance); Sweden, Oct 2016)
- **CCAMLR** (L. Newman, A. Constable; Aus, Oct 2016)
- **Polar Data Interoperability Workshop** (P. Bricher, Virtual attendance; Nov 2016)

Objective 3: Facilitate linking of sustained long-term observations to provide a system of enhanced data discovery and delivery, utilising existing data centres and programmatic efforts combined with, as needed, purpose-built data management and storage systems

- **NASA GCMD [SOOS Metadata portal](#)**
 - Engagement with administrators for improvements and negotiations for upgrade
 - Engagement with data providers and end users
 - Brokering discussions for improvement of translations between key word vocabularies of PANGAEA and DIF
 - Negotiations for improvements in understanding of ISO “flavours” or ways of use
 - Negotiations for development of ISO-DIF translation tools for key portals (AODN, SeaDataNet, PANGAEA, CCHDO)
- **Mooring Data Project**
 - BEDI funding application for mooring data rescue (successful)
 - Position advertised and filled for mooring data coder
 - Management of mooring data coder position

- Engagement with mooring data providers and other stakeholders (e.g., OceanSITES)
- Outreach for mooring data product
- **NECKLACE data management**
 - Community consultation on requirements for NECKLACE data management
 - DMSC scoping of available infrastructure to meet NECKLACE needs
 - Development of data policy options for NECKLACE
- **Federated Data Search Tool**
 - Community consultation on requirements for federated search tool
 - Engagement with Arctic data community for joint effort on tool development
 - Development of product scoping document
- **Data Support and Advocacy**
 - Development of data policy for Australian Research Council's Antarctic Gateway Partnership
 - Negotiation for ICSU World Data System membership
 - Memorandum of Coordination with the Australian Antarctic Data Centre
 - Memorandum of Coordination with SCADM

Objective 4: Provide services to communicate, coordinate, advocate and facilitate SOOS objectives and activities

- **Advocacy for Southern Ocean Observations**
 - 4 newly endorsed field campaigns
 - Plenary presentation at SCAR OSC
 - Development of document highlighting Southern Ocean observational requirements for submission to G7
 - Promotion of Southern Ocean contribution to WMO Year of Polar Prediction
- **Engagement with international stakeholders**
 - Of note in 2016: IMOS, GOOS Regional Alliances, POGO, OOPC, CCAMLR, CEP, EU-PolarNet, WMO YOPP, COLTO, SORP, SONA, MESOPP, MEOP, JCOMMOPS, APECS, SOCCOM
 - Engagement with national representatives and communities
- **Communication Strategy is implemented**
 - 3 Newsletter issues published
 - 6 peer-reviewed publications
 - 2 Workshop Reports
 - SOOS 2016 Posters and Presentations published online
 - Regular updates to social media channels
 - Website maintained with up-to-date information and products

- Draft design of new homepage with focus on key products
 - Advocacy and outreach of SOOS products and activities
- **Sustained funding for SOOS IPO**
 - Draft of SOOS Funding Strategy
 - Draft of SOOS 5-Year Business Plan
 - Agreement by all existing [IPO sponsors](#) (direct and in-kind) for continuation of existing level of sponsorship for 2016
 - Change in funders of Executive Officer salary from the Institute for Marine and Antarctic Studies at the University of Tasmania (ended August 2016) to the Australian Research Council's Special Research Initiative [Antarctic Gateway Partnership](#) (Project ID SR140300001), which now funds both the Executive Officer (until mid-2018) and Data Officer (until Oct 2017).
 - Agreement for University of Gothenburg co-sponsorship of SOOS Data Officer position for 2017
- **Governance**
 - SOOS network grown from 46 to 48 [Affiliated Organisations](#) and new [national representatives](#) from Japan and Argentina.
 - Organisation and running of SOOS monthly EXCOM meetings
 - 2016 SOOS Scientific Steering Committee meeting (May 2016, USA, Minutes available [here](#)).
 - 2016 SOOS Data Management Sub-Committee meeting (May 2015, USA, Minutes available [here](#)).
 - Changes to the SSC membership: 3 inaugural members rotated off at the end of 2016 (S. Ackley, J. Liu, A.N. Garabato). Three new SSC members selected from an open, international call for nominations. New members are Anya Waite (Germany), Burcu Ozsoy (Turkey), Dake Chen (China). Existing member, Andrew Constable, approved for his second 3-year term
 - Annual reports to Antarctic Treaty, SCAR, SCOR, IPO Sponsors
 - Management of Scientific Steering Committee, Executive Committee and Data Management Sub-Committee activities and communication
 - Organisation of annual SOOS 2017 meetings for EXCOM, SSC and DMSC (June 2017, AWI, Germany)
- **Strategic Activities**
 - SCAR/SCOR International review of 5-Year Implementation Plan: Development of document "SOOS Response to Review"
 - Modification of Implementation Plan
 - 5-Year Operating Plan
 - 5-Year Business Plan
- **IPO Support for Implementation Activities**
 - Support for Working Group workshops
 - Sourcing funding for Working Group activities/products

- Management of SOOS sponsorship and funding of SOOS activities
- **Efficient running of the IPO**
 - Management of IPO staff
 - Management of SOOS budget and finances
 - Fulfilment of IMAS-UTAS requirements
 - IPO Annual Workplan

Sponsorship

SOOS thanks the following sponsors for their support in 2016:

- SCOR
- SCAR
- Australian Research Council's Special Research Initiative [Antarctic Gateway Partnership](#) (Project ID SR140300001)
- IMAS, University of Tasmania,
- Australian Antarctic Division
- Antarctica New Zealand
- University of Gothenburg
- Integrated Marine Observing System
- Tasmania Partnership for Advanced Computing
- NASA Global Change Master Directory
- NSF - CLIVAR and Carbon Hydrographic Data Office

SOOS also acknowledges the support provided to our SSC and DMSC members by their institutions.

Request for Approval: Proposed Changes to the SOOS Scientific Steering Committee 2017

BACKGROUND TO DECISIONS AND REQUESTS FOR APPROVAL

1) SOOS EXCOM comprises:

- 1 Physical Sciences Co-Chair (currently Anna Wahlin, Sweden)
- 1 Biological Sciences Co-Chair (currently Oscar Schofield, USA)
- 1 Physical Sciences Vice Chair (currently Seb Swart, Sweden)
- 1 Biological Sciences Vice Chair (currently Andrew Constable, Australia)

Both Co-Chairs are due to rotate off the SSC at the end of 2017, and therefore new EXCOM members are required.

Andrew Constable and Sebastiaan Swart have been Vice Chairs for SOOS since 2014. They have both been very active in EXCOM, helping to lead SOOS by providing strong strategic and visionary oversight. **Following discussion at the 2017 SSC meeting, the SSC unanimously recommend both Vice Chairs be promoted to Co-Chair positions.**

In April 2017, SOOS EXCOM requested nominations by the SSC for two new Vice Chairs. The following criteria were used to select appropriate Vice Chairs:

- Both the physical sciences and the biological sciences must be represented
- No SSC member can serve on the SSC or EXCOM for more than 9 years combined. Therefore, new EXCOM members can only be selected from those SSC members who are still in their first 3-year term on the SSC.
- Gender Balance on EXCOM

Taking these criteria into account, the SSC members available for nomination to Vice Chairs were:

- Mike Williams (Physics, NZ, currently in year 3 on SSC)
- Matt Mazloff (Physics, USA, currently in year 3 on SSC)
- Jean-Baptiste Sallee (Physics, France, currently in year 3 on SSC)
- SangHoon Lee (Biology, Korea, currently in year 3 on SSC)
- Anya Waite (Biology, Germany, currently in year 1 on SSC)
- Burcu Ozsoy (Physics, Turkey, currently in year 1 on SSC)
- Dake Chen (Physics, China, currently in year 1 on SSC)

The SSC were unanimous in their nomination of Mike Williams for Physical Sciences co-chair. Mike Williams joined the SSC in 2015. During his time as an SSC member, Mike has played an important role in driving SOOS implementation forward through a number of activities, such as the leadership of the Ross Sea Task Team; Leadership of the Ross Sea WG; representation of SOOS in CCAMLR MPA planning; consistent advocacy for and scoping of funding opportunities for SOOS within NZ; and regular, timely and important input into both SSC meetings and throughout the year with the IPO and EXCOM. **Given the unanimous vote, and the aforementioned engagement, SOOS EXCOM recommends Mike Williams as the next Physical Sciences Vice Chair.**

The SSC also unanimously nominated Anya Waite for Biological Sciences Vice Chair. Given her existing workload, and that she did not yet feel informed enough about SOOS (see point 4 below), Anya declined the position. This has left us unable to fill the Biological Vice Chair position with somebody that meets all required criteria. SOOS EXCOM feels that the only alternatives for the position are Sang Hoon Lee and Oscar Schofield. Sang Hoon Lee was not considered, based on point 2 below. **EXCOM therefore recommends Oscar Schofield becomes *acting Vice Chair* for 1 year, to provide enough time to identify a new Vice Chair that meets required criteria.**

The SSC also recommended that EXCOM membership should be staggered, to avoid the simultaneous off-rotation of both Co-Chairs in one year the future. We will continue to discuss and plan how this can be achieved in forthcoming EXCOM rotations.

SOOS, through EXCOM, requests a discussion with the EXCOMs of SCAR and SCOR on the process of nomination for the SSC and the process of selection of EXCOM members that will satisfy membership requirements and provide flexibility for securing suitable appointments to EXCOM.

- 2) The following SSC members will finish their first 3-year term and need to be considered for a second term:
 - Matthew Mazloff (modelling, USA)
 - Mike Williams (Physical Oceanography, NZ)
 - Jean-Baptiste Sallee (Physical Oceanography, France)
 - SangHoon Lee (Microbiology, Korea)

SOOS EXCOM held discussions with each of the above members, and asked for their interest in continued involvement in SOOS. Three members indicated their willingness to commit to another 3-year period. Sang Hoon Lee notified the EXCOM that he was reducing his workload in preparation to retire, and could not commit to a full second term. Based on these discussions, **EXCOM recommends the following second terms:**

- **Matthew Mazloff: 3-year term (May 2018 – May 2021)**
- **Mike Williams: 3-year term (May 2018 – May 2021)**
- **Jean-Baptiste Sallee: 3-year term (May 2018 – May 2021)**
- **Sang-Hoon Lee: 1-year term (May 2018 – May 2019)**

- 3) In the developmental phase for SOOS (2012-2015), implementation activities were carried out by the Scientific Steering Committee, and hence the SSC was a large, multidisciplinary, multi-national body. Now, much of SOOS implementation is being carried out by the Regional Working Groups (RWG), with the SSC providing oversight. There is a need for strong engagement between the RWG Co-Chairs and the SSC at the annual SSC meeting, however in the current structure, there is no financial support available for RWG Co-Chairs to attend.

To enable this engagement, **SOOS requests approval to use SCAR/SCOR funds to support the attendance of one Co-Chair (or a member, in the absence of a co-chair being able to attend) from each Regional Working Group to attend the annual SSC meetings (e.g., use of funds for non-SSC members).** SOOS will reduce the size of the SSC by up to 3 positions to make these funds available. No additional funds are requested.

- 4) Historically, SSC membership terms have started and ended on a calendar year. SOOS SSC meetings, however, generally take place May/June each year. This means there is a 6-month period where new

SSC members have limited knowledge of SOOS, and therefore make little contribution. Further, off-rotating members have already left the committee, resulting in a gap in expertise and input.

The SSC agreed that SSC meetings will now be used as the start and end point of all SSC memberships, rather than the calendar year. Off-rotating SSC members will finish their membership just prior to an SSC meeting (but will still be invited to attend at their own expense), which will enable on-rotating SSC members to begin their membership of SOOS at an SSC meeting. Similarly, **SSC meetings will be used as the start/end point of all EXCOM memberships**, however both the existing and new members will attend the SSC meeting, for official hand-over of duties. **No extra expense will be incurred as all new EXCOM members are existing SSC members.**

- 5) Six inaugural SSC members have had 2 x 3-year terms, and are due to rotate off the SSC at the end of 2017:

- Mike Meredith (Physical Oceanography, UK)
- Mauricio Mata (Physical Oceanography, Brazil)
- Anna Wåhlin (Co-Chair, Physical Oceanography, Sweden)
- Parli Bhaskar (Microbiology, India)
- Oscar Schofield (Co-Chair, Biological Oceanography, USA)
- Dan Costa (Biological Oceanographer, USA)

In accordance with point 2 and 4 above, **EXCOM recommends:**

- **Anna Wåhlin rotated off the EXCOM and SSC at the end of the June 2017 SSC meeting**
- **Oscar Schofield will remain on for an additional year (until mid-2018)**
- **Mike Meredith, Mauricio Mata, Parli Bhaskar and Dan Costa will all rotate off the SSC just prior to the 2018 SSC meeting (therefore extending their terms by approximately 5 months)**

- 6) Whilst reducing the size of the SSC over a number of years as per point 3, **SOOS will run an open call for SSC nominations in November 2017** and will likely replace 2-3 of the 4 off-rotating members. These new members will begin their first term at the 2018 SSC meeting (as per point 4). The SSC identified the following priority gaps that we will try to address through the next round:

- Upper trophic level expert
- Gender balance
- Carbon
- South Africa, South America, UK
- Vice Chair Biological Sciences

- 7) SOOS has not had representation of APECS on the SSC for several years. Our previous APECS representative was only able to attend a small number of SSC meetings, mainly due to budget constraints. SOOS would like to strengthen the involvement of APECS representatives, and will be implementing the following:

- An APECS representative will be invited to take part in organising and participating in the annual SSC meetings. The representative will change each year, and will be selected from the nation that is hosting the SSC meeting.
- Each SOOS Working Group will be offered the opportunity to have an APECS representative on their Steering Committee. The APECS representative will help with administrative tasks of the Working Group, and in return will be involved in at least one workshop or publication.

RESULTING SSC MEMBERSHIP

Based on the above decisions (pending approval), the resulting SSC would comprise the following members:

Name	Country	Expertise	2012	2013	2014	2015	2016	Mid 2017	Mid 2018	Mid 2019	Mid 2020	Mid 2021	Mid 2022
Anna Wåhlin	Sweden	Physical	1	1	1	2	2	2					
Mauricio Mata	Brazil	Physical	1	1	1	2	2	2	2.5				
Mike Meredith	UK	Physical	1	1	1	2	2	2	2.5				
Jan Costa	USA	Biology	1	1	1	2	2	2	2.5				
Parli Bhaskar	India	Biology	1	1	1	2	2	2	2.5				
Oscar Schofield	USA	Biology	1	1	1	2	2	2	3				
SangHoon Lee	Korea	Biology				1	1	1	2				
Sebastiaan Swart	Sweden*	Physical	1	1	1	2	2	2	3	3	3		
Andrew Constable	Australia	Biology			1	1	1	2	2	2	3		
Matthew Mazloff	USA	Physical				1	1	1	2	2	2		
B Sallee	France	Physical				1	1	1	2	2	2		
Mike Williams	NZ	Physical				1	1	1	2	2	2	3	3
Jake Chen	China	Physical						1	1	1	2	2	2
Burcu Ozsoy	Turkey	Sea ice						1	1	1	2	2	2
Anya Waite	Germany	Biology						1	1	1	2	2	2
JMSC Co-Chair													

*Note – These members have changed country of residence since joining the SSC

Light Blue = past years; Dark Blue = current year; Grey = requested terms; Beige = potential terms

SUMMARY OF REQUIRED APPROVALS AND KEY DECISIONS

Summary of Required Approvals from SCAR and SCOR:

- 1) SOOS request approval of current SSC member Mike Williams to become Physical Sciences Vice Chair, starting immediately, for a 3-year term.
- 2) SOOS request approval of current Co-Chair Oscar Schofield to become acting Biological Sciences Vice Chair, starting immediately, for a 1-year term.
- 3) SOOS requests approval of current vice chair Andrew Constable to be the next Biological Sciences Co-Chair, starting immediately, for a 3-year term.
- 4) SOOS requests approval of current vice chair Sebastiaan Swart to be the next Physical Sciences Co-Chair, starting immediately, for a 3-year term.
- 5) SOOS requests approval of the following second terms, all starting in May 2018 just prior to the 2018 SSC meeting:
 - a. Matthew Mazloff: 3-year term (May 2018 – May 2021)
 - b. Mike Williams: 3-year term (May 2018 – May 2021)
 - c. Jean-Baptiste Sallee: 3-year term (May 2018 – May 2021)
 - d. Sang-Hoon Lee: 1-year term (May 2018 – May 2019)
- 6) SOOS requests approval to use SCAR/SCOR funds to support the attendance of one Co-Chair or representative from each Regional Working Group to attend the annual SSC meetings. SOOS will reduce the size of the SSC by up to 3 positions to make these funds available. No additional funds are requested.

- 7) SOOS, through EXCOM, requests a discussion with the EXCOMs of SCAR and SCOR on the process of nomination for the SSC and the process of selection of EXCOM members that will satisfy membership requirements and will provide flexibility for securing suitable appointments to EXCOM, as described in background point 1 above.

Summary of key decisions by SOOS SSC:

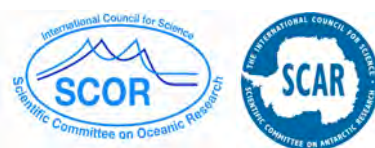
- 1) SSC meetings will now be used as the start and end point of all SSC and EXCOM memberships, rather than the calendar year.
- 2) Anna Wåhlin and Oscar Schofield finished their terms as Co-Chairs at the 2017 SSC meeting. Anna Wåhlin has now rotated off the EXCOM and SSC.
- 3) Four inaugural SSC members will be rotating off in May next year, just prior to the 2018 SSC meeting:
 - a. Michael Meredith
 - b. Daniel Costa
 - c. Parli Bhaskar
 - d. Mauricio Mata
- 4) SOOS will run an open call for SSC nominations in November 2017 to replace off-rotating members
- 5) EXOCM membership should be staggered.



SOOS
SOUTHERN OCEAN
OBSERVING SYSTEM

IMPLEMENTATION PLAN

2016 - 2020



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PREFACE

The Southern Ocean Observing System (SOOS) is an initiative of the Scientific Committee on Oceanic Research (SCOR) and the Scientific Committee on Antarctic Research (SCAR). SOOS was officially launched in August 2011 with the opening of the International Project Office (IPO), hosted by the Institute of Marine and Antarctic Studies at the University of Tasmania, Australia. This was preceded, however, by almost a decade of discussion and planning by the Southern Ocean community. This planning phase included the development of the SOOS [Initial Science and Implementation Strategy](#) (Rintoul et al., 2012), which provides a comprehensive overview of the scientific rationale for SOOS, the status of the international activities and programmes that are stakeholders in SOOS, and provides a framework of potential implementation avenues for SOOS to achieve its objectives.

Since 2011, SOOS has focussed on developing its governance and policies, international connections, and network building. In 2013, SOOS published its 20-year vision (Meredith et al., 2013), which articulated our ultimate objective, and allowed a trajectory of actions to be defined towards achieving this objective. What is now required is a detailed Implementation Plan that specifies these steps towards achieving the overall SOOS vision:

“Sustained observations of dynamics and change of the physics, chemistry, geology and biology of the Southern Ocean system should be readily accessible to provide a foundation for enabling the international scientific community to advance understanding of the Southern Ocean and for managers to address critical societal challenges”

The Implementation Plan

This document is intended to define actions of the SOOS community for the period 2016–2020. This plan is deliberately flexible, to enable SOOS to adapt as new demands and priorities are identified. This Implementation Plan has been compiled by the SOOS Scientific Steering Committee, and has undergone international review and input by SCAR and SCOR.

This Implementation Plan clarifies the SOOS mission by articulating the specific role of SOOS and its relationship to key communities; outlines the vehicles of implementation that are required to facilitate activities (including both field activities, and activities to enhance knowledge acquisition and capabilities). It also includes a Strategic Plan, which defines the goals, objectives, and key deliverables (described as Key Result Areas (KRAs) from here on). Furthermore, this Implementation Plan includes an Operating Plan that identifies the communities and resources required to achieve each KRA.

The process used to develop this plan is illustrated in the Figure 1 below (modified from CIVICUS Strategic Planning Toolkit www.civicus.org/).

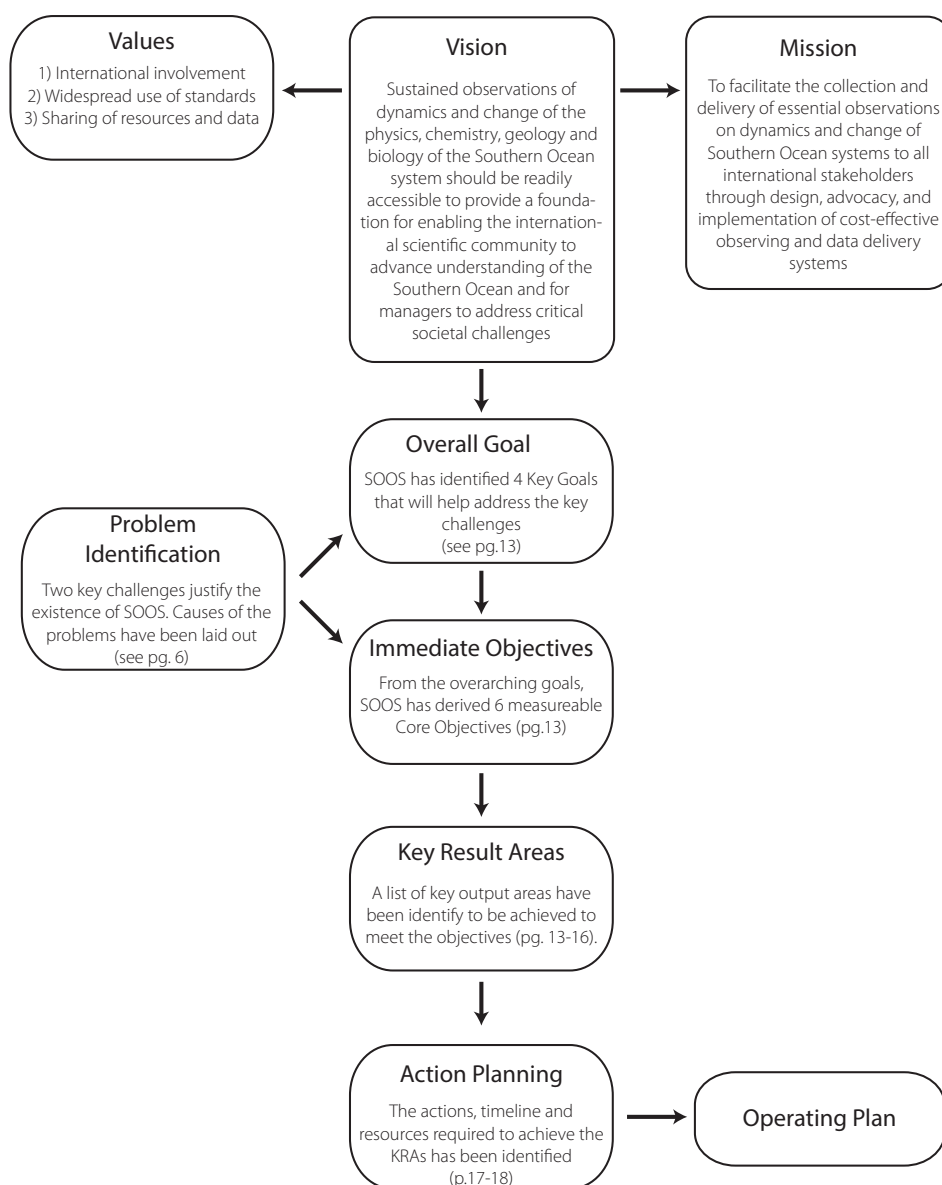


Figure 1: The CIVICUS Strategic Planning process as applied to the development of the SOOS Implementation Plan

THE NEED FOR A SOUTHERN OCEAN OBSERVING SYSTEM

Scientific Rationale

The Southern Ocean has a profound influence on global ocean circulation and the Earth's climate (Rintoul et al., 2012). The Southern Ocean provides the principal connections between the major ocean basins, and controls the connection between the deep and upper layers of the global overturning circulation, thereby regulating the capacity of the ocean to store and transport heat, carbon and other properties that influence climate and global biogeochemical cycles. The Southern Ocean contributes more to ocean storage of excess heat and carbon added to the Earth-atmosphere system by human activities than any other latitudinal band (Sabine et al., 2004; Purkey and Johnson, 2010), while export of nutrients by the upper limb of the overturning circulation ultimately supports 75% of the global ocean primary production north of 30°S (Palter et al., 2010).

Changes in the physical and biogeochemical state of the Southern Ocean are already underway, and will have global implications. The circumpolar Southern Ocean is warming more rapidly, and to greater depth, than the global ocean average (Purkey and Johnson, 2010; IPCC, 2013). The upper layers have freshened and widespread warming of the Antarctic Bottom Water has been observed (Böning et al., 2008; Durack and Wijffels, 2010; Purkey and Johnson, 2010). Since 1992, the satellite altimeter record shows an overall increase in sea level, with strong regional trends. Similarly, changes in sea ice extent are showing strong regional trends, with large increases in the Ross Sea sector contrasted with large decreases in the Bellingshausen Sea and around the Antarctic Peninsula (Parkinson and Cavalieri, 2012). The uptake of CO₂ by the ocean is changing its chemical balance, increasing the acidity and reducing the concentration of carbonate ions. The response of the Southern Ocean food web to changes in ocean chemistry remains largely unknown, but impacts on individual species are already being detected (e.g., Bednarsek et al., 2012; Constable et al., 2014).

Southern Ocean food webs rely on ice-associated intermediate trophic levels for the transfer of energy from primary producers to vertebrate predators. Generally speaking, the Southern Ocean food web is characterised by a keystone species, Antarctic krill, and this heavy dependence on a single species and aspects of the uniqueness of the Southern Ocean food webs and biogeochemical cycles make the system potentially vulnerable to climate variability and change (Murphy et al., 2012; Constable et al., 2014). There is evidence of changes in other components of the Southern Ocean food web, from phytoplankton to penguins and seals (e.g., Atkinson et al., 2004; Trivelpiece et al., 2011; Bost et al., 2015), however lack of long-term observations across large areas makes it difficult to assess long-term trends (Constable et al., 2014; Nymand Larson et al., 2014).

These recent changes underscore the importance of the Southern Ocean in the Earth system. Improved understanding of the links between Southern Ocean processes, global climate, biogeochemical cycles and marine productivity is needed to inform an

effective response to the challenges of climate change, sea-level rise, ocean acidification and the sustainable use of marine resources. In particular, it is critical to understand how the Southern Ocean system will respond to changes in climate and other natural and human forcings, as well as the potential for feedbacks. To achieve this enhanced understanding, sustained multi-disciplinary observations are essential.

Derived from these imperatives, SOOS activities will be focused to address 6 interconnected Scientific Themes:

- 1) The role of the Southern Ocean in the planet's heat and freshwater balance
- 2) The stability of the Southern Ocean overturning circulation
- 3) The role of the ocean in the stability of the Antarctic Ice Sheet and its contribution to sea-level rise
- 4) The future and consequences of Southern Ocean carbon uptake
- 5) The future of Antarctic sea ice
- 6) The impacts of global change on Southern Ocean ecosystems

A more detailed scientific rationale on the imperative of SOOS is available in the SOOS [Initial Science and Implementation Strategy](#) (Rintoul et al., 2012) and the SOOS [20-Year Vision](#) (Meredith et al., 2014)

Key Challenges

The Southern Ocean Observing System has been established to overcome two important challenges for science and management in the region:

1) Southern Ocean observations are sparse, difficult, and expensive to obtain, and are often limited in space, time, quality, and variables measured, due to:

- Uncoordinated, short-term, single nation/discipline approach to observations leaves spatial and temporal gaps in a range of physical, chemical and biological observations.
- Lack of continuous funding for sustained observations leaves gaps in observations in time and space.
- Lack of strategic interfacing between nations, projects and disciplines on activities, plans, products and needs makes it difficult to streamline efforts and leverage investments to provide integrated datasets.
- Technological constraints have placed limitations on the type/amount of data that can be collected in an efficient and cost-effective way.
- Variation in observational methodologies and protocols hamper intercomparability of measurements made by different systems in different locations.

2) Access to multidisciplinary, quality-controlled, observational data from the Southern Ocean is difficult and time consuming due to:

- Many fragmented, unconnected, mono-disciplinary or mono-platform data centres
- Lack of funding and/or action on data sharing and platform interoperability
- Variations in national/institutional data policies and data-sharing cultures
- Lack of general knowledge on the data that are being collected, are already available, and accessible

The role of SOOS

SOOS aims to deliver an integrated base-level set of observations needed to facilitate assessments of the multidisciplinary state of the Southern Ocean, by linking existing data streams and facilitating new ones where needed. SOOS will provide an international interface for communication between nations and programs to streamline efforts and advocate for consistent best practices for data collection. The goal is for SOOS to enable the international community to address the question “What do we need to measure to elucidate and explain fundamental system dynamics and change?”. This will require that observations are sustained, multi-disciplinary, standardised, quality-controlled and accessible. Traditional field process and targeted observational studies can then focus on more specific questions requiring additional/different measurements or more intensive data coverage. Whilst aspects of some SOOS activities may overlap with other programs, SOOS fills a gap that is not currently addressed by existing international efforts. Where overlap exists, SOOS will not duplicate efforts, but rather make every effort to support and work with aligned endeavours.

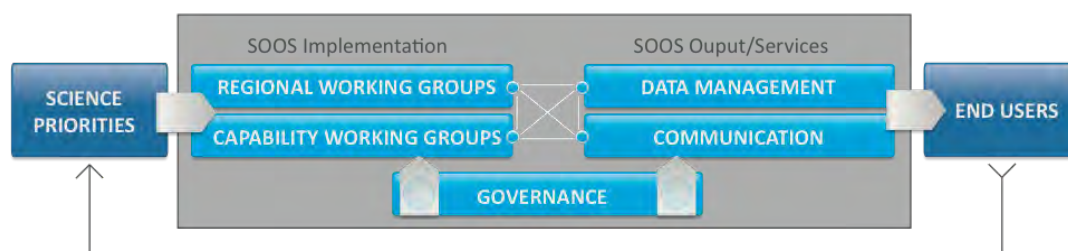


Figure 2: The core elements of SOOS include Implementation, output/services, and governance. Strong connections exist with key external science communities and end-users. The scope of SOOS is encompassed by the grey box.

SOOS works within the 2 core elements shown in Figure 2 above, with the SOOS governance structure of Scientific Steering Committee members, sponsors, partners and the IPO, all underpinning and managing the core elements:

1) SOOS Implementation:

- Bringing the community together to create a set of best practices and requirements (e.g., system design, methodologies)

- Coordination of international efforts towards enhanced collection of standardised observations

2) SOOS Output/Services

- Data discovery/delivery
- Communication of activities and products, informing the community

Mission and Values

The mission for SOOS is to facilitate the collection and delivery of essential observations on dynamics and change of Southern Ocean systems to all international stakeholders (researchers, governments, industries), through design, advocacy, and implementation of cost-effective observing and data delivery systems.

Underpinning this mission are values that are shared by SOOS and form the basis for our collaboration and connection with stakeholders.

- Open involvement of all interested nations, programmes, organisations and projects across all relevant disciplines, industries, and stakeholders
- Widespread adoption of international standards in data quality control and methodologies
- International sharing of resources and knowledge
- Open access to data and data products

Governance

SOOS has a relatively simple governance structure, with close connections to external scientific and coordination bodies. It is important to note that the governance bodies of SOOS, including the IPO, are not the core implementers of SOOS activities. They are support structures to provide guidance and strategic direction for the implementation groups (see Vehicles of Implementation below). The SOOS IPO and committees will:

- 1) Identify key communities already working towards addressing issues and build partnerships with these communities to facilitate their efforts;
- 2) Identify gaps in existing efforts and develop capability working groups or task teams from within the broader community to address these gaps; and
- 3) Develop strategies for the outcomes/outputs of the abovementioned efforts to be implemented through the regional working groups towards enhanced observations and data delivery



Figure 3: The governance and implementation structure of SOOS).

Committees

Executive Committee – www.soos.aq/about-us/ssc

The strategic vision and direction for SOOS is led by the Executive Committee (EXCOM) comprising a Biological Sciences Co-Chair and Vice Chair, a Physical Sciences Co-Chair and Vice Chair, and the Executive Officer. The EXCOM is in regular contact with sponsors and core stakeholders to ensure international input in the strategic governance of SOOS.

Scientific Steering Committee (SSC) – www.soos.aq/about-us/ssc

All SOOS activities are overseen by the international SOOS Scientific Steering Committee (SSC). The SSC meets annually and provides scientific direction for the SOOS in achieving its mission. The SSC comprises three organisational levels: EXCOM members, Scientific Members, and ex-officio representatives from key sponsors, nations and organisations.

Data Management Sub-Committee (DMSC) – www.soos.aq/data/dmsc

The SOOS Data Management Sub-Committee (DMSC) advises the SOOS SSC on the most effective collaboration mechanisms for managing and publishing observational data from the Southern Ocean. The DMSC comprises members who have professional data management expertise and who are affiliated with international and national data centres, networks, and programs.

The International Project Office (IPO) – <http://soos.aq/about-us/ipo>

The SOOS IPO is currently staffed by two personnel; an Executive Officer and a Data Officer, both with very different roles. The role of the Executive Officer is not one of SOOS implementation, but of support and facilitation of SOOS implementation. In addressing the 4 Objectives of SOOS (see page 14), the Executive Officer contributes predominantly to Objective 4, whilst providing support for the greater community to achieve the other objectives. The Data Officer's role contributes predominantly to Objective 3, while again providing support across the other objectives as required.

VEHICLES FOR IMPLEMENTATION

Implementation of SOOS will be carried out by a combination of SOOS working groups and task teams, and through strategic partnerships with *external* programs and initiatives.

Working Groups

Regional Working Groups – www.soos.aq/activities/regional-wg

SOOS will ultimately be implemented regionally based on interconnected sectors of national infrastructure and activities. The Southern Ocean community has identified five priority regions for development as Regional Working Groups (RWGs): The Southern Ocean Indian Sector (SOIS), the Ross Sea, the Weddell and Dronning Maud Land, the West Antarctic Peninsula, and the Amundsen/Bellingshausen Sea.

The Regional Working Groups will coordinate and implement the observing system in their region, including facilitating improved readiness and ability where needed. Development of Regional Working Groups allows identification of overlap in national areas of focus and observational activities that could be translated into better logistic coordination, scientific collaboration, and sharing of operational resources. It also allows the creation of joint funding proposals to progress SOOS in these regions, where such mechanisms exist.

Participation in any given RWG is flexible and defined by the location of national infrastructure, shipping routes, and involvement in regionally defined activities (e.g., any countries working in a region can be “member nations”). Although membership is flexible, there will be a small number of representatives responsible for the overall coordination of each Sector, and for communication of information to and from the SOOS SSC (and other relevant Stakeholders).

Capability Working Groups – www.soos.aq/activities/capability-wgs

The development and implementation of technologies, improvement in observational design, efficiency and coverage, as well as processes for information management and dissemination will be managed by Capability Working Groups. These working groups may take advantage of new developments in science and technology or be established to fill important gaps identified by RWGs or the SSC.

Task Teams – www.soos.aq/activities/task-team

Task Teams are short-term initiatives developed to produce a specific SOOS product (e.g., publication or document), scope out community needs and readiness for actions on specific capabilities, or organise an activity. Task Teams are predominantly initiated

and driven by SOOS IPO and SSC, but input from the greater scientific community is sought where required. Task Group products will be made freely available from the SOOS website and/or the SOOS [Zenodo Catalogue](#).

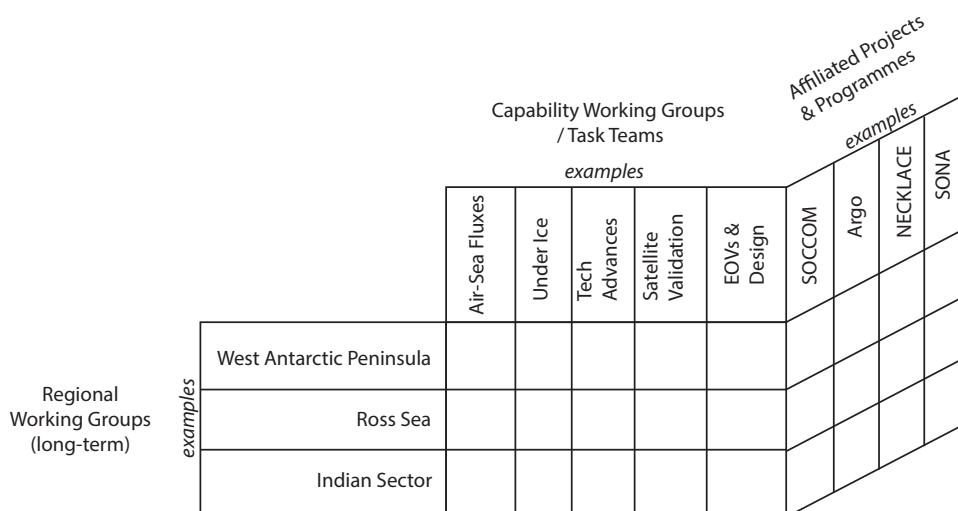


Figure 4: Existing national and international projects and programs contribute to SOOS and their efforts need to be identified and recognised as contributing regionally and/or to enhancing capabilities. This schematic visualises the relationship between Working Groups, Task Teams and affiliated activities in three dimensions.

Strategic Partnerships

There are numerous existing programs and initiatives that facilitate and coordinate some aspects of the planning, organisation, collection and management of observational data. These communities are therefore important for SOOS to connect to, and are direct contributors to SOOS implementation.

In instances where these communities are already active in efforts that will address SOOS objectives, SOOS will not duplicate efforts but rather identify ways that we can support the existing effort, if required. Where existing efforts require a level of modification to deliver against SOOS objectives, SOOS will work with the community to build on the existing effort and tailor outputs to SOOS requirements. In instances that no active efforts exist but SOOS has identified a requirement, SOOS Working Groups or a Task Team will work with any relevant community to address the issue.

In all cases, SOOS Working Groups and Task Teams will identify key programs and initiatives that should be engaged in the SOOS effort, to achieve common goals, avoid duplication and to enhance impact and reach.

More information on specific programmatic connections is available at www.soos.aq/network/programmatic-connections

SOOS NETWORK

SOOS has identified a network of programs and initiatives that must be connected to, to efficiently achieve our mission. The network encompasses communities that connect through both Governance structures and Implementation Vehicles, and also include end users of SOOS. Figure 5 below illustrates the network, as identified in 2016, whilst recognising that this is a flexible schematic that will likely change throughout the life of the Implementation Plan.

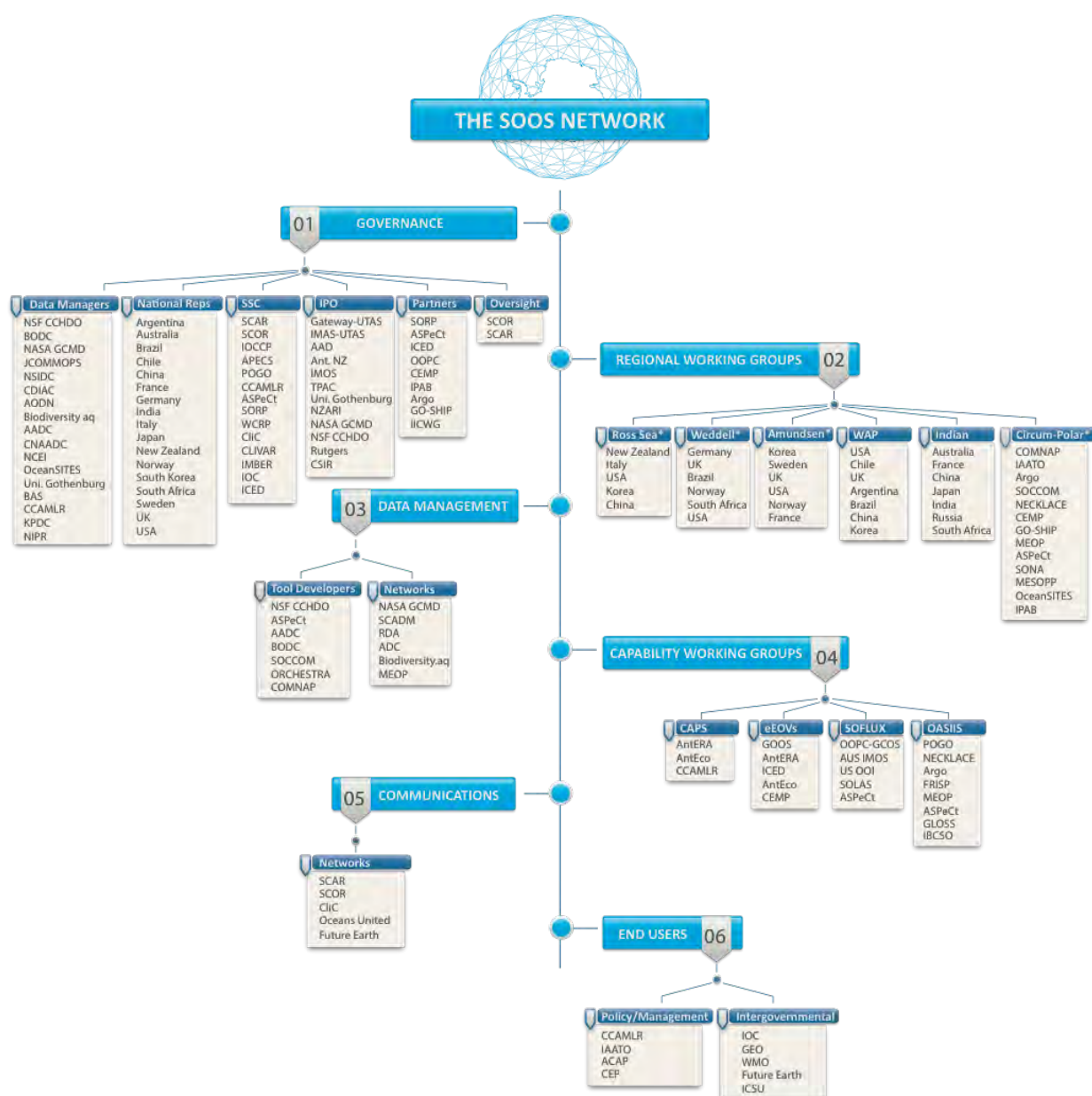


Figure 5: Schematic showing the programs, nations and initiatives that form the broad SOOS network. Many of these communities are Strategic Partners and help to implement activities and efforts towards SOOS objectives.

THE 5-YEAR STRATEGIC PLAN

SOOS has identified 4 key goals that will help address the key challenges (page 6), and from this, we have derived 4 Core Objectives and specific result areas that will address the causes (also page 6) of the key challenges.

Overall Goals

Goal 1: A coordinated, integrated, efficient, and sustained international program to deliver long-term, sustained observations of essential elements of Southern Ocean systems.

Goal 2: Regional implementation of long-term, sustained observations to achieve circumpolar coverage of Southern Ocean systems built upon existing efforts by national programs.

Goal 3: Facilitation and promotion of activities to improve observations of Southern Ocean systems, through international coordination and technological research and development, including the affiliation of projects and programs with this work.

Goal 4: Efficient and internationally integrated data management systems to enable stakeholders to access observations and synthesis products on the dynamics and change of Southern Ocean systems.

Objectives

Objective 1: Facilitate the design of a comprehensive and multi-disciplinary observing system for the Southern Ocean

- KRA 1.1: Establish criteria for adopting EOVS and communicate them
- KRA 1.2: Southern Ocean Essential Ocean Variables are identified and the manner in which they satisfy the criteria are communicated
- KRA 1.3: Spatio-temporal, system-level EOVS sampling requirements are identified, documented and agreed, and strategies for implementation developed if needed.
- KRA 1.4: A strategy for the uptake of EOVS within the Regional Working Groups is developed

Objective 2: Unify and enhance current observation efforts and leverage further resources across disciplines, and between nations and programmes

- KRA 2.1: Working Groups and Task Teams that coordinate efforts across disciplines and programs, and between nations are developed to fill priority gaps

- KRA 2.2: Key products for the Southern Ocean that aid in information transfer and facilitate collaborative efforts are identified and produced
- KRA 2.3: Collaborative, multidisciplinary and multinational workshops and meetings are undertaken, resulting in the SOOS mission being achieved

Objective 3: Facilitate linking of sustained long-term observations to provide a system of enhanced data discovery and delivery, utilising existing data centres and programmatic efforts combined with, as needed, purpose-built data management and storage systems

- KRA 3.1: A multidisciplinary metadata portal is developed and populated and continuously updated with records. Efforts include archiving of orphan datasets and advocating for direct links to the data in metadata records
- KRA 3.2: Up-to-date information on key Southern Ocean data programmes, centres, and repositories is provided
- KRA 3.3: Web-based tools will be explored and, as needed, developed to aid data discovery and delivery; the wider community is encouraged to adopt and enhance tools that already exist
- KRA 3.4: Community-developed data synthesis tools and products for the Southern Ocean are accessible through the SOOS website

Objective 4: Provide services to communicate, coordinate, advocate and facilitate SOOS objectives and activities

- KRA 4.1: The need for sustained Southern Ocean observations is strongly articulated
- KRA 4.2: Engagement with international stakeholders, across all disciplines and nations, is maintained
- KRA 4.3: A SOOS community bibliography is developed
- KRA 4.4: The SOOS Communication Strategy is implemented
- KRA 4.5: Support for SOOS International Project Office is maintained and enhanced
- KRA 4.6: SOOS Administration, facilitation of Strategic Plan activities, and delivery of support services is maintained

Key Milestones, deliverables and timeline

Over the lifetime of this 5-year plan, SOOS plans to deliver the following outcomes/outputs

		Additional Information	Implementers	Proposed Start	Proposed Delivery	Dependencies	Contribution to KRAs
#	Objective 1: Facilitate the design of a comprehensive and multi-disciplinary observing system for the Southern Ocean						
1	Published table of status of EOVs		SSC, Regional working groups, Capability Working Groups, broad community input	2017	2018		1.1; 1.2
2	Published, internationally defined criteria for EOVs		SSC, Regional working groups, Capability Working Groups, broad community input	2017	2018	#1	1.1
3	Compiled EOV descriptions and supporting documentation		SSC, Regional working groups, Capability Working Groups, broad community input	2018	2018	#2	1.1; 1.2; 1.3
4	Development of 5 international networks for regional coordination of SOOS implementation (Regional Working Groups)	Each regional working group will have group-specific products and outputs	Broad national, disciplinary and programmatic involvement	2016	2018		1.3; 1.4; 2.1; 2.3
5	Reviews of current status of EOV coverage, key gaps and requirements	Involves several workshops	Conducted regionally, by Regional Working Groups	2017	2019	#4	1.3
6	5 Regional implementation strategies		Regional working groups, Capability Working Groups, international field programs	2019	2020	#5	1.3; 1.4
31	Report identifying core satellite data requirements for the Southern Ocean		Designated SOOS Task Team, broad community input	2015	2016		2.2; 4.1
7	International strategic plan for observing the ocean beneath Antarctic sea ice and ice shelves	Other products/outcomes as a result of this working group are defined here	Capability working group, broad community input	2017	2019		1.3; 2.1
8	Coordinated network to enhance Southern Ocean flux observations	Specific products resulting from this coordinated network can be found here	Capability working group, broad community input	2016	2020		1.3; 2.1
9	International standards, methodology and strategy for sustained and reliable remote sensing-based monitoring of pack-ice-seal populations	Details on these products can be found here	Capability working group	2016	2020		1.3; 2.1
10	Development of international initiative to Benchmark Southern Ocean ecosystems, including implementation of eEOV-based system design	Specific products resulting from this initiative will be defined in the working group TORs and made available on the SOOS website	Capability working group	2016	2022		1.2; 1.3; 2.1
#	Objective 2: Unify and enhance current observation efforts and leverage further resources across disciplines, and between nations and programs						
11	Database of Upcoming Expeditions to the Southern Ocean	www.duesouth.soos.ag http://data.aad.gov.au/duesouth/	IPO, DMSC, broad community engagement	2015	2017		2.2; 3.3
12	SOOS Map		IPO, DMSC, JCOMMOPS, EMODnet Physics, broad community	2016	2018		2.2; 3.3
13	Community annual calendar		IPO	2017	2017		2.2
14	Capability and Regional Working Group workshops	Each working group will likely hold a workshop/meeting each year, either virtually or in-person	Working Group members and broader community, IPO and SSC as required	As needed			2.1; 2.3
15	Capacity- or community-building workshops	Different to working group workshops, these events will focus on enhancing connections or building capacity in a specific aspect of SOOS (e.g., SOOS-Asian Workshop 2013; SOOS-SOCCOM joint workshop 2016; SOOS-AWI Symposium 2017)	Specific community focus but generally open to all	As needed			2.3
16	International conference sessions, town-halls, side meetings, information sessions		SSC, IPO, Regional working groups, Capability Working Groups	As needed			2.3; 4.1; 4.4

#	Objective 3: Facilitate linking of sustained long-term observations to provide a system of enhanced data discovery and delivery, utilising existing data centres and programmatic efforts combined with, as needed, purpose-built data management and storage systems						
17	Metadata Portal (NASA GCMD)	http://gcmd.nasa.gov/portals/soos/	IPO, DMSC, SCADM	2014	Ongoing		3.1
18	International Mooring Network	<ul style="list-style-type: none"> - Up-to-date list and interactive web-map of all Southern Ocean moorings http://www.soos.aq/activities/soos-at-sea/moorings - Registration of all mooring platforms at JCOMMOPS - Potential development of a THREDDS server to allow straightforward subsetting and merging of mooring datasets (not yet resourced) 	IPO, DMSC	2015	2017		2.2; 3.1
19	Orphan data rescue	<ul style="list-style-type: none"> - International mooring data rescue - International glider data rescue 	IPO, DMSC, GliderDAC, OceanSITES, other communities as required	2016	2020		3.1
20	Southern Ocean Glider Network	<ul style="list-style-type: none"> - Up-to-date list and interactive web-map of all Southern Ocean glider deployments and tracks - Registration of all glider platforms at JCOMMOPS 	IPO, DMSC, GliderDAC,	2018	2020		2.2; 3.1
21	NECKLACE data management policy	- A data management policy is agreed by the NECKLACE community and documented by the IPO	IPO, NECKLACE community, DMSC	2016	2017		2.2; 3.1
22	Up-to-date catalogue of Southern Ocean data providers	- A list of data providers is published on the SOOS website and kept current	IPO, SSC	2016	2016		3.2
23	Federated Data Search tool	<ul style="list-style-type: none"> - A federated search tool enables direct searching of multiple data repositories simultaneously - Development requires a funding stream and a team of collaborators 	IPO, DMSC, Broad community engagement	2017	2020		2.2; 3.3
24	Catalogue of key Southern Ocean data synthesis tools and products	<ul style="list-style-type: none"> - Lists of key Southern Ocean data synthesis products and tools are provided on the SOOS website. http://www.soos.aq/data/analysisvisualisation	IPO, SSC, DMSC	2017	2019		2.2; 3.4
25	Annual SOOS Data management sub-committee meetings		DMSC, observers	Annually			3.1; 3.2; 3.3; 3.4; 4.2; 4.6

#	Objective 4: Provide services to communicate, coordinate, advocate and facilitate SOOS objectives and activities						
26	Stakeholder Engagement Strategy	Internal document only	IPO, SSC, EXCOM	2017	2018		4.2; 4.6
27	5-Year Business Plan and Funding Strategy	Internal document only	IPO, SSC, EXCOM	2016	2018		4.5; 4.6
28	Annual SOOS scientific steering committee meetings		SSC, EXCOM, IPO, Observers	Annually			4.2; 4.6
29	Annual SOOS Executive Committee meetings		Executive Committee	Annually			4.5; 4.6
30	“SOOS Update” quarterly newsletter		IPO	2012	Ongoing		4.4
32	Progress reports to key stakeholders	SSC, SCAR, SCOR, ATCM, Sponsors	IPO, EXCOM	2012	Annual		4.1; 4.2; 4.3; 4.4; 4.5; 4.6
33	Products database	Online database of presentations, posters, publications, videos, science strategies and reports	IPO	2012	Ongoing		2.2; 4.4
34	An up-to-date website is provided		IPO	2012	Ongoing		2.2; 4.1; 4.2; 4.3; 4.4; 4.6
35	An efficient and productive International Project Office		IPO, EXCOM	2012	Ongoing		4.5; 4.6

Closing Statement

The SOOS 5-Year Implementation Plan communicates a step-wise, logical and realistic strategy towards achieving our ambitious long-term vision. The operating plan articulates the community effort required for each step, the resources required, and the measurable indicators of success. The governance structure for SOOS, and key international stakeholders and end-users, will play an important role in reviewing progress throughout the life of this plan. A detailed review of efforts will also take place in 2020, as part of the planning process for the following 5 years of SOOS implementation. Given the aim of sustained observation of the Southern Ocean, several core activities defined herein are likely to continue on into future implementation plans, as indicated in the Operating Plan. These efforts will require sustained resourcing and support at a minimum of the existing level, although growth in SOOS activities is required moving forward, and enhanced support is being sought to support this growth.

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